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Seminar Special Issue
of
Transformative Agriculture and Sustainable Development: Rethinking Agriculture for a Changing World

ABOUT THE SOCIETY

MOBILIZATION Society was established in 2003 as a non-profit professional society aimed at sensitizing and mobilizing development partners and community for sustainable development. The Society, during these ensuing years has successfully mobilized researchers, academicians, planners, grass root mobilizers and student and created conducive intellectual atmosphere for introspective deliberations and conducted National seminars/ workshop to address the emerging problems experienced by the agrarian mass. Presently the Society has more than 1750 Life Members. The recognition of the Society in the efforts for strengthening the forum for scientific communication is growing among the related professionals and concerned agricultural stakeholders rapidly. The Society works on following objectives-

1. To document the on-farm and adaptive research experiences in multi- disciplinary agri-bio sciences and extension education.
2. To offer a platform for sharing the empirical experiences of development professionals, community mobilizers, academicians, multi-sectoral researchers, students etc. for the benefit of ultimate users.
3. To facilitate close and reciprocal linkage among the institutions for sustainable rural development.
4. Promoting potential and practicing entrepreneurs.
5. To disseminate the documented knowledge to the global partners through approach abstracting and indexing.

ABOUT THE JOURNAL

Journal of Community Mobilization and Sustainable Development (print ISSN 2230 – 9047; online ISSN 2231 – 6736) is published by Society for Community Mobilization for Sustainable Development twice a year. The Journal of Community Mobilization and Sustainable Development has NAAS rating 5.67 and Journal ID J158. The Journal of Community Mobilization and Sustainable Development, is also available on our website www.mobilization.co.in and it has been registered with www.indianjournal.com for national and global abstracting and indexing. MOBILIZATION envisages reorienting the young professionals and researches for imbibing the values of community participation in research, training and extension efforts.

The aim and scope of the journal are:

1. Sharing the relevant experiences and issues related to agriculture and allied fields at the grass root level and global forum to create the necessary academic and development climate.
2. Sensitizing the different stakeholders about the knowledge and innovation management system in pluralistic agri-rural environment.
3. Developing network among the related partners for convergence of their efforts for sustainable academic development of extension education discipline.

Editorial

Transforming the agrifood system through regenerative agriculture holds significant promise in advancing sustainable development goals (SDGs) by addressing various environmental, social, and economic challenges. This holistic approach to farming focuses on restoring and enhancing ecosystem health, biodiversity, soil fertility, and water management, while also promoting resilience to climate change and enhancing the livelihoods of farmers. Through practices such as cover cropping, crop rotation, agroforestry, and no-till farming, regenerative agriculture aims to sequester carbon, reduce greenhouse gas emissions, conserve water, and mitigate soil erosion. By prioritizing soil health and biodiversity, regenerative agriculture contributes to SDG 2 (Zero Hunger) by increasing food security and agricultural productivity. It also aligns with SDG 13 (Climate Action) by mitigating climate change impacts and promoting carbon sequestration. Additionally, regenerative agriculture supports SDG 15 (Life on Land) by preserving biodiversity and ecosystems, as well as SDG 12 (Responsible Consumption and Production) by promoting sustainable farming practices and reducing the use of chemical inputs. Furthermore, it can enhance rural livelihoods and foster inclusive economic growth, thus contributing to SDG 1 (No Poverty) and SDG 8 (Decent Work and Economic Growth). The Society for Community Mobilisation for Sustainable Development, also known as the MOBILISATION Society, is a multidisciplinary professional organisation that constantly offers forums for bright minds to exchange and hone novel concepts and inventions that can support sustainable development endeavours at the field, policy, and research levels. One such step is the 11th National Seminar on "Transformative Agriculture and Sustainable Development: Rethinking Agriculture for a Changing World," in collaboration with Maharana Pratap University of Agriculture and Technology (MPUAT), Udaipur which is held from 05th -07th March 2024 at MPUAT, Udaipur. Moreover, the society is privileged to announce a Seminar-special issue of the Journal of Community Mobilisation and Sustainable Development dedicated to this event. This special issue features several noteworthy contributions from esteemed experts in the field.

The topics in the seminar special issue of the journal covered various studies encompassing a wide range of agricultural, social, and economic aspects pertinent to different regions of India. These studies delve into the performance and impact of various agricultural practices and interventions, such as the evaluation of cluster frontline demonstrations on pigeon pea productivity, awareness of water conservation among cotton farmers, and the sustainability of scientific piggery ventures among tribal farmers. Additionally, the research also explores social dynamics, including gender differences in agricultural constraints and the changing roles of women in rural areas following male out-migration. Furthermore, studies on socio-economic factors affecting women's employment, youth occupational choices, and the role of self-help groups in entrepreneurship shed light on broader societal trends. Other topics, such as the perception of climate change effects, dietary habits during COVID-19, and the efficiency of farm diversification, highlight the intersection of environmental factors and agricultural practices. These studies collectively contribute valuable insights into the challenges and opportunities faced by various stakeholders in India's agricultural landscape, offering avenues for informed policy-making and sustainable development initiatives.

I wish to express my deepest gratitude and appreciation to the dedicated editorial team for their unwavering commitment. Additionally, I extend my sincere thanks to all the engaged readers, critics, and authors whose valuable contributions continually enhance the quality and depth of our journal content. I am particularly grateful to the authors who demonstrated overwhelming enthusiasm and interest in responding to the conference special call. Your dedication has greatly enriched our publication.

J.P. Sharma
Chief Editor

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Review Article

A Theoretical Perspective of Producer Organisations in India

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ABSTRACT

Indian farming faces challenges like small land holdings, fragmented ownership, and perishable produce, diminishing farmers' bargaining power in selling and purchasing. To bridge this gap, cooperatives and producer organizations have emerged. Producer organizations are legal entities formed by primary producers, including farmers, milk producers, fishermen, weavers, artisans, and craftsmen. This paper explores their characteristics, types with relevance to agriculture such as Farmer Producer Organizations (FPOs), Fish Farmer Producer Organizations (FFPOs), Dairy Producer Organizations (DPOs), and Handloom/Weaver Producer Organizations (H/WPOs). Farmer Producer Organisations are farmer-operated entities representing interests and promoting collective decision-making. Fish Farmer Producer Organisations provide comprehensive support to small-scale fishers and fish farmers. DPOs formed on the initiative of group of farmers, which has one or more aims. This includes negotiating contracts for the delivery of raw milk on behalf of its members. Role of extension personnel is provision and enhancement of extension services, locating farming community, awareness creation and community mobilization, organizing community meetings through local leaders, social capital formation and capacity building. Farmers are enterprise owners in agriculture, and it is the responsibility of the agricultural extension system to transform their knowledge, attitude and skills with aim to enhance their productivity, production and profitability.

Keywords: Cooperatives, Dairy farmers, Fish farmers, Producer organizations

INTRODUCTION

Agriculture contributes 18.8 per cent to GDP (2021-22) and 52 per cent of population depends on agriculture. India's agriculture said to be rich, but the small and medium farmers are still poor. Small and marginal farmers constitute the largest group of cultivators in Indian agriculture. About 85 per cent of operational holdings are smaller than or about two hectares and amongst these holdings, 66 per cent are less than one hectare (Singh, 2012). Due to the issue of small land holding of farmers the bargaining powers of those farmers are very less while selling of their produce and also while purchasing inputs for cultivation of crops. Farmers, particularly smallholders who are compelled to produce because they lack access to capital, reliable and affordable inputs, transportation options, or marketplaces, must compete against big business. Even if they are able to enter marketplaces, their poor bargaining position limits them when dealing with big buyers (Penrose-Buckley, 2007). To solve this issue and to minimize the gap between farmers and consumers some cooperatives and producer organizations came in to existence. Cooperative enterprises are the largest organization in the world (Anonymous, 2014). Cooperatives are "autonomous associations of persons united voluntarily to meet their common economic, social and cultural needs and aspirations through a jointly owned and democratically controlled enterprise" (Chikaire *et al.,* 1999).

In the middle of the 19th century, Producer Organization began in Europe. Traditional cooperatives struggled to meet the demands of smallholder farmers

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during the 1990s and 2000s due to poor management, lack of transparency and internal conflicts. So, to meet these challenges producer organizations came into existence. Producer Organization is a legal entity formed by primary producers, viz. farmers, milk producers, fishermen, weavers, rural artisans, craftsmen. Producer organization is an association, a society, a cooperative, a union, a federation, or even a firm that has been established to promote the interests of producers (Bijman and Wollni, 2008).

Farmer Producer Organisation (FPOs) is a legal entity form of organisation formed and operated by farmers and some types of Farmer producer organizations are Farmer Interest Groups, farmers' associations, non-profit society/organizations, trust Groups. Shree and Vyshnavi (2022) from their study on challenges faced by FPOs concluded that majority of farmers faced undeveloped storage facilities and lack of proper practices followed by low price of produce and involvement of middle men, lack of proper crop insurance facilities and lack of proper infrastructure, lack of proper market information, lack of awareness of credit facilities, lack of proper government price policy and lack of proper government price policy.

Dairy producer organizations (DPOs) formed on the initiative of group of farmers, which has one or more aims. This includes negotiating contracts for the delivery of raw milk on behalf of its members. Milk Producers' Organization is essential to create an impact of unified or collective action for a sensible and visible outcome (Nikam *et al.,* 2019). Fish Farmer Producer Organizations (FFPOs) is one of the innovative approaches to increase and provide end-to-end support and services for small-scale fishermen. Role of extension personnel is provision and enhancement of extension services, locating farming community, awareness creation and community mobilisation, organising community meetings through local leaders, social capital formation and capacity building. Farmers are enterprise owners in agriculture, and it is the responsibility of the agricultural Extension system to transform the knowledge, attitude and skills of farmers with aim to enhance their productivity, production and profitability.

Mechanism of doubling farmers income through Farmer Producer Organizations (FPOs) are better farm income, provision of market information, economies of scale, enable vertical integration, ensure market access and develop market and buyer relations, etc. (MP and Mathur, 2019)

Sahu *et al.* (2017) from their study on socio-economic impact FPOs in Punjab concluded that income for members and non-members was Rs 3.7 lakhs and Rs. 1.7 lakhs. Here, higher income generating capacity of the members was clearly evident, which was the outcome of the efficient production and direct marketing of their produce through established outlets.

HISTORY OF COOPERATIVES

Origin of modern cooperatives in Europe and to other industrializing countries dates back to late 19th century as a self-help method to counter extreme conditions of poverty (Hoyt, 1989). Ingalsbe and Groves (1989) grouped three main factors responsible for development of cooperatives as (1) economic conditions (caused by war, depression, technology, government economic policy, etc.) (2) Farmer organizations (including quality of their leadership, their motivation and enthusiasm to promote cooperatives, power to influence public policy, etc.); and (3) public policy (as determined by government interest, legislative initiative, and judicial interpretation). Cooperatives are "autonomous associations of persons united voluntarily to meet their common economic, social and cultural needs and aspirations through a jointly owned and democratically controlled enterprise (Chikaire *et al.*, 1999).

Robert Owen called as father of the cooperative movement. In 1844 a group of 28 artisans working in the cotton mills in the town of Rochdale, in the north of England established the first modern cooperative business. In 1904 Cooperative moment by enactment of cooperative societies act came into India and the first cooperative societies movement was in Karnataka in Kanaginahal village 1905 and Siddanagouda Patil is known as the Father of Cooperative movement in Karnataka. Cooperatives in Rural Milieu "Cooperatives" - basically designed and oriented to meet economic and societal needs of rural segments, particularly the poor. "Cooperatives" contributes for rural credit supply fertilizer supply, sugar production, wheat procurement, cotton procurement cloth production, milk production etc.

CAUSES OF SLOW PROGRESS

In their research, Ortmann and King (2007) highlight various limitations that could hinder the effectiveness of cooperatives. These limitations encompass restricted access to farming inputs, credit information, inadequate property rights, and the burden of high transaction costs. Moreover, household heads, who are frequently lacking in education and transportation, reside in geographically dispersed areas with limited road infrastructure and communication networks. Policymakers should therefore reconsider their strategies for supporting cooperatives that serve small-scale farmers in light of these challenges.

The slow progress of the cooperative movement in India can be attributed to various factors (Singh, 2016)

- Government interference has hindered the independence and self-reliance of cooperative institutions, as they have been treated as part of the administrative setup. This has dampened people's enthusiasm and prevented the movement from becoming a true people's movement.
- Mismanagement and manipulation have corrupted the democratic principles of the cooperative movement. Farmers with larger landholdings have gained disproportionate power, altering the power dynamics within cooperatives and undermining the interests of farmers with smaller holdings.
- Lack of awareness among the public about the goals and nature of the cooperative movement has impeded its progress. Instead of understanding its significance, people often view cooperatives as a means to access government benefits. This lack of understanding is perpetuated by inadequate dissemination of accurate information and the influence of caste-based elections and bureaucratic attitudes.
- Restricted coverage of cooperative societies has limited their effectiveness. Many societies operate on a small scale, involving only a few villages and having limited resources. This hampers their ability to address problems holistically and offer comprehensive assistance.
- Functional weakness arises from a lack of adequately trained staff and insufficient training institutions. The scarcity of skilled personnel and the limited operations of cooperatives have resulted in a lack of motivation among qualified individuals to work in cooperative institutions.

EVOLUTION OF PRODUCER ORGANISATIONS (POs)

The Primary Agricultural Cooperative Society (PACS) is one of the oldest forms of producer organizations in India. In addition to these, there are many other forms of producer organizations catering to specific needs in India. However, failure of collectivization of farmers through co-operatives in agriculture sector, growing agrarian crisis and simultaneously rapid growth in private sector through corporatization led to beginning of new thinking of bringing best attributes of co-operatives and the corporates together. Producer organizations are defined as "membership-based organizations or federations of organizations with elected leaders accountable to their constituents" (World Bank, 2008) POs have been viewed as a hybrid of private companies and cooperative societies (Trebbin and Hassler, 2012. In India, the Companies Act, 1956 was amended in 2002 to permit the establishment of producer organizations on the basis of the recommendations of a high powered committee chaired by Y K Alagh committee (Government of India, 1999).

A producer organization is defined as a formal rural group whose members are committed to enhancing farm revenue through local processing, marketing, and production improvements (Rondot and Collion, 2011). Shylendra (2009) explained producer company/producer organization as a new solution to addressing the social requirements of aggregating small and marginal farmers, strengthening their leverage through collective means, and integrating their livelihoods into lucrative markets. This solution seeks to correct the unsatisfactory experiences of cooperatives. Institutions of primary producers may also be member of PO in some forms, such as producer companies. The primary goal of PO is to give producers a better income by creating their own organization (Singh and Singh, 2013).

Farmer producer organizations

Small Farmers' Agribusiness Consortium (SFAC), a Society promoted by Ministry of Agriculture and

Cooperation, Govt. of India was designated as the nodal agency for promotion of FPOs in India. National Bank for Agriculture and Rural Development (NABARD) is promoting farmer producer organizations (FPOs) in rural areas in the form of producer companies with the financial support of Government of India. In 2013, FPOs Formation Guidelines were issued by Government of India and next year i.e. 2014 was declared as "Year of Farmer Producer Organizations (FPOs)" by the Ministry of Agriculture, Government of India with special package allocation of Rs. 200 crores to NABARD as produce Fund to promote FPOs.

In simple words farmer producer organization (FPO) is nothing but a group of primary producers of any commodity but it is a legal entity formed by producers (NABARD, 2015). Farmers who produce their own products might create associations called Farmer Producer Organizations (FPO), whose members grow agricultural and related primary products. It is one kind of PO where the members are solely grower (Halpati *et al.,* 2022). Mobilizing farmers into groups of between 15-20 members at the village level called Farmer Interest Groups (FIGs) and building up their associations to an appropriate federating point i.e. Farmer Producer Organizations (FPOs). Farmer organizations can improve small producers' access to modern technology, market information and business services in rural areas, all of which have a positive impact on the productivity, growth, intensification, and commercialization of smallholder agriculture and thereby increasing their incomes (Shiferaw *et al.,* 2016). FPOs will play a significant role in enabling small farmers to increase the viability and profitability of their agricultural enterprise in order to better their socio-economic status (Singh *et al.,* 2019)

Raja *et al.* (2020) and his co-workers (2020) conducted from their experiments on A study on perception of Farmers Interest Group (FIG) members towards its functioning in Bengaluru urban district, India that less than half (40.83%) of the respondents had better perception followed by equal proportion i.e., 30.00 and 29.16 per cent of them had average and poor perception respectively towards functioning of FIG.

The primary objective of FPOs is

- To improve farmers' economic status by expanding their market access
- Increasing their bargaining power, and minimizing transaction costs.
- FPOs typically function on a not-for-profit basis and are owned and controlled by farmers. Small and marginal farmers are brought together, who frequently do not have access to contemporary technology, financing, and marketing connections.
- FPOs can exploit economies of scale, bargain better prices for their produce, and lessen their reliance on middlemen by combining their resources and working together.
- Depending on the local environment and the requirements of the farmers, FPOs can take on several forms. They can be anything from loose associations of farmers who band together for a particular goal to legally recognised cooperatives that offer a variety of services to their members.
- To gain technical support, funding, and market connections, FPOs can also collaborate with governmental bodies, NGOs, and businesses.
- FPOs contribute significantly to enhancing food security, encouraging rural development, and lowering poverty. They provide farmers more control over their decisions regarding production and marketing and give them access to resources that would otherwise be difficult to get.
- FPOs also contribute to sustainable agriculture by promoting good agricultural practices and ensuring the quality and safety of agricultural products.

Some schemes and policy initiatives supporting farmer producer organizations in India are NABARD and NABKISAN sponsored schemes, Equity Grant Scheme of SFAC, Credit Guarantee Fund Scheme of SFAC, Exemption from Corporate Tax, Rashtriya Krishi Vikas Yojana (RKVY)-Remunerative Approaches for Agriculture and Allied sector Rejuvenation (RAFTAAR), PM-Kisan FPO Scheme and NAM (National Agriculture Market Scheme).

Success story of FPOs

Susag Millets Producer Company Limited. Susag Millets Producer Company Limited is an Indian Non-

Government Company, incorporated on 10 Feb, 2016. It's a private company and is classified as company limited by shares. It was located in Visakapatnam with total of 720 members. NABARD and SFAC help them in providing credits and turnover of this company is Rs. 43,12,903 and they got profit of 1,68,781. Some of the activities done by them are procurement of Millets, processing and marketing for helping the farmers to improve their livelihood. The company got some achievements such as honored in the winner category of Vijayalaxmi Das- A Friend of Women FPO award and Susag millets FPC is in the A grade in NABFPO Digitization. They faced many challenges in developing their company some of them are Lack of proper storage of the produce, no sufficient space for processing and selling the commodities and requires capacity building training for strengthening the marketing and value addition technology to bring wide range of products. Some other successful organizations of FPOs are Dharani Farmer Producer Organization (Anantapur, AP), Van Dhan Producer Company (Tamilnadu) and Sahaja Aharam Producer Company limited (Hyderabad).

Different ways in which FPOs are helping farmers

The farmers' producer organizations and producer companies were very much beneficial to improve the value chain of agricultural produce and thereby proved to be in getting good prices for their produce (Sawairam, 2014). The most important function of the organization is to provide its members with services and access to these services is among the most important incentives to become a member (Stockbridge *et al.,* 2003). Some of the services provided by FPOs to farmers are:

Input supply services: Farmer Producer Organizations (FPOs) offer essential agricultural inputs, such as fertilizers, pesticides, seeds, and sprayers, to their member farmers at lower rates compared to the market prices.

procurement and packaging services: FPOs facilitate the procurement of agricultural produce from the fields after harvesting. When necessary, FPOs process the produce for value addition, such as converting raw turmeric into turmeric powder, and subsequently package it for sale in the market.

Marketing services: Through the aggregation and bulk handling of produce, FPOs enable farmers to obtain better prices. By doing so, they bypass numerous intermediaries present in the agricultural value chain.

Custom hiring service centre: FPOs provide rental services for agricultural implements like tractors, cultivators, tillers, harvesters, and other equipment. This is particularly useful for farmers with small landholdings who may find it challenging to purchase such implements on their own.

Insurance services: FPOs offer insurance services related to crops, livestock, and agricultural machinery. This includes crop insurance and livestock insurance for milking animals like cows and buffaloes, ensuring that farmer members have coverage and protection.

Technical and networking services: FPOs, being farmer-driven organizations, have the responsibility to provide their member farmers with the latest information on farming techniques. They update farmers' knowledge, skills, and attitudes towards farming. Additionally, FPOs facilitate networking and linkages with financial institutions, traders, and consumers, connecting farmers to wider opportunities and markets.

Producer organizations offer numerous benefits to their members, including increased bargaining power, improved market access, enhanced product quality, access to finance and resources, knowledge exchange, advocacy, and social support. By working collectively, producers can overcome individual limitations and achieve sustainable economic growth and development.

Babu (2019) reported that constraints faced by the FPO members are irregular supply of inputs followed by poor collective marketing of the produce, absence of value chain processing facility, lack of credit facility and lack of coordination among members. Prasanna *et al.* (2022) indicated some suggestions are wide publicity should be given to the concept of FPO for increasing its awareness amongst the farmers followed by farmer members of FPOs should share the information about FPOs with non-members, success stories of FPOs should given wide publicity and state government should extend all benefits of cooperatives.

Dairy Producer Orgaizations (DPOs)

An organization created on a group of farmers' initiative that has one or more goals. On behalf of its members, this also entails negotiating contracts for the delivery of raw milk. Dairy cooperatives in India have made a notable contribution to the price, quantity, and quality of milk production while also being accountable for securing a better price for milk farmers (Kumar *et al.,* 2011). The Milk Producers' Organization keeps in contact with the relevant groups involved in their institutional and economic environments and advances the appropriate agendas as required (Sahu, 2014).

Supporting dairy cooperatives and farmer producer organizations scheme: It provide working capital loan to State Cooperatives and Federations. An amount of Rs. 303 crore has been released to National Dairy Development Board till December 2021 for implementation of the scheme. Milk Producer Company can set up milk pooling points in villages and engage in milk procurement and processing. Use of electronic milk testing facility, GIS and other ICT tools ensures transparency in its operation (Paayas, 2019).

Objectives

- To support the State Dairy Cooperative Federations by offering a soft working capital loan to get through the crisis brought on by extremely unfavourable market conditions or natural disasters.
- To give dairy farmers consistent access to markets.
- In order to continue timely dues payments to farmers by State Cooperative Dairy Federations.
- In order to make it possible for the cooperatives to buy milk from the farmers at a fair price, even during the flush season.

Some of the services offered by milk producer companies

Marketing: For the sale of milk and milk products, dairy producer companies are well positioned. Through milk pooling, farmers can receive services for milk storage and transportation. Consequently, milk producer firms can increase milk quality, packaging, and branding (Shreeja, 2018).

Veterinary services: The dairy company has engaged veterinary and para-veterinary professionals to assure delivery of artificial insemination and veterinary services. Recently, the Indian government approved the establishment of multipurpose AI technicians in rural India by farmer producer companies. (GOI, 2020). This enables increased AI coverage through MPCs to the farmers.

Social security services: Companies that manufacture dairy products give loans and savings to farmers (Jose and Meena, 2019). Farmers and their families can receive discounted medical treatments from Vijaya Visakha Milk Producer Company. It provides agricultural producers' children with access to school, employment preference, irrigation projects, bridges, and canals, among other things(Rao, 2019).

Success story of DPOs

The Shreeja Mahila Milk Producer Company Ltd. is a remarkable success story as the world's largest women-owned milk producing company in Andhra Pradesh. Approximately eight years ago, a group of women formed the 'Shreeja Mahila Milk Producer Company' in Gudimallam village with 27 members. Today, the company has grown exponentially, boasting a membership of around 73,000 female milk producers and generating an impressive turnover of Rs. 415 crore. Operating through a network of 3,000 milk pooling points across three states (Andhra Pradesh, Tamil Nadu, and Karnataka), the company procures a staggering 4.5 lakh litres of milk per day. The company effectively manages multiple intricate and interconnected processes, including raw milk procurement, dairy production planning, dairy process control, quality management, sales order processing, and distribution. It operates in compliance with cooperative society laws, and notably, Shreeja stands out as the only dairy in the country that is entirely run by women. Vijaya, the chairperson, highlights the company's commitment to financial inclusion by ensuring that every member has a bank account, with collected amounts being deposited twice a month. Other successful milk producing companies include Saahaj Milk Producer Company Limited (Agra), Ujalaa Milk Producer Company Limited (Rajasthan), Baani Milk Producer Company Limited (Punjab), Maav Milk Producer Company Limited (Maharashtra), and Dalmia Nawabpeta Dairy Producer Company Limited (Kadapa, AP).

Josh and Meera (2019) concluded that opinion of dairy farmers towards services rendered by farmer producer companies is majority of farmers found that high quality of inputs followed by input supply at subsidized rate, organizing farmers for occupational problem diagnosis, catalyzing collective action for remedial measures, establishing internal monitoring systems through coordinated management. Thakur (2020) stated that the small scale dairy farmers face numerous challenges in animal feeding, health care, extension and milk marketing constraints. Many of these problems can be overcome by milk producer companies.

FISH FARMER PRODUCER ORGANIZATIONS (FFPOS)

FFPOs is one of the innovative approaches to increase and provide end-to-end support and services for small-scale fishers and fish farmers. Aquaculture has become the worlds' fastest growing food-producing sector, with an annual growth rate of 10% since 1984. Asia contributes about 91% of the worlds' total aquaculture production with China, India, Japan, the Republic of Korea, the Philippines, Indonesia and Thailand as top producers. In India, freshwater aquaculture has made notable progress in recent years and contributed about three-fourth of the total fish production in the country. Fisheries development in India has made considerable progress over the successive Five Year Plan periods. Freshwater aquaculture depends mainly on carp culture that account for around 80% of the total inland fish production and have proved sustainable at different levels of production over the years. The states of West Bengal and Andhra Pradesh occupy the first and second positions, respectively in fish production (Abraham *et al.,* 2010).

The Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying (MoFAHD) under the Pradhan Mantri Matsya Sampada Yojana (PMMSY)-provides financial assistance. First 5 FFPOs: States of Bihar, Himachal Pradesh, Andhra Pradesh and Uttar Pradesh on pilot basis under the Centrally Sponsored Scheme Blue Revolution. Under PMMSY 50 FFPOs were developed during 2020-21.

Objectives

- Economically empower the fishers and fish farmers and enhance their bargaining power by achieving economies of scale.
- Increase efficiency by using resources in an effective, economical, and sustainable way.
- Achieve higher returns for their produce thanks to improved liquidity and favourable market connections.
- Create resources to help people learn business skills so that FFPOs may support themselves economically

Success story of FFPOs

Kothapalem Coastal Marine and Aqua Producer Company Limited, situated in Vijayawada and established on 14th June 2018, has emerged as a success story. This Indian Non-Government Company operates as a private company and falls under the category of 'company limited by shares' with a primary focus on Agriculture and Allied Activities. The company has played a vital role in supporting fish farmers through activities such as fishing, operation of fish hatcheries, and providing fish farm services. With a turnover of Rs. 1,000,000 and a profit of Rs. 6,21,000, the company's increased turnover has enabled the engagement of more members from the fish farming community.

Yates (2014) in his study on Perceptions on marine management from the fishing community and suggestions for improvement concluded that engaging the fishing community and gaining an appreciation of fisher's perceptions, attitudes and behaviours is essential for understanding potential implications of management decisions and technological innovations. Fortunately, fishers are keen to participate, having an inherent vested interested in productive and sustainable fisheries. Facilitating fisher participation in both the development and implementation of management decisions should led to more effective long-term solutions to marine and fisheries management problems.

ROLE OF EXTENSION PERSONNEL

The role of extension personnel in promoting producer organizations (POs) is crucial for their successful establishment and functioning. Extension personnel, often referred to as agricultural extension agents or officers, play a pivotal role in bridging the gap between farmers/producers and various stakeholders involved in the promotion and development of POs. Here are some key roles they undertake:

Awareness and education: Extension personnel are responsible for creating awareness among farmers/ producers about the concept, benefits, and importance of POs. They educate farmers about the potential advantages of collective action, such as improved market access, better bargaining power, access to finance and resources, and enhanced productivity.

Capacity building: Extension personnel provide training and capacity-building programs to farmers/ producers on various aspects of PO development and management. This includes imparting knowledge and skills related to governance, leadership, financial management, market intelligence, value addition, and quality control.

Facilitation and networking: Extension personnel facilitate the formation and registration of POs by providing guidance on legal requirements, documentation, and organizational structure. They help connect POs with relevant government departments, financial institutions, market intermediaries, and other stakeholders. They also encourage networking and collaboration among POs to foster learning and sharing of best practices.

Technical assistance: Extension personnel provide technical assistance to POs in terms of crop selection, production techniques, post-harvest handling, storage, packaging, and quality assurance. They offer guidance on adopting sustainable agricultural practices, technology adoption, and innovation to enhance productivity and profitability.

Market linkages: Extension personnel assist POs in establishing linkages with markets, buyers, and value chain actors. They facilitate access to market information, support in negotiating fair prices, and help POs in understanding market trends, demands, and standards. They may also facilitate participation in trade fairs, exhibitions, and buyer-seller meets.

Monitoring and evaluation: Extension personnel monitor the progress and performance of POs by conducting regular assessments, evaluating their impact, and providing feedback. They assist in identifying challenges and suggesting solutions for the sustainable functioning of the POs.

Babu (2021) concluded that majority (60.00%) of the FPOs had medium level of extension contact followed by low (18.00%) and high (22.00%) respectively.

LIMITATIONS OF PRODUCER ORGANIZATIONS

Producer organizations (POs) are entities formed by farmers or producers with the aim of collectively improving their bargaining power, market access, and overall economic conditions. While POs have several advantages, they also face certain limitations. Here are some of the limitations of producer organizations:

Limited resources: POs often struggle with limited financial and human resources, especially in the initial stages of their formation. Insufficient funds and a lack of skilled personnel can hinder their ability to implement effective strategies and initiatives.

Coordination challenges: Effective coordination and cooperation among members can be a significant challenge for POs, especially when they encompass a large number of farmers or producers. Differences in opinions, conflicting interests, and communication barriers can hinder decision-making processes and hinder the achievement of common objectives.

Capacity building: Many POs face a lack of technical knowledge and skills among their members. Providing adequate training and capacity-building programs to enhance agricultural practices, marketing strategies, financial management, and other relevant areas is crucial for the success of the POs. However, resource constraints and limited access to training opportunities can impede this process.

Market volatility: POs often operate within dynamic and unpredictable market conditions. Fluctuating prices, changing consumer demands, and unforeseen external factors such as weather conditions or policy changes can significantly impact the profitability and sustainability of the POs. Adapting to market dynamics and building resilience becomes a constant challenge.

Limited access to inputs and services: Some POs may struggle to access quality inputs such as seeds, fertilizers, and technology, as well as essential services like credit, storage facilities, and transportation. Inadequate infrastructure and limited availability of these resources can restrict the productivity and growth potential of the POs.

Institutional and legal framework: The success of POs depends on a supportive institutional and legal framework that facilitates their formation, operation, and protection of members' rights. In some regions, the lack of appropriate policies, regulations, and legal mechanisms can create barriers for POs, hindering their ability to function effectively.

External market competition: POs may face competition from other market players, including large-scale agribusinesses or multinational corporations. These entities often possess greater financial resources, advanced technologies, and extensive market networks, which can pose challenges to the smaller-scale POs in terms of market access and competitiveness.

It's important to note that while these limitations exist, they can be overcome through targeted interventions, government support, capacity-building programs, and collaborations with other stakeholders. With the right strategies and resources, POs can enhance their effectiveness and contribute to the economic empowerment of farmers and producers.

CONCLUSION

Organizing producers, particularly small and marginal farmers, represents a pivotal approach in addressing some of the most pressing challenges faced in the agricultural sector. By bringing these producers together, a multitude of benefits can be achieved. To ensure that small-scale farmers can maximize their gains, it is essential to integrate their activities into a cohesive framework. This integration process underscores the paramount importance of extension services, which play a crucial role in facilitating knowledge transfer and technical assistance. In order to empower and enhance the effectiveness of Producer Organisations (POs), it becomes imperative to strengthen them through various means. This includes equipping them with the necessary knowledge, infrastructure, and technical support to excel in the fields of agriculture and agripreneurship. Adequate capacity building methods should be adopted to ensure that PO members and office bearers possess the skills and competence required to make informed decisions in a timely manner. By investing in their development, these individuals can become key drivers of success within the POs.

To achieve the best possible outcomes, it is vital to foster robust linkages between POs and financial institutions. This facilitates access to financial resources and services that can fuel growth and expansion. Additionally, cultivating a deep understanding of market dynamics is essential. POs should be equipped with market knowledge and insights to effectively navigate the competitive landscape, while also establishing the necessary market infrastructure and robust supply chains to ensure the smooth flow of goods and services. However, it is important to acknowledge that the journey towards establishing successful businesses through Producer Organisations is not without challenges. Ongoing assistance and support are often vital for their long-term sustainability and growth. Unfortunately, such support is not always readily available, posing a significant hurdle in achieving the full potential of these organizations. Efforts should be made to bridge this gap and provide the necessary resources and assistance to enable POs to thrive and flourish in their endeavors.

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Research Article

Role of Rainwater Harvest Based Nutri-Gardens in Nutritional Security of Rural Households

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ABSTRACT

The rural population in western Rajasthan is more dependent on natural resources for their livelihood and rain water harvest based nutri-garden is an important option to meet their nutritional requirement and economic needs. The present study to access the role of rainwater harvest based nutri-gardens in nutritional security of rural households was carried out in Jodhpur district of Rajasthan. The 120 rural women were selected randomly for study. It was found that training programmes and front line demonstrations on nutritional gardening has significantly increased knowledge of beneficiaries about all aspect of vegetables production and 96.66 per cent rural women had knowledge about land preparation and layout and 93.33 per cent women has knowledge of critical stages of irrigation in nutritional gardens. After these interventions, rural women grown 21 types of vegetables and production of vegetable was increased 330 per cent, resulting in increased consumption (32%), distribution among neighbours and relatives (100%). The significant increase in availability of all elements of human diet was found and availability of iron was increased by 412 per cent. The availability of water for irrigation was major constraint for production of vegetables and accorded first rank whereas, Unavailability of quality seed /planting material was ranked second.

Keywords: Rain water harvest, Nutri-gardens, Nutritional security, Knowledge, Trainings, Front line demonstrations, Constraints

INTRODUCTION

There is a need to look at multiple strategies to combat the issue of food security in the context of the ever-growing demand. Nutri-Gardens can play an important role in improving national food security and healthy community by supplementing rations and providing essential nutrients. Nutrition gardens enhance dietary diversity by providing micro nutrients through constant supply of fruits and vegetables sufficient to meet the family's requirements. The nutri-garden produce are good source of micro nutrients especially in the poor households, and nutrition gardens can prove to be a sustainable model for providing food security and diversity to combat malnutrition at the household or community level. Rural areas have ample space and establishing a nutritional garden is far simpler as farm families are involved in agriculture. Jodhpur district located in western part of Rajasthan, have limited irrigation facility and agriculture in the district is mainly dependent on rainfall. Almost 80 percent of the total annual rainfall is received during the southwest monsoon, which enters the district in the first week of July and withdraws in the mid of September (Anonymous, 2013). The rural population is more dependent on natural resource base for their livelihood and harvesting of rainwater is a key intervention for small scale agricultural activities. The production of fruit and vegetables from rain water harvest based nutri-garden is an important option for rural households to meet their nutritional requirement and economic needs

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through amount saved by non purchase of fruits and vegetables from market.

Realizing the importance of nutritional gardening, the Krishi Vigyan Kendra, Central Arid Zone Research Institute, Jodhpur conducted front line demonstrations (FLDs) on rain water harvest based nutritional gardens and an effort was made through present study to access the role of rainwater harvest based nutri-gardens in nutritional security of rural households.

MATERIALS AND METHODS

The present work was carried out by Krishi Vigyan Kendra, Central Arid Zone Research Institute, Jodhpur in purposively selected two villages namely; Palri Ranawta and Lunawas Khara of Jodhpur district where training programmes and front line demonstrations on rain water harvest based nutritional gardens were conducted in both the kharif and rabi season. The 300 rural women were benefited though training and front line demonstrations during 2015 to 2020. Out of 300 beneficiaries 120 rural women (60 from each village) were selected randomly for study. The ten major cultivation practices were selected to access the pre and post intervention knowledge level of beneficiaries and data were collected by recording response in Yes and No by assigning 1 and 0 marks respectively. The frequency counted and percent were calculated accordingly.

For individual household, an area of 250 meter square was taken for the establishment of rain water harvest based nutrition kitchen garden to meet dietary allowance of an average sized 6 family members. Krishi Vigyan Kendra has provided seed and planting material of improved varieties to the selected households. For kharif season, the vegetables selected for kitchen garden included okra, bottle gourd, sponge gourd, bitter gourd, brinjal, tomato, and cow pea whereas in rabi season, they were provided seeds/planting material of coriander, fenugreek, spinach, radish, carrot, beet root, cauliflower, cabbage, tomato, brinjal, chilli and green pea. To assess the impact of establishing nutrition kitchen garden in the rural households, average yield per unit was obtained. A dietary survey was done in the selected households in order to assess their food consumption pattern before and after establishment of kitchen garden using 24 hour dietary recall method. The nutrient availability to every individual member of the household was calculated using the food composition tables given by Gopalan *et al.* (1989). Then the nutrient availability was compared with the recommended dietary allowances given by ICMR-National Institution of Nutrition (2020) for Indians. The vegetable crop sequences are selected in such a way that the garden remains occupied throughout the year. The data on the major constraints for nutritional gardening was collected through Participatory Rural Appraisal (PRA) technique and preferential ranking technique was used to prioritize the constraints faced by them.

RESULT AND DISCUSSION

Data obtained is presented in Table 1 showed an increase in the knowledge of participants after their participation in training on various aspect of nutritional gardening.

Least (15%) rural women had knowledge on seed treatment whereas highest knowledge was observed on land preparation and layout (66.66%) before the training. After training, their knowledge has been increased in all aspect of vegetables production through nutritional gardening**.** A total of 96.66 per cent rural women showed knowledge on land preparation and layout followed by critical stages of irrigation (93.33%) and manures and fertilizers (90.00%). Veena Sahi *et al.* (2019) also reported an increase in the knowledge of rural women after providing them training on various aspects of kitchen gardening in diet diversification and nutritional security.

Table 2 revealed that before interventions respondents cultivated only three seasonal vegetable crops (Onion, Tomato and Chili), but after intervention they had grown 21 types of vegetables like Onion, Potato, Tomato, Chili, Spinach, Amaranth, Fenugreek, Brinjal, Cauliflower, Carrot, Radish, bottle gourd, bitter gourd, ridge gourd, okra, Lobia, coriander, cauliflower, cabbage, pea, and fenugreek in *Kharif*, *Zaid* and *Rabi* seasons. Table 2 shows that after trainings and establishment of nutritional garden through front line demonstrations, the production of vegetable at beneficiaries field was increased 430 per cent which resulted in increased consumption (272%), distribution (100%) and purchase of vegetables was decreased by 53 per cent.

Table 1: Pre and post training Knowledge of farm women regarding establishment of nutritional Kitchen garden (N=120)

Cultivation Practice	Before training		After training	
	N	%	N	%
Land preparation and layout	80	66.66	116	96.66
Sowing time	64	53.33	102	85.00
Improved varieties	26	21.66	98	81.66
Seed Rate and Transplanting distance	30	25.00	96	80.00
Integrated Pest Management	20	16.66	92	76.66
Critical Stages of irrigation	22	18.33	112	93.33
Seed Treatment	18	15.00	104	86.66
Manure and fertilizer	28	23.33	108	90.00
Requirements of vegetables in daily diet	20	16.66	98	81.66
Intercultural operation	22	18.33	92	76.66

Table 2: Per unit production, consumption and utilization of nutri-garden vegetables

Particulars	Type of Vegetables	Production (kg)	Purchase (kg)	Distribution /Sale (kg)	Consumption (kg)
Before Intervention	Onion, Tomato and Chilli	65	310	00	375
After Intervention	Onion, Potato, Tomato, Chili, Spinach, Amaranth, Fenugreek, Brinjal, Cauliflower, Carrot, Radish, bottle gourd, bitter gourd, ridge gourd, okra, Lobia, coriander, cauliflower, cabbage, pea, and fenugreek	280	165	50	495
Change	18 Type of Vegetables added	+215	-145	+50	+120
Percent Change		330	46	100	32

It is evident from Table 2 that Nutritional gardens demonstration resulted in increase of vegetable production as well as consumption and excess vegetables produced were provided to neighborhood and relatives. Similar results were reported by (Nandal and Vashisth, 2009).

Table 3 indicates that there was significant increase in availability all elements of human diet and availability of iron was increased by 412 per cent. The reason behind such higher increase might be due to cultivation of spinach which is rich in iron. The increased per capita availability of energy, (230 Kcal), protein (73%), Calcium (280%), Vitamin C (161%) and Beta-carotene (175%) was found. Before adoption of technology, the consumption of roots and tubers was higher in comparison to green leafy vegetables, whereas, after demonstration, consumption of green leafy vegetables increased. These vegetables were also dried and stored in powdered form as well as in dried pieces for later consumption. Similar results were also reported by Rahman *et al.* (2010) and Biswas and Masanta (2009). Awasthi *et al.* also reported increased per capita vegetable consumption after plantation of kitchen garden in Kanpur Dehat and Kushinagar districts of Uttar Pradesh.

Data presented in Table 4, showed that availability of water for irrigation is the major constraint for production of vegetables in these areas and accorded first rank by respondents. Unavailability of quality seed /planting material and lack of technical knowledge ranked second and third respectively. Other constraints were lack of interest in cultivation, traditional practices of vegetable production, not giving much priority to kitchen gardening, lack of knowledge regarding preservation and processing of surplus produce. Sethy *et al.* (2010) reported input constraint as most important constraint with first rank in Burdwan district of West Bengal followed by technical constraints, socio-cultural

Table 3: Per capita availability of energy, protein and nutrients before and after establishing nutritional kitchen garden

Nutrients/requirement	Per capita availability of nutrients/day		% RDA		Increase in RDA (%)
	Before	After	Before	After	
Protein (g)	3.21	4.58	4.92	8.54	+ 73
Iron (mg)	1.34	6.48	9.32	38.42	+ 412
Calcium (mg)	110.8	313.2	18.4	51.62	+ 280
Beta-carotene (mcg)	2104.8	4104.2	46.98	82.38	+ 175
Vitamin C (mg)	91.3	148.4	230.4	371.4	+161
Folic acid (mcg)	13.9	48.32	6.92	22.64	+ 327

Table 4: Constraints in adoption of improved kitchen gardening techniques (n=120)

S.No.	Particulars	Number	Percent	Rank
1	Unavailability of quality Seed /planting material	92	76.66	II
2	Non availability of water for irrigation	100	83.33	I
3	Lack of technical knowledge	82	68.33	III
4	Lack of interest in kitchen gardening	55	45.83	V
5	Adoption of traditional practices for growing vegetable	66	55.00	IV
6	Lesser priority is given to kitchen gardening than other farm activities	52	43.33	VI
7	Lack of knowledge regarding preservation and processing of surplus produce	46	38.33	VII

constraints and post-harvest constraints which were accorded II, III & IV ranks in rank order by the respondents. Unavailability of quality seed/planting material and lack of technical knowledge ranked second and third respectively by respondents.

CONCLUSION

It was concluded from the study that the knowledge level of beneficiaries has significantly increased about all aspect of vegetables production through nutritional gardening and 96.66 per cent rural women had knowledge about land preparation and layout and 93.33 per cent women has knowledge of critical stages of irrigation. The women cultivated only three seasonal vegetable crops before demonstrations but after intervention they had grown 21 types of vegetables. The production of vegetable After trainings and establishment of nutritional garden was increased 430 per cent resulting in increased consumption (272%), distribution (100%). The significant increase in availability all elements of human diet was found and availability of iron was increased by 412 percent. The increased per capita availability of energy, (230 Kcal), protein (73%), Calcium (280%), Vitamin C (161%) and Beta-carotene (175%) was also found. The availability of water for irrigation was major constraint for production of vegetables and accorded first rank.

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Research Article

Preference of the Farmers for DD Kisan Programs

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ABSTRACT

DD Kisan, India's specialized television channel focused on agriculture has played a pivotal role in the distribution of critical agricultural knowledge to farmers and rural populations throughout the country. Committed to empowering the agricultural sector, DD Kisan has meticulously designed a diverse range of programs aimed at improving farming practices, advancing rural development, and enhancing the overall quality of life for its audience. Some of its notable program offerings include *Choupal Charcha, Gaon Kisan, Kisan Samachar, Mausam Khabar, Mandi Khabar, and Hello Kisan,* etc. it is imperative to comprehend the specific elements within these programs that resonate most profoundly with the viewers. This comprehension is vital for refining content delivery and maximizing the channel's influence. Consequently, the principal aim of this study is to explore the preference of farmers concerning DD Kisan programs. Conjoint analysis was used for the study. Combining some important elements like enterprise, time of the program, presentation style, duration of the program, speaker, and content of the program, 27 combinations were generated by orthogonal design. The combinations were administered to 320 respondents from Uttar Pradesh and Maharashtra states. Analysis of data showed that viewers of DD Kisan programs exhibited distinct preferences: they favored animal husbandry programs, preferred evening time slots, showed greater interest in phone-in programs over straight talk, preferred program durations of 30-60 minutes, favored programs with anchors interacting with farmers, and had a preference for content related to crop protection.

Keywords: DD Kisan, Conjoint analysis, Preference of the farmers

INTRODUCTION

In this day and age of information and communication technology, television is one of the most effective developmental communication instruments. Television, because of its audio-visual elements, is a particularly efficient medium for imparting knowledge and information to a wide spectrum of urban and rural populations. Communication is a highly strong mechanism for disseminating information in order to improve our farm. Television is a contemporary scientific marvel for successful communication. Manasa *et al.* (2012) reported that TV has been hailed as the most successful medium for disseminating information into rural areas, particularly to rural women. It is one of science's most crucial innovations for communication and development, and it has captured millions of minds. Rural development in India is mostly dependent on agricultural growth, as agriculture provides a living for 70 per cent of the people.

Nargave *et al.* (2022) revealed that just over half, precisely 51.25 per cent of the farmers demonstrated a significantly favorable disposition towards mass media. According to Adhikari *et al.* (2022) the utilization of television as a cornerstone of mass media plays a pivotal role in supporting campaigns, such as the micro-irrigation campaign This suggests that mass media, particularly television, can be effectively utilized as a means for fostering rural development. Knowing

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this, the first farm and rural development program, "*Krishi Darshan*," was launched at Delhi *Doordarshan Kendra* on January 26, 1967. *Doordarshan* launched the *'Krishi Darshan'* initiative in India in 1967 to communicate agricultural facts to farmers and motivate them to adopt improved agricultural practices. On May 26, 2015, Hon'ble Prime Minister Narendra Modi launched the new channel 'DD Kisan' at New Delhi's Vigyan Bhawan. Doordarshan owned channel with the motto "Changing Indian Farmer", DD Kisan is a 24-hour agriculture television station in India. DD Kisan's programming is only available in Hindi. This channel focuses on agriculture and related industries, providing farmers with relevant information on modern agricultural techniques. The channel gives information about new agricultural practices to be used as well as connected agricultural advancements and improvements. The service also often updates viewers on changing weather conditions.

DD Kisan, as a dedicated agricultural television channel, offers a diverse array of programs aimed at imparting invaluable knowledge to farmers and enthusiasts across the agricultural spectrum. However, understanding which aspects of these programs resonate most with viewers is crucial for fine-tuning content delivery and optimizing the channel's impact. Hence, the primary objective of this study is to delve into the preferences of farmers regarding DD Kisan programs. To ensure a comprehensive exploration of viewer preferences, we employed an orthogonal design approach, generating 27 distinct combinations that encapsulate the myriad choices presented to our viewers. These combinations were subsequently presented to the participants for ranking, enabling us to discern the precise elements that hold the most appeal among the diverse array of DD Kisan program offerings.

MATERIALS AND METHODS

The selection of Uttar Pradesh and Maharashtra as the study's focal states was purposive, driven by the high viewership of the DD Kisan channel in these regions. Within Uttar Pradesh, the districts of Lucknow and Bhghpat were chosen randomly, as were the districts of Pune and Aurangabad in Maharashtra. Subsequently, four villages were randomly selected from each of these districts. Within each village, twenty (20) respondents who were identified as viewers of the DD Kisan channel were chosen. Consequently, the sample size totaled 320 individuals.

An *ex-post facto* research design was used for this study. Data collection was done through a structured interview schedule that was designed for the study's specific needs. To study the preference of viewers, conjoint analysis was used. To study the preferences, conjoint analysis was used. Important aspects like enterprise, time of the program, presentation style, and duration of the program, speaker, and content of the program were considered for generating combinations.

For the study, a semi–structured interview schedule was prepared. The interview schedule, which consisted of 27 preferences, was administered to 320 individuals. In enterprise, agriculture, horticulture, and animal husbandry were selected. To observe the time slot preferred by viewer's morning, afternoon, and evening options were given. In the presentation style category, straight talk, interview, phone in program, and field reporting were given as choices. To see the preference of speakers, anchor alone, anchor + scientist, and anchor+ farmers were given as choices. In the section on content crop production, crop protection, and marketing were chosen. Using the orthogonal design, 27 combinations were generated. These sets have been given for ranking preference by the farmers. For generating preferences, orthogonal design was used. For further analysis of data, MS Excel and SPSS software was used.

Table 1 shows the conjoint model that was generated, with attributes at their different levels and their relation to ranks/scores. Six attributes were selected to determine viewers' preference for DD Kisan programs. All the attributes, except for presentation, were assessed on three levels with presentation being assessed at four levels.

Table 1: Conjoint model description

Attribute	Levels
Enterprise	3
Time	3
Presentation	4
Duration	3
Speaker	3
Content	3

RESULTS AND DISCUSSION

Conjoint analysis was employed to investigate viewer preferences. This method took into account crucial factors such as enterprise, program timing, presentation style, program duration, speaker selection, and program content when creating combinations. Through the application of orthogonal design principles, a total of 27 distinct combinations were systematically generated. These combinations were then presented to a sample of 320 individuals through the interview schedule, which encompassed the 27 specific preferences. Conjoint analysis was carried out. It produced values of each of the attribute (Table 2).

Table 2: Part-worth of different levels of attributes for DD Kisan programs

Items	Levels	Utility estimate	Std. error
Enterprise	Agriculture	-.824	.496
	Horticulture	.266	.496
	Animal husbandry	.558	.593
Time	Morning	-1.152	.496
	Afternoon	-.326	.496
	Evening	1.478	.593
Presentation	Straight talk	-.114	.675
	Interview	-.368	.675
	Phone in program	.383	545
	Field reporting	.099	.675
Duration	<30 minutes	.273	.496
	30-60 minutes	.277	.496
	>60 minutes	-.550	.593
Speaker	Anchor + scientist	.076	.496
	Anchor + farmers	-.302	.496
	Production	.226	.593
Content	Crop production	.524	.496
	Crop protection	1.342	.496
	Crop marketing	-1.867	.53
(Constant)		12.893	.45

The data in Table 2 showcases the utility estimates corresponding to different attribute levels for DD Kisan programs. These utility estimates serve as indicators of the preference levels for each attribute and its various levels. Higher utility estimates signify a stronger preference for a particular attribute, while lower estimates suggest less favorability. Negative utility estimates indicate a higher level of selectivity among the viewers.

Significantly, viewers displayed a clear inclination toward animal husbandry programs, as evidenced by the positive utility estimate associated with this attribute. Furthermore, a substantial portion of the viewers expressed a preference for evening time slots when watching programs. These findings align with the research conducted by Meena *et al.* (2010), who investigated the preferences of farmers in Haryana regarding agricultural telecasts. According to their study, a majority of both male and female respondents favored watching agricultural programs between 6-7 p.m. during the winter season, and 8-9 p.m. was the preferred time slot during the summer months.

The phone-in program garnered more viewer interest compared to "Straight Talk" and other formats. A similar pattern emerged in a study conducted by Kumar (1992) in the *Panchayat Samiti* of Sambhar block in Jaipur district, where farmer responses to agricultural broadcasts were examined. One more study also aligns with the findings. According to Hansra (1981), in the Mera Pind Mere Khet program broadcasted by the Jalandhar TV Station, farmers demonstrated a preference for demonstrations over interviews and discussions. Among the various techniques of presentation, they ranked demonstration as their top choice. Conversely, "straight talk" was the format that generated the least interest among the farmers. The result also provided the important scores of dimensions (Table 3).

The data in Table 3 provides averaged importance scores for various attributes of DD Kisan programs. These scores are presented as percentages, reflecting

Table 3: Averaged scores for different attributes of DD Kisan programs

Attribute	Percentage score
Enterprise	14.82
Time	28.19
Presentation	8.04
Duration	8.86
Speaker	5.65
Content	34.40

Table 4: Utility scores for different ranked combinations

No.	Enterprise	Time	Presentation	Duration	Speaker	Content	Utilities	Rank
1.	Horticulture	Evening	Straight talk	<30 minutes	Anchor+scientist	Crop protection	3.44	I
2.	Agriculture	Evening	Straight talk	30-60 minutes	Anchor+farmer	Crop protection	2.88	II
3.	Horticulture	Evening	Farmer's interview	<30 minutes	Anchor	Crop production	2.71	III
4.	Animal husbandry	Evening	Phone in program	30-60 minutes	Anchor+scientist	Crop production	2.42	IV
5.	Horticulture	Afternoon	Farmer's interview	30-60 minutes	Anchor	Crop protection	1.73	V
6.	Horticulture	Afternoon	Phone in program	30-60 minutes	Anchor	Crop protection	1.52	VI
7.	Animal husbandry	Afternoon	Interview	<30 minutes	Anchor+scientist	Crop protection	1.17	VII
8.	Animal husbandry	Morning	Straight talk	<30 minutes	Anchor	Crop production	0.66	VIII
9.	Horticulture	Afternoon	Interview	<30 minutes	Anchor+farmer	Crop production	0.59	IX
10.	Agriculture	Afternoon	Straight talk	<30 minutes	Anchor+scientist	Crop protection	0.54	X
11.	Animal husbandry	Morning	Farmer's interview	>60 minutes	Anchor+farmer	Crop protection	0.52	XI
12.	Horticulture	Afternoon	Straight talk	>60 minutes	Anchor	Crop production	0.37	XII
13.	Agriculture	Afternoon	Straight talk	30-60 minutes	Anchor+farmer	Crop production	0.26	XIII
14.	Horticulture	Morning	Straight talk	>60 minutes	Anchor+scientist	Crop protection	-0.01	XIV
15.	Agriculture	Morning	Phone in program	<30 minutes	Anchor	Crop protection	-0.39	XV
16.	Agriculture	Afternoon	Farmer's interview	<30 minutes	Anchor+scientist	Crop production	-0.55	XVI
17.	Agriculture	Morning	Interview	30-60 minutes	Anchor	Crop protection	-0.64	XVII
18.	Agriculture	Morning	Straight talk	<30 minutes	Anchor	Crop production	-0.72	XVIII
19.	Horticulture	Morning	Interview	30-60 minutes	Anchor+scientist	Crop production	-0.75	XIX
20.	Animal husbandry	Afternoon	Straight talk	30-60 minutes	Anchor	Marketing	-0.89	XX
21.	Agriculture	Morning	Farmer's interview	30-60 minutes	Anchor+scientist	Crop production	-1.37	XXI
22.	Agriculture	Afternoon	Phone in program	>60 minutes	Anchor+scientist	Crop production	-1.59	XXII
23.	Agriculture	Morning	Phone in program	<30 minutes	Anchor+scientist	Crop production	-1.59	XXIII
24.	Agriculture	Evening	Interview	>60 minutes	Anchor	Marketing	-2.05	XXIV
25.	Horticulture	Morning	Phone in program	<30 minutes	Anchor+farmer	Marketing	-2.36	XXV
26.	Horticulture	Morning	Straight talk	30-60 minutes	Anchor+scientist	Marketing	-2.39	XXVI
27.	Agriculture	Afternoon	Farmer's interview	<30 minutes	Anchor+scientist	Marketing	-2.94	XXVII

the relative popularity of each attribute among viewers. As per the table, content emerged as the most highly favored attribute, receiving a substantial score of 34.40 per cent. Time was the second-most preferred attribute, with a score of 28.19 per cent. Enterprise garnered a score of 14.82 per cent. While duration and presentation received scores of 8.86 per cent and 8.04 per cent, respectively. The speaker attribute obtained a score of 5.65 percent. Through the utility score of each attribute, preference score of every combination was calculated and given below (Table 4).

The data in Table 4 represents the utility scores for different ranked combinations. The combination "Horticulture + Evening + Phone-in-program + <30 minutes + Anchor + Scientist + Crop protection "is preferred more followed by "Agriculture + Evening Straight talk + 30-60 minutes Anchor + Farmer + Crop protection". This study is consistent with the research conducted by Kumar *et al.* (2016), which examined farmers' preferences regarding agricultural television programs. The majority of farmers (35%) favored demonstrations by scientists, which they ranked higher than phone-in-live sessions (26.6%), scientists talk (19.2%), and success stories (19.2%).

CONCLUSION

Conjoint analysis provides a valuable means to evaluate the value that viewers attribute to the different characteristics and elements present in DD Kisan programs they prefer to watch. It employs a multivariate approach to explore how respondents shape their preferences for DD Kisan programming. In summary, the findings of this study offer valuable guidance for

content producers and broadcasters in tailoring DD Kisan programs to better align with the preferences and interests of the farming community. Understanding these preferences is essential for ensuring that agricultural information and knowledge dissemination effectively meet the needs of the viewers, ultimately contributing to the advancement of agriculture in India.

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Research Article

Listeners Recognition Towards Sustainability of Community Radio in Barh (Bihar)

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ABSTRACT

The community radio (CR) is the powerful tools to address and resolve community related issues by empowering the community members. Community media helps in community empowerment by fulfilling the community's informational needs and by encouraging the community members in participation of their own development. Altogether 1200 respondents had been taken from 40 villages of three blocks and data were collected through well-structured interview schedule. Out of six categories of programme aired by CR Station "Krishak Manch" was liked most and rank first (score-300) followed by Health & Nutrition programme which ranked second (score-266) in listeners liking. Among the different programme under Krishak Manch listeners recognized best programme (score-160) is management of Insect, Pest and Disease in vegetable and filed crops followed by Mushroom cultivation for income and employment generation (score=156). Best broadcast time of Community Radio as per listeners liking is 1-2 pm followed by 2-3 pm as it was free time most of listeners to hear and take decision accordingly if required. Community Radio Station, Krishi Vigyan Kendra, Barh, Patna sustaining well among listeners in creating awareness towards new agricultural technologies, health and hygiene, sanitation, *Swachta* mission, etc. aired by CR Station for their upliftment, creating additional income and employment and finally for their better livelihood.

Keywords: Community radio, Awareness towards agricultural technologies, Health and nutrition

INTRODUCTION

The community radio (CR) is one of the powerful community media tools to address and overcome the different community related issues by empowering the community members. Community media help in community empowerment by fulfilling the community's informational needs and by encouraging the community members in participation of their own development. CR is about the horizontal exchange of information, a participatory interaction between the community and the radio station rather than a vertical, one-way communication method, delivering information from a medium to the public. The most important aspects of community radio are that the community participants emphasized, often on volunteer basis. Community radio involves community organization, joint thinking and decision-making, all of which entail great potential for empowering communities and building a democratic society.

Community radio is "one that is operated in the community, for the community, about the community and by the community" (Tabing, 2002). Community radio is regarded as third tier of broadcasting service after public and commercial broadcasting services and it emphasizes to bring small communities together to realize their potential and encourages local aspirations. Community radio as an ICT tool now playing a major role in disseminating information to communities in remote and rural areas as it is cost-wise pro-poor and enable greater community participation.

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The emergence of community radio stations in the country has been driven by an organized effort at building collective identity among vigilant citizens across the country as a grassroots culture, embracing alternative organizational practices (Singh, 2010). Community radio is a catalyst of positive social change in rural parts of India, which speaks volumes about its potential as a change agent (Barl, 2009). Community radio uses the local language and dialects in its content broadcasted, which provides a sense of belongingness to the local people and eliminates the illiteracy constraints in rural areas.

Community Radio Station, Krishi Vigyan Kendra, Barh, Patna was established in June, 2011. Initially it was started with focus on farming community. Programme on Agriculture and allied activities were recorded by the Scientist working under Bihar Agricultural University, Sabour, ICAR institutes, nearby KVKs. After recording programme were edited and then aired in the 20 km arial radius of community radio. After completion of seven years in 2018-19 CR received a Project on "Addressing Issues of Malnutrition among vulnerable community of Patna district". After successful completion of this pilot project Community Radio workers, volunteers and listeners motivated towards health & nutritional aspects. After the completion of this pilot project, a no. of minor project was initiated on awareness on Covid, awareness on *Swachhta*, awareness on voter for casting the votes during election, awareness towards health and nutrition, special campaign towards TB, etc. with the financial support of Govt. agencies as well as Voluntary Organizations. Still there are numerous constraints prevailing in the sustainability of community Radio like no radio jockey, lack of financial provision for the community radio, etc. In spite of numerous hurdles, Community Radio is running successfully since its inception and completed thirteen years of its journey. Keeping above sustainability problems present study were undertaken with following objectives:

- To find out the listener's favoritism towards broadcast timing of the community radio, KVK, Patna.
- To identify the Listener's like and dislike towards title of the programme broadcasted by Community Radio.
- To assess the listeners' recognition towards agricultural and health and nutritional programme aired through Community Radio.
- To suggest suitable measures for sustainability of Community Radio.

MATERIALS AND METHODS

For the present study three nearest blocks were selected on the basis of listeners. Among three selected blocks 40 villages were selected on the basis of number of listeners and which come under the periphery of Community Radio within 12 km of aerial radius. Thus, altogether 40 villages of three blocks viz 15 villages in Barh block, 15 villages in Pandarak block and only 10 villages from Athmalgola block has been selected. From these three blocks 30 villages were selected keeping in mind that in that village having active radio listeners. Out of 40 villages 30 active radio listeners were selected from each village. Thus, total sample size of the study was 1200 (Table 1). A structured interview schedule was prepared with the help of the experts, CR volunteers and active listeners and tested in the sampling area for final data collection. Data were collected with the help of structured schedule which were tabulated, compiled, analysed, interferences were drawn from results of the collected data.

RESULTS AND DISCUSSION

Data depicted in Table 2 reveal about the audience favoritism towards broadcast timing of Community Radio, and it was observed that maximum listeners 124 (10.33%) out of 1200 liked the broadcast time in between 1 to 2 PM with rank score of 233 followed by 2 to 3 PM and 3-4 PM with rank score of 214.

Out of 1200 listeners 124 (10.33%) listeners liked 1 to 2 PM while 98 (8.17%) liked 2-3 PM and 78 (6.50%) of the total liked 3-4 PM of broadcast time of Community radio.

Table 1: Sampling technique for present study

Name of block	No. of selected village	No. of listeners in each village	Total sample
Barh	15	30	450
Pandarak	15	30	450
Athmalgola	10	30	300
Total	40		1200

Table 2: Audience favouritism towards broadcast timing of CRS

Broadcast time	Most accepted		Acceptable		Least accepted		Not accepted		Rank	Rank
	No.	%	No.	%	No.	%	No.	%	Score	
10-11AM	37	3.08	24	2.00	22	1.83	16	1.33	99	7th
11-12AM	32	2.67	44	3.67	31	2.58	23	1.92	130	6th
12-01PM	53	4.42	42	3.50	37	3.08	34	2.83	166	5th
01-02PM	124	10.33	52	4.33	36	3.00	11	0.92	223	1st
02-03PM	98	8.17	63	5.25	27	2.25	26	2.17	214	2nd
03-04PM	78	6.50	55	4.58	47	3.92	17	1.42	197	3rd
04-05PM	37	3.08	42	3.50	56	4.67	36	3.00	171	4th
Total	459	38.25	322	26.83	256	21.33	163	13.58	1200	

Table 3: Audience most liked programme broadcasted by CRS

Broadcasted programme	Most accepted		Acceptable		Least accepted		Not accepted		Rank	Rank
	No.	%	No.	%	No.	%	No.	%	Score	
Krishak Manch	137	11.42	72	6.00	67	5.58	24	2.00	300	1st
Corona Awareness	38	3.17	34	2.83	31	2.58	29	2.42	132	5th
Health & Nutrition	87	7.25	77	6.42	71	5.92	31	2.58	266	2nd
Mahila Jagat	79	6.58	63	5.25	49	4.08	31	2.58	222	3rd
Bal Manch	42	3.50	34	2.83	27	2.25	24	2.00	127	6th
Safalta ki Kahani	31	2.58	38	3.17	43	3.58	41	3.42	153	4th
Total	414	34.50	318	26.50	288	24.00	180	15.00	1200	

Table 4: Most recognised nutritional pogramme broadcasted by CRS

Broadcasted programme	Most accepted		Acceptable		Least accepted		Not accepted		Rank	Rank
	No.	%	No.	%	No.	%	No.	%	Score	
Gyandev Chacha ki Gyan Ki Baten (Radio Drama)	152	12.67	84	7.00	91	7.58	43	3.58	370	1st
Kuposhan Varta (Talk Show)	62	5.17	61	5.08	71	5.92	83	6.92	277	3rd
Vaigyanik Evam Chikitshak Salah (Interactive Session)	116	9.67	97	8.08	81	6.75	32	2.67	326	2nd
Poshan Ki Kahani (story telling)	54	4.50	66	5.50	52	4.33	55	4.58	227	4th
Total	384	32.00	308	25.67	295	24.58	213	17.75	1200	

Preferences of the listeners/ audiences has been also recorded during the course of study towards Programme broadcasted by community Radio and it was observed that out of 6 different programmes broadcasted by the CR *Krishak Manch* ranked top with score of 300 point and audience acceptance 137 (11.42%) followed by 87 (7.25%) listeners liked health and nutrition awareness programme with rank of 266 and 79 (6.58%) audience preferred *Mahila Jagat* programme with rank of 222 point (Table 3).

Another most important programme recognized is health and nutritional aspects which was broadcasted by community radio, Patna is presented in Table 4.

Table 5: Most recognized agricultural pogramme broadcasted by CRS

Broadcasted	Most accepted		Acceptable		Least accepted		Not accepted		Rank	Rank
programme	No.	%	No.	%	No.	%	No.	%	Score	
Vegetable farming for higher income	52	4.33	31	2.58	41	3.42	19	1.58	143	**3rd**
Crop Production	47	3.92	37	3.08	31	2.58	24	2.00	139	**4th**
Insect Pest & Disease management in field crops	67	5.58	46	3.83	34	2.83	13	1.08	160	**1st**
Soil Test for better use of fertilizers	29	2.42	28	2.33	17	1.42	23	1.92	97	**8th**
Nursery Management	35	2.92	20	1.67	34	2.83	10	0.83	99	**7th**
Orchid management	21	1.75	27	2.25	14	1.17	17	1.42	79	**10th**
Mushroom cultivation for income & employment generation	48	4.00	53	4.42	41	3.42	14	1.17	156	**2nd**
Beekeeping for income & health	22	1.83	29	2.42	19	1.58	16	1.33	86	**9th**
Vermicompost production technology and its use	28	2.33	26	2.17	14	1.17	53	4.42	121	**5th**
Dairy Farming	49	4.08	46	3.83	25	2.08	0	0.00	120	**6th**
Total	398	33.17	343	28.58	270	22.50	189	15.75	1200	

Table 6: Sustainability of community radio through financial gain

S.No.	Year	Amount received (Rs.)	Purpose	Received from institution
1.	2018-19	18,30,000.00	Project on Awareness	ICDS, Ministry of Social Welfare, Govt. of Bihar
2.	2019-20	5,000.00	Awareness on Cyber Crime	SSB, Patna
3.	2019-20	20,000.00	Voter Awareness Prog.	Election Commission,New Delhi
4.	2020-21	56,350.00	BMGF	SMART, New Delhi
5.	2020-21	38,000.00	Covid -19 Campaign	SMART, New Delhi
6.	2022-23	58,080.00	Awareness onPlastic use	SMART, New Delhi
7.	2022-23	44,100.00	Covid -19 Campaign	SMART, New Delhi
8.	2022-23	49,000.00	Swachhta BAN	SMART, New Delhi
9.	2022-23	29,000.00	The TB Challenge	SMART, New Delhi
10.	2022-23	48,620.00	Women Awareness	Vermillion, New Delhi
11.	2022-23	40,000.00	The TB Challenge	SMART, New Delhi

Result revealed that out of four different programmes broadcasted in from of drama "*Gyandev chacha ki gyan ki baten*" ranked 1st with 370 score among 1200 villagers, 152 (12.67%) most recognized followed by 116 (9.67%) doctor & scientist suggestions which was in the form of interactive session and 62 (5.17%) of listeners preferred *Kuposhan varta* (discussion on Malnutrition) which was broadcasted as talk show.

Data in Table 5 depicted about most recognized programme of agriculture and allied sector broadcasted by community radio, Patna. Results communicate that a lots of programmes on agriculture & allied sectors were broadcasted though community radio for the increasing the livelihood of listeners.

Among the 10 different programmes telecasted out of that insect, pest and disease management of

different field crops ranked 1st with 160 score point and liked by 67 (5.58%) listeners. Second most important livelihood improvement programme broadcasted is mushroom cultivation for income & employment generation with ranking of 156 by 48 (4.0%) villagers respondents followed by and vegetable farming 52 (4.33%).

From the Table 6, it was evident that since the inception of Community Radio till 2017-18 no financial support received from any organizations for its sustainability.

In 2018-19 financial support started on project mode and till 2022-23 altogether 11 projects completed successfully. Among the different project, Awareness on malnutrition among listeners from Integrated Child Development Services, Ministry of Social Welfare, Govt. of Bihar, with financial support of Rs. 18,30,000/-. In 2022-23 total fund received was Rs. 2,68,800 from different organizations for betterment of community.

CONCLUSION

From the above results and discussions, it may be concluded that since the inception of Community Radio Station, Krishi Vigyan Kendra, Barh, Patna sustaining well among listeners in creating awareness towards new agricultural technologies aired by CR Station for their upliftment, creating additional income and employment for better livelihood. Out of six categories of programme aired by CR Station "Krishak Manch" was liked most and rank first (rank score-300) followed by Health and Nutrition programme which ranked (second rank score-266) in listeners liking. Under Krishak Manch "Insect, Pest and Disease management" ranked first (score-160) as recognized by the listeners. Today insect, pest and disease management are a vital issue in achieving higher yield of field crops. High yield of crop is the key factor of increasing their income and finally for their better livelihood. Programme aired on Mushroom cultivation for income & employment generation secured second rank (score=156) as per listener's recognition, as mushroom is not only a healthy, nutritious, rich in vitamins, minerals, amino acid but also having more opportunities in raising income as well as employment. Regarding broadcast time of Community Radio as per listeners liking the best time of listening radio is 1-2 pm followed by 2-3 pm and 3-4 pm because at this time most of listeners feel free from all their works. At the last, since opening of CRS was running in financial weakness but at present listener's feedback regarding how programme helpful in their better livelihood, their effort in recording, editing and executing CR programme. Various organizations supporting through fund for broadcasting their programme on awareness at various level.

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Research Article

Socio-economic Factors Affecting Women Employment in Rural Families

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ABSTRACT

The study was conducted to assess the socioeconomic factors affecting women employment, to analyse the allocation of women's income, women's say in spending their income and job problems. A total sample of 120 respondents was taken from the four villages from two districts of Haryana i.e. Hisar and Panchkula. Results revealed that most prominent reason to take up the job among the respondents was insufficient income of the husband whereas the main purpose of the income was to supplement family income followed by education of children. 69.17 per cent of the respondents were found not to have free will to spend their income. The most prominent job problem encountered by the respondents was difficulty in performing dual role. The economic status of women plays a key role in determining her social status also interventions to improve women's resources will improve family nutrition and food consumption. Income of women, production-focused inputs, labour-saving technology, microfinance, social networks, and human capital should be promoted through such collaboration. Most importantly role women in decision making is a significant facet for women empowerment.

Keywords: Women employment, Women's income, Job problems, Dual role, Economic status

INTRODUCTION

The pace of development in any country at a greater extent depends upon the people's participation including women in economic sphere. The female contribution to the overall economy, particularly in agriculture is greater throughout Asia. Bangladesh, Bhutan, Cambodia, China, India, Myanmar, Nepal, Pakistan and Vietnam have particularly high percentages of women employed in the agricultural sector, with estimates ranging between 60 and 98 per cent (FAO, 2003). As per Census 2011, the workforce participation rate for females is 25.51 per cent against 53.26 per cent for males in India. Rural area has a better female workforce participation rate of 30.02 per cent as compared to 53.03 per cent for males. Whereas for urban sector, it is 15.44 per cent for females and 53.76 per cent for males. Aggregate female workers in India is 149.8 million and female workers in rural areas are 121.8 million. Out of total 149.8 million workers 35.9 million are working as cultivators and another 61.5 million are agricultural labourers. Remaining female workers, 8.5 million are in household industry and 43.7 million are categorised as other workers. Indian women particularly in rural areas have to play multiple roles i.e. a wife, mother, and daughter in law etc., who also participates in labour force and contributes a significant proportion to family income. On an addition they have a central role in food chain activities such as production and distribution of food. With the increase in population throughout the globe the access to basic needs of life has been limited and it was then the need of modern time that women work side by side with men in order to run their house. Being at workplace and at home brings various challenges for women which in turn influence the quality of life of women and her health (Ahmad and Khan, 2018).

In rural India women are not just primary caregivers, they also contribute to national income in

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their capacity to earn. Women are the backbone of rural economies and according to FAO (2006) in the least developed countries more than 70 per cent of the economically active women are working in agriculture. Financial independence gives women more respect in the society and it enhance one's reputations and independence in the society, women also feel empowered and helps them to raise their economic and social status (Kumari, 2012). It is evident that women are good partners of the socioeconomic development of the country in general and the family in particular. They can contribute significantly to the socioeconomic upliftment of the family if proper environment with facilities are ensured (Chowdhury *et al.,* 2009). This paper focuses on aspects such as (i) to find the socioeconomic factors affecting women employment (ii) to find the reasons of taking up a job (iii) allocation of income (iv) job related problems faced by women.

MATERIALS AND METHODS

The study was conducted in rural areas of Haryana state. Two districts Hisar and Panchkula, both the districts were selected purposively on the basis of high and medium female literacy rate respectively. The study was carried out in two selected blocks i.e. (i) Hisar II and (ii) Barwala. From these two blocks four villages were selected i.e. two from each block. Sarsana and Balsamand were chosen from Hisar II and Rattewali and Manak Tabra from Barwala block. A total sample of 120 respondents were selected randomly; 30 from each village. An Interview Schedule was prepared for collection of data. The collected data were coded, tabulated, analysed and interpreted according to the objectives of the present study with the help of appropriate statistical techniques. The descriptive statistical tools such as frequency, percentage, chi-square, mean.

RESULTS AND DISCUSSION

Analysis in Table 1 revealed that association between caste and type of employment was found to be significant and the general caste dominated in the category of government services (58.33%), private services (16.67%) and entrepreneurship (22.97%). Only one respondent from general caste was found to be engaged in labour work. Whilst majority of the respondents from backward and scheduled caste were engaged as labourers in industries or farms.

Respondent's education was found highly significant with their type of employment. Study indicates that all the respondents who were illiterate found to be working as industrial/farm labourers

Table 1: Distribution of respondents according to their social factors and type of employment

Caste	Government Service	Private Service	Entrepreneur-ship	Labour (industrial/farm)	Total
General	28 (58.33)	08 (16.67)	11 (22.97)	01 (2.08)	48 (40.00)
Backward	12 (29.26)	05 (12.19)	03 (7.37)	21 (51.21)	41 (34.17)
Scheduled	11 (35.47)	02 (6.45)	00 (00)	18 (58.06)	31 (25.83)
Total	51 (42.5)	15 (12.50)	14 (11.67)	40 (33.33)	120 (100.00)
					$\chi^2 = 39.63^{**}$
Education					
Illiterate	00 (00)	00 (00)	00 (00)	23 (100.00)	23 (19.17)
Up to Primary	00 (00)	01 (5.56)	01 (5.56)	16 (88.89)	18 (15.00)
Up to middle school	07 (100.00)	00 (00)	00 (00)	00 (00)	07 (5.83)
Up to High School	19 (86.36)	01 (4.54)	01 (4.54)	01 (4.54)	22 (18.33)
Up to Senior Secondary	13 (61.98)	02 (9.52)	06 (28.57)	00 (00)	21 (17.50)
Up to Graduation	10 (50.00)	05 (25.00)	05 (25.00)	00 (00)	20 (16.67)
Up to Post-Graduation	02 (22.22)	06 (66.67)	01 (11.11)	00 (00)	09 (7.50)
					$\chi^2 = 148.49^{**}$

*Significant at 5 % level of significance; **Significance at 1 % level of significance; Figures in parentheses denote percentage

whilst half who studied up to graduation were in government services and other half in private services (25%) and (25%) respondents were entrepreneurs. Also an overwhelming majority of respondents (86.36%) who attended high school were in government services. Similar findings were reported in the study by Datta *et al.* (2020) caste and education emerge as important variables that explain women's workforce participation which follows a clear caste pattern.

Data presented in Table 2 reveals that an enormous majority (82.85%) of respondents whose family income was up to Rs.1, 50,000 per annum were engaged in industries/farms as labourer. More than three fifth of the respondents (64.27%) family's income above Rs. 3,00,000 found to be involved in government services. Whereas 21.42% of the respondents whose family's income was above Rs. 3,00,000 were engaged in private services. Which showed that the Income of the family was significantly associated with type of employment of women respondents. Analysis also disclosed that 69.09% of them had low socio-economic status and belonged to industry/farm labourers. Contrary to that 72.00% of the respondents who had high level of socio-economic status were in government services.

Reasons for taking up job is presented in Table 3 which shows that more than half of the respondents (59.17%) stated insufficient income of the husband be the reason of taking the job. Whilst 34.17 per cent of them stated it as their 1st priority. Similarly 30.00 per cent respondents 1st biggest reason to do the job was to provide better facilities for children to pay tuition fees, better food, clothing etc. 21.66 per cent of the women took up job to have self-satisfaction and be independent and considered it as the 1st priority. Among all 19.17 per cent women interviewed gave time utilisation as the reason to do the job. Study by Sarkar *et al.* (2019) also found that an increase in wealth and income of other members of the household leads to lower entry and higher exit probabilities of women.

Data analysis in Table 4 disclosed that all respondent's income is used to supplement the family

Table 2: Distribution of respondents according to their economic factors and type of employment

Family income	Government Service	Private Service	Entrepreneur-ship	Labour (industrial/farm)	Total
Up to Rs. 1,50,000	03 (8.57)	02 (5.71)	01 (2.85)	29 (82.85)	35 (29.17)
Rs. 1,50,000-3,00,000	21 (48.83)	04 (9.30)	07 (16.27)	11 (25.58)	43 (35.83)
Above Rs. 3,00,000	27 (64.27)	09 (21.42)	06 (14.27)	00 (00)	42 (35.00)
Total	51 (42.50)	15 (12.50)	14 (11.67)	40 (33.33)	120 (100)
					χ^2 = 6 2.78**
Socio-economic status					
Low	13 (23.63)	03 (5.45)	01 (1.81)	38 (69.09)	55 (45.83)
Medium	20 (50.00)	05 (12.50)	13 (32.50)	02 (5.00)	40 (33.33)
High	18 (72.00)	07 (28.00)	00 (00)	00 (00)	25 (20.83)
					χ^2 = 78.67**

*Significant at 5 % level of significance; **Significance at 1 % level of significance; Figures in parentheses denote percentage

Table 3: Distribution of respondents as per their Reason/ causes for taking up a job

S.No.	Reason for taking up a job	Priority			Total Score	Rank
		1st	2nd	3rd		
1.	Insufficient income of husband	41 (34.17)	29 (24.17)	1 (0.83)	71 (59.17)	I
2.	Better living and proper facilities for children	36 (30.00)	7 (5.83)	27 (22.50)	70 (58.33)	II
3.	For self-satisfaction and be Independent	26 (21.66)	2 (1.67)	7 (5.83)	35 (29.17)	III
4.	Time utilisation and improving status	17 (14.17)	0 (00)	6 (5.00)	23 (19.17)	IV

Figures in parentheses denote percentage

income. Further 49.17 per cent respondents assured to fulfill this purpose at first from their income and 36.6 per cent preferred to spend their income for education of children and special needs gave it a 1st priority on which they spend their income. Only 10.00 per cent respondents preferred to spend on purchasing household items out of their income. Among everyone only 3.33 per cent of the women prioritised saving their income. It was also found that no one gave first priority to spend their income to improve personal wardrobe but 28.83 per cent of the respondent gave it second and third priority to spend their income. Khan and Khan (2006) also confirmed that women being head of household and her education have a significant positive impact on contribution in household budget.

Data presented in Table 5 shows that only 25.49 per cent women who were engaged in government were free to spend their income as they wished. Similarly 26.66 per cent women from private services and 28.57 per cent entrepreneurs had a say in spending their income as desired. Whereas in case of women labourers 40 per cent of them had liberty to spend their income according to their will. Apparently 69.17 per cent of women from all types of employment were not free to spend their earned income as per their wish. Budhiraja (2002) and Gupta (2014) also mentioned that the women were not given any decision making power in respect of their salary. Even after slogging all month long 25 per cent working women hardly had any economic independence and majority of the respondents were facing clash with their husbands over the use of money.

Table 6 shows that 77.50 per cent women found difficulty in performing dual role. Whereas 49.17 per cent disclosed having irregular payments chiefly among

Table 6: Distribution of the respondents as per job problems

S. No.	Job problem	Frequency	Percentage	Rank
1.	Difficult to perform dual role	93	77.50	I
2.	Irregular payments	59	49.17	II
3.	No guarantee of work	49	40.83	III
4.	Heavy work load	42	35.00	IV

Figures in parentheses denote percentage; Responses were multiple

Table 4: Distribution of the respondents as per purpose of spending the income

S.No.	Purpose on which income spent	Preference			Total score	Rank
		1st	2nd	3rd		
1.	For supplementing family income	59 (49.17)	28(23.33)	33‘(27.50)	120	I
2.	For education of children and special needs (toys, dresses etc.)	44 (36.67)	40 (33.33)	04 (3.33)	88	II
3.	For purchasing household items	12 (10.00)	24 (20.00)	07 (5.83)	43	III
4.	Savings	04(3.33)	07 (5.83)	30 (25.00)	42	IV
5.	To improve personal wardrobe	0 (00)	03 (2.50)	31 (25.83)	34	V
6.	In order to support parents	01 (0.83)	00 (00)	00 (00)	01	VI

Figures in parentheses denote percentage; Responses were multiple

Table 5: Distribution of respondents according to their say in spending income

Type of employment	Say in spending income		
	Yes	No	Total
Government service	13 (25.49)	38 (74.50)	51 (42.50)
Private service	4 (26.66)	11 (73.33)	15 (12.50)
Entrepreneurship	4 (28.57)	10 (71.42)	14 (11.67)
Labour (Farm /Industrial)	16 (40.00)	24 (60.00)	40 (33.33)
Total	37 (30.83)	83 (69.17)	120 (100)

Figures in parentheses denote percentage; Responses were multiple

labourers. Study also revealed that 40.83 per cent women were worried of no guarantee of work in future. Also 35 per cent of them had problem of heavy work load. Shiva (2013) and Mittal (2016) also revealed in their study that women's dual role sometimes creates trouble in family and career and as a professional woman, working women have hard time managing their family properly and cannot give quality time to their children as the career and professional aspirations are still considered as secondary for women.

CONCLUSION

The study concludes that there are some social and economic factors such as caste, education, income and occupation which notably affects the life of an employed woman in rural areas in certain ways. Although women education and participation in economy has led to increase in household income but complex role of rural women often become an impediment in their personal growth and wellbeing. Women also have to juggle between the responsibilities of home and job due to long working hours at both places. There are still several cases wherein women are the breadwinner of family who takes up the job to supplement the household income and raise the standard of living of family but does not really have much independence in spending their own income. So, there is a dire need for a paradigm shift in terms of the stereotypical mentality about the roles played by women and decision making power. It's important to share the load of domestic work among family members so that no compromise is made by a working women in terms of health and wellbeing and socialisation of children. Government must make a national policy on women and it must be coupled with the national planning of development. Also women participation in an economy cannot be only be realised through governmental and technical efforts but with the development of an informal mental workout where men and women both are recognised as the agent of development without any discrimination.

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Research Article

Assessment of the Productive and Reproductive Performance of Cattle and Buffalo in Northern Bihar: A Quantitative Analysis

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ABSTRACT

The livestock industry is crucial to the socio-economic advancement of rural households. Milk production and the profitability of the dairy industry are directly impacted by the reproductive and productive abilities of dairy animals. The present study was conducted in three districts of Northern Bihar to assess the productive and reproductive performance of cattle and buffalo. Three districts from North Bihar were selected on the basis of stratified random sampling. A total of 180 respondents with at least five years of experience in dairy farming and at least one animal in milk were surveyed regarding the productive and reproductive performance of cattle and buffalo using a semi-structured interview schedule. The findings of the study indicate the poor productive performance of cattle and buffalo in the study area. The reproductive performance of dairy animals was also found to be poor as compared to the recommended values. Milk production and the profitability of the dairy industry are directly impacted by the reproductive and productive abilities of dairy animals. To improve the productive and reproductive performance of dairy animals, Government entities, NGOs, and KVKs must promote awareness. Farmers' capacity may be built through the organization of training programs, and timely input may be provided. Government organizations must set up animal health camps, and KVK can arrange for training in dairy farming.

Keywords: North Bihar, Dairy, Productive, Reproductive, Farmers, Cattle, Buffalo

INTRODUCTION

Animal husbandry plays an essential and crucial role in India's predominant crop-livestock mixed production system. Livestock husbandry contributes significantly to the Indian economy by boosting family income, improving nutritional security for households, and providing gainful work for 22.45 million people (Srivastava, 2016). Many households rely on cattle and buffaloes as a source of income, and the money from these animals serves as a cushion for the home economy. As productivity is indirectly correlated with reproductive qualities, the optimum fertility of animals must be taken into consideration in order to maximise the return from livestock farming. The capacity for animals to produce depends on the various management techniques. Due to a variety of variables, these practices differ across the agro-climatic areas. To determine the advantages and disadvantages of the system of animal rearing and to develop an effective policy intervention, it is essential to comprehend the livestock management practises used by livestock owners in a given area (Gamit *et al.,* 2021). India has a large number of cattle (299.6 million), which is the primary source of milk production. As of 2019, there are 192.49 million cattle in the country, an increase of 0.8 per cent from the previous Census (Anonymous, 2019). Bihar is sixth in terms of buffalo population being home to 6690 (thousand) buffaloes. About 6.35 per cent of the country's buffalo are found in Bihar

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(Anonymous, 2012). Bihar is one of India's least developed states, typified by low per capita income, a dense population, inadequate infrastructure, the predominance of small-scale landholdings, and a very high prevalence of rural poverty (Singh, 2014). Milk production is a key source of revenue for small and marginal farmers in the state of Bihar as well. The output of milk has increased steadily during the past few years in Bihar, where the dairy industry is expanding. Yet, the dairy industry must significantly expand and produce more milk in order to fulfil the state's expanding population's growing milk consumption. Strong support services, including better breeding, improved animal health, and feeding inputs to milk producers, are still needed for the development of the dairy business (Singh, 2014). Over the past six years, milk production in India has increased at an average annual growth rate of 6.3 per cent, while global milk production is increasing at a rate of 1.5 per cent annually. Despite the farmers' reliance on livestock and its critical relevance, production is far lower than it might be. The cattle industry makes up around 4 per cent of the nation's GDP for the whole of India and about 25 per cent of the whole agricultural GDP. In contrast, the Bihar cattle industry makes up 5 per cent of the state's overall economy. Bihar ranks fifth in the nation for the number of cattle and sixth for the number of buffalo. However, the rank of Bihar is still low in terms of milk production. The milk productivity of Northern Bihar is less than the National average and even less than the average milk productivity of Bihar state as a whole. (Keshava and Mandape, 2001). Crossbred cow yield is 17 per cent lower than the national average, and buffalo output is 22 per cent lower, but nondescript cow yield is 11 per cent higher than the national average (DAHD&F, 2019). The output of milk varies spatially between districts in an uneven way. It may be caused by the uneven growth or decline in the number of crossbred cows, unremarkable cows, and buffaloes in the areas (Singh, 2020). There may be a number of causes behind this poor output. There is strong evidence that the primary determinants of livestock productivity and production such as breeding, health, nutrition, and management of animals which limits livestock production in Bihar (Singh, 2014). The performance of the farmers' cattle and buffaloes, both in terms of productivity and reproduction, is a major factor in milk output (Kale *et al.,* 2018). One of the key factors affecting the profitability of dairy animal production is reproduction. For successful livestock production, animals must complete their reproductive functions efficiently. This is crucial for the production of milk and for the provision of replacement animals. The appropriate degree of reproduction is essential to the dairy production system's effectiveness (Dhaka *et al.,* 2017). Therefore, it is essential to assess the productive and reproductive parameters of the dairy animals in Northern Bihar to assess the reasons for the low productivity of the livestock.

MATERIALS AND METHODS

This study was conducted in Northern Bihar. Northern Bihar was selected purposively because of its poor performance in terms of productive and reproductive parameters. In North Bihar, three districts were selected on the basis of stratified random sampling, these were namely, Madhepura, Supaul and Darbhanga. From each district, two blocks were chosen at random, one being closest to and the other being farthest from the district headquarters, bringing the total to six blocks. Twelve villages total–two from each block–were chosen randomly, and fifteen respondents were chosen randomly from each village, for a sample size of 180 respondents overall. For the study, dairy farmers were chosen who had at least five years of expertise in dairy farming and at least one animal producing milk. A well-structured, pre-tested, and standardized interview schedule created for the intended purpose was used for data collection. Focussed group discussion was also used for the collection of information. Using appropriate statistical methods like frequency and percentage, the acquired data were analysed. Correlation analysis was also used to understand the relationship between socio-economic profile of dairy farmers and the productive and reproductive performance of the dairy animals. The data included information about the productive and reproductive performance of dairy animals in three districts of Northern Bihar.

RESULTS AND DISCUSSIONS

Average daily milk yield in kg is calculated by dividing the lactation milk yield by the lactation length. In Northern Bihar, a review of the productive and reproductive efficiency of cattle and buffaloes was conducted. The results are shown in Table 1. Indicates that the average daily milk yield of the indigenous cow

Table 1: Productive parameters of dairy animals in Northern Bihar (n = 180)

Particulars	Type of Animal	Madhepura District	Supaul District	Darbhanga District	Overall
Average daily milk yield	Indigenous cow	3.13	2.97	2.48	2.86±0.21
	Crossbred cow	6.05	5.98	5.14	5.73±0.35
	Buffalo	4.42	3.94	3.28	3.88±0.23
Average lactation length (Days)	Indigenous cow	285.71	280.14	285.09	284.11±6.17
	Crossbred cow	269.43	274.39	261.47	268.43±5.31
	Buffalo	290.91	281.68	292.45	288.34±6.98
Average lactation milk yield (Litres)	Indigenous cow	922.84	832.01	678.37	811.07±40.24
	Crossbred cow	1751.29	1640.85	1226.29	1539.47±48.66
	Buffalo	1285.82	1109.81	959.23	1118.28±41.28
Average Peak Yield (Litres)	Indigenous cow	5.10	4.90	3.80	4.60±0.33
	Crossbred cow	8.20	8.34	8.78	8.44±0.24
	Buffalo	6.20	5.90	6.25	6.11±0.27
Average dry Period (Days)	Indigenous cow	228.79	232.16	227.28	229.41±14.16
	Crossbred cow	218.37	215.31	219.14	217.60±13.23
	Buffalo	267.18	271.24	272.19	270.20±12.23

in Madhepura district was 3.13 litres per day, whereas for Supaul district, it was 2.97 litres per day and for Darbhanga district, it was 2.48 litres per day. Similarly, for the crossbred cow, the average daily milk yield in Madhepura district was 6.05 litres per day, for Supaul district it was 5.98 litres per day and for Darbhanga district, it was 5.14 litres per day. For the buffalo, the average daily milk yield in Madhepura district was 4.42 litres per day, for Supaul district it was 3.94 litres per day and for Darbhanga district, it was 3.28 litres per day. The overall average daily milk yield of the indigenous cow in all three districts was 2.86±0.21 litres per day per household, for crossbred, it was 5.73±0.35 litres per day per household and for buffalo, and it was 3.88±0.23 litres per day. These findings were supported by the findings of Kabir *et al.* (2017) and Meena *et al.* (2015).

One of the key measures of the performances of dairy animals is the ideal length of lactation. It is defined as the number of days in milk from the date of calving to the date of drying or cessation of milk production. Table 1, shows that the average lactation length of the indigenous cows in Madhepura district was 285.71 days, whereas for Supaul district, it was 280.14 days and for Darbhanga district, it was 285.09 days. Similarly, for the crossbred cows, the average lactation length in Madhepura district was 269.43 days, for Supaul district it was 274.39 days and for Darbhanga district it was 261.47 days. For the buffalo, the average lactation length in Madhepura district was 290.91 days, for Supaul district it was 281.68 days and for Darbhanga district it was 292.45 days. The overall average lactation length of indigenous cow from all three districts was 284.11±6.17 days, for crossbred cow, it was 268.43±5.31 and for buffalo, it was 288.34±6.98 days. These findings are in-line with the findings of Meena *et al.* (2015) who also reported that the lactation length of indigenous cow, crossbred cow and buffalo was 294±18 days, 274±16 days and 276±14 days, respectively. Though the recommended value is 305 days (Anonymous, 2022), therefore, it can be implied that the average lactation length in the area was falling short of the recommended value indicating poor productive performance.

The average lactation milk output positively correlates with the dairy animals' total productivity. It is defined as the milk yield in kg from the date of calving to the date of drying or cessation of milk production. From Table 1, it was found that the average lactation milk yield of the indigenous cow in Madhepura district was 922.84 litres, whereas for Supaul district, it was 832.01 litres and for Darbhanga

district, it was 678.37 litres. Similarly, for the crossbred cow, the average lactation milk yield in Madhepura district was 1751.29 litres, for Supaul district it was 1640.85 litres and for Darbhanga district, it was 1226.29 litres. For the buffalo, the average lactation milk yield in Madhepura district was 1285.82 litres, for Supaul district, it was 1109.81 litres and for Darbhanga district, it was 959.23 litres. The overall average lactation milk yield of indigenous cows from all three districts was 811.07±40.24 litres, for crossbred cows, it was 1539.47±48.66 litres and for buffalo, it was 1118.28±41.28 litres.

The market price increases in direct proportion to the dairy animal's peak output. The highest daily milk yield in kg during the lactation period is referred to as peak yield. From Table 1, it was found that the average peak yield of the indigenous cow in Madhepura district was 5.10 litres, whereas for Supaul district, it was 4.90 litres and for Darbhanga district, it was 3.80 litres. Similarly, for the crossbred cow, the average peak yield in Madhepura district was 8.20 litres, for Supaul district it was 8.34 litres and for Darbhanga district, it was 8.78 litres. For the buffalo, the average peak yield in Madhepura district, was 6.20 litres, for Supaul district, it was 5.90 litres and for Darbhanga district, it was 6.25 litres. The overall average peak yield of indigenous cows from all three districts was 4.60±0.33 litres, for crossbred cows, it was 8.44±0.24 litres and for buffalo, it was 6.11±0.27 litres. These findings are in concordance with the findings of Kabir *et al.* (2017).

Farmers suffer financial losses due to a longer dry period. It is defined as the number of days from the date of drying to the date of the next calving. The desirable dry period for cattle and buffalo is around 60 days. From Table 1, it was found that the average dry period of the indigenous cow in Madhepura district was 228.79 days, whereas for Supaul district, it was 232.16 days and for Darbhanga district, it was 227.28 days. Similarly, for the crossbred cow, the average dry period in Madhepura district was 218.37 days, for Supaul district it was 215.31 days and for Darbhanga district it was 219.14 days. For the buffalo, the average dry period in Madhepura district was 267.18 days, for Supaul district it was 271.24 days and for Darbhanga district it was 272.19 days. The overall average dry period of indigenous cows from all three districts was 229.41±14.16 days, for crossbred cows, it was 217.60±13.23 and for buffalo, it was 270.20±12.23 days. Though the recommended value is 60 days (Anonymous, 2022), so it can be said that the average dry period of the animals in the study area was higher than the recommended value, therefore the performance of the animals was below the standard value. The low productive performance of dairy was supported by the findings of Singh (2014) who also reported that the productivity of the livestock sector was low as compared to other states. Many biotic and abiotic factors, such as the predominance of low-quality breeds, poor animal health, and a lack of feed and fodder, contribute to low animal productivity.

From Table 2, it was found that the indigenous cows with up to 8 parity was found in Madhepura district, in Supaul district, it was up to 8 parity and in Darbhanga district, it was up to 7. Similarly, crossbred cows with up to 6 parity was found in Madhepura district, in Supaul district, it was up to 7 parity and in Darbhanga, it was up to 7 parities. Further, buffaloes up to 8 parity in Madhepura district, up to 9 parity in Supaul and up to 8 parity in Darbhanga district were found. The overall parity for indigenous cows in all three districts was up to 8, for crossbred cows, it was up to 7 and for buffalo, it was up to 9.

Age at first calving is one of the most crucial factors affecting how well dairy cows reproduce. It is defined as the age of a cow or buffalo in days at the time of first calving. Dairy animals perform better reproductively when their first calving occurs at a younger age, and vice versa. From Table 2, it was found that the average age at first calving of the indigenous cow in Madhepura district was 43.85 months, whereas for Supaul district, it was 44.14 months and for Darbhanga district, it was 43.89 months. Similarly, for the crossbred cow,the average age at first calving in Madhepura district was 38.88 months, for Supaul district it was 39.56 months and for Darbhanga district it was 38.97 months. For the buffalo, the average age at first calving in Madhepura district was 50.35 months, for Supaul district, it was 52.67 months and for Darbhanga district it was 50.68 months. The overall average age at first calving of indigenous cows from all three districts was 43.72±0.067 months, for crossbred cows, it was 39.13±0.062 and for buffalo, it was 51.23±0.074 months. Though the recommended value of average age at first calving for indigenous

cows is 36 months, for crossbred cows, it is 24 months and for buffalo, it is 42 months (Anonymous, 2022), therefore it can be said that the average age at first calving of the dairy animals in the study area is higher than the recommended value. Hence, the performance was below the recommendation.

One easy way to gauge fertility is to look at the average number of services or insemination needed for each conception (Payne, 1970). Service period is defined as the number of days from the date of calving to subsequent service resulting in conception. From Table 2, it was found that the average service period of the indigenous cow in Madhepura district was 229.11 days, whereas for Supaul district, it was 231.17 days and for Darbhanga district, it was 232.41 days. Similarly, for the crossbred cow, the average service period in Madhepura district was 197.17 days, for Supaul district it was 200.14 days and for Darbhanga district it was 199.38 days. For the buffalo, the average service period in Madhepura district was 255.08 days, for Supaul district it was 247.26 days and for Darbhanga district it was 251.12 days. The overall average service period of indigenous cows from all three districts was 229.41±11.82 days, for crossbred cows, it was 217.60±9.92 and for buffalo, it was 270.20±13.50 days. However, the recommended value of the service period for indigenous cow is about 60 to 90 days for indigenous, crossbred cows and buffalo (Anonymous, 2022). Therefore, it can be interpreted that the service period of the dairy animals in the study area is more than the recommended values. Hence, the performance of the dairy animals in the study area was below than the recommendation.

The secret to a successful dairy business is a shorter calving interval. From the Table 2, it was found that average calving interval the indigenous cow in Madhepura district was 17.17 months, whereas for Supaul district, it was 17.05 months and for Darbhanga district, it was 17.09 months. Similarly, for the crossbred cow, the average calving interval in Madhepura district was 16.24 months, for Supaul district it was16.32 months and for Darbhanga district it was 16.02 months. For the buffalo, the average calving interval in Madhepura district was 18.60 months, for Supaul district it was 18.43 months and for Darbhanga district it was 18.82 months. The overall average calving interval of indigenous cow from all three districts was 17.11±0.491 months, for crossbred cow, it was 16.19±0.662 and for buffalo, it was 18.71±0.621 months. Though the recommended values of calving interval for the indigenous and crossbred cow is 12 to 14 months and 15 to 20 months for buffalo (Anonymous, 2022). Therefore, the calving interval of the dairy animals in the study area is higher than the recommended values showing lower performance.

To find out the linear relationship between the selected independent variable and productive and reproductive performance of dairy animals, Pearson

Table 2: Reproductive parameters of dairy animals in Northern Bihar (n = 180)

Particulars	Type of Animal	Madhepura District	Supaul District	Darbhanga District	Overall
Parity	Indigenous cow	1-8	1-8	1-7	1-8
	Crossbred cow	1-6	1-7	1-7	1-7
	Buffalo	1-8	1-9	1-8	1-9
Average age at first calving (years)	Indigenous cow	43.85	44.14	43.19	43.72±0.067
	Crossbred cow	38.88	39.56	38.97	39.13±0.062
	Buffalo	50.35	52.67	50.68	51.23±0.074
Average service period (days)	Indigenous cow	229.11	231.17	232.41	230.89±11.82
	Crossbred cow	197.17	200.14	199.38	198.84±9.92
	Buffalo	255.08	247.26	251.12	251.15±13.50
Average calving interval (months)	Indigenous cow	17.17	17.05	17.09	17.11±0.491
	Crossbred cow	16.24	16.32	16.02	16.19±0.662
	Buffalo	18.60	18.43	18.82	18.71±0.621

correlation analysis was done. From the correlation analysis of the selected independent variables with the productive performance of the cattle and buffalo in the study area (Table 3), it was found that average daily milk was found to be positively correlated with family education status of the respondents, family size of the respondents, experience in dairy farming of the respondents, total annual income of the respondents and herd size at 1 per cent level of significance. When the family education status of the farmers will increase, he/she will be adopting balanced feeding practices, therefore the milk production will increase. When the experience of dairy farmers will be high, he/she will adopt better dairy farming management practices leading to increased milk yield. When the total annual income of the dairy farmer will be high, he/she will provide quality feed and fodder and adopt advanced dairy farming practices which will ultimately lead to increased milk yield. Similarly, average lactation milk yield of the cattle and buffalo was found to be positively correlated with family education status of the respondents, family size of the respondents, experience in dairy farming of the respondents, total annual income of the respondents and herd size at 1 per cent level of significance. The average peak yield of the cattle and buffalo was found to be positively correlated with family education status of the respondents, family size of the respondents, total annual income of the respondents, land holding of the respondents and herd size at 1 per cent level of significance.

Table 3: Relationship between Socio-economic variables with the productive performance of cattle and buffalo in the study area (n = 180)

Socio-economic variables	Pearson correlation coefficient (r)				
	Average daily milk yield	Average lactation length	Average lactation milk yield	Average peak yield	Average dry period
Age	0.063	0.074	-0.032	-0.076	-0.031
Family Education Status	0.165**	0.048	0.151**	0.278**	-0.064
Family Size	0.146*	-0.024	0.162**	0.143*	0.007
Experience in Dairy Farming	0.016*	0.007	0.013*	0.053	-0.025
Total Annual income	0.154**	0.009	0.176*	0.212**	-0.007
Land holding	0.077	0.016	0.061	0.144**	0.011
Herd size	0.157**	0.084	0.148**	0.130*	-0.72
Mass media exposure	0.075	0.032	0.046	0.231	0.040

** Correlation is significant at the 0.01 level; * Correlation is significant at the 0.05 level

Table 4: Relationship between Socio-economic variables with the reproductive performance of cattle and buffalo in the study area (n = 180)

Socio-economic variables	Pearson correlation coefficient (r)		
	Average calving interval	Average service period	Average age at first calving
Age	0.043	0.018	0.034
Family Education Status	0.126*	-0.019*	0.083
Family Size	0.041	0.084	0.109
Experience in Dairy Farming	0.035	0.030	-0.034
Total Annual income	0.048	-0.018	0.009
Land holding	0.056	-0.056	0.030
Herd size	0.084	0.060	0.072
Mass media exposure	0.072	0.015	-0.054

** Correlation is significant at the 0.01 level; * Correlation is significant at the 0.05 level

From the correlation analysis of the selected independent variables with the reproductive performance of the cattle and buffalo in the study area (Table 4), it was found that the average calving interval was positively and significantly correlated with family education score at 5 per cent level of significance. The average service period was found to be negatively correlated with the family education status of the respondents at 5 per cent level of significance. As the family education status will be higher, the respondent will adopt better reproductive management practices leading to shorter service period and ultimately resulting in enhanced reproductive performance.

CONCLUSION

The figures of the present study revealed the low productive performance of dairy animals in the state. The productive parameter like the average dry period was higher than the recommended value of 60 days. The study further revealed that the reproductive performance of dairy animals was also poor. The average age at first calving was higher than the standard values, which caused a decline in the production of milk. The service period and average calving interval were also higher than the recommended values which also led to a decline in the production of milk. This lower performance of the dairy animals can be attributed by several factors of production and reproduction. The weak veterinary infrastructure in the under-developed Northern region of Bihar as well as animal feed not being enough for all species are some of the important factors. Hence, by educating farmers about better management techniques, the government should assist and concentrate on improving those crucial economic performance characteristics of the cattle and buffaloes. Government entities, NGOs, and KVKs must promote awareness. Farmers' capacity may be built through the organization of training programs, and timely input may be provided. Government organizations must set up animal health camps, and KVK can arrange for training in dairy farming.

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Research Article

Haemato-biochemical Changes in Cows Fed on Rations Supplemented with Anionic Salts and it's Therapeutic Efficacy in Management of Milk Fever

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ABSTRACT

In this study eighteen animals were engaged for therapeutic trial with three groups (Group 1; Control, Group 2; Mixture of Ammonium Chloride & Calcium Sulphate at 1:1 ratio and Group 3; Commercial salts preparation, Hyporid™) containing 6 animals each. The efficacy of various anionic salt preparations was determined on the basis of haemato-biochemical changes, improvement in Body Condition Score (BCS), Dry matter Intake (DMI), Urine pH & incidence of milk fever after calving. In this therapeutic trial DCAD concentration (+25.22 mEq/ 100 g of DM) and incidence of milk fever (33.33%-2/6) was high in Group 1 as compared to Group 2 & Group 3. DCAD level was negative in both the Group 2 (-11.44 mEq/100 g of DM) and Group 3 (-8.26 mEq /100 g of DM) after adding anionic salts preparation (NH_4CL +$CaSO_4$) and Hyporid™, respectively. Incidence of Milk Fever was 0% (0/6) in both the Group 1 and Group 2. Better haemato-biochemical status was reported in both Group 2 and Group 3 compared to Group 1. Higher Urine pH was found in Group 1 compared to Group 2 & Group 3 on day -14 (7.73), +2 (8.25), +30 (7.77). On day +2 urine pH was more alkaline in case of Group 1 whereas in Group 2 and Group 3 urine pH was acidic i.e. 6.33 & 6.60, respectively. As regards to of BCS & DMI is concerned, there was gradual improvement in Group 2 and Group 3 from 14 days before calving to 30 days after calving.

Keywords: Milk fever, Anionic salts, DCAD, DMI

INTRODUCTION

Milk fever, also known as Parturient Paresis or Hypocalcemia is one of the most economically important production diseases in dairy cows. It has a substantial impact on animal production (Curtis *et al.*, 1985). It is an acute to per acute, afebrile, flaccid circulatory condition occurs most frequently in high productive adult lactating dairy cows. Milk fever is one of the most common mineral-related metabolic conditions affecting dairy cows at parturition, a disorder that occurs immediately after or close to calving due to low level of Ca in blood as a result of excessive loss of Ca through colostrums and milk. A mild degree of hypocalcemia develops in the majority of cows during the peripartum period and has been linked to calving problems, retained placenta, uterine prolapse, metritis, mastitis, ruminal statis, depression of the immune system and generally reduced reproductive performance, resulting in reduction of

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productive life by 3.4 years and/or death if left untreated (Khan *et al*., 2015).

Dietary cation-anion difference, or DCAD, is a measure used in both dry and lactating cow as regards to the metabolic status of the animal is concerned. In close-up dry cows, a negative DCAD can help prevent metabolic problems and in lactating cows, a positive DCAD can help increase milk production in post-partum period. The most common equation to determine DCAD is based on dietary concentration of the cation minerals sodium (Na) and potassium (K), and the anion minerals chloride (Cl) and sulfur (S).

The most common strategy employed to achieve this negative DCAD is the addition of anionic salts to the diet of pre calving cattle (Goff *et al*., 2004). According to Block (1984) the addition of anions to prepartal rations of dairy cows is a proven means of reducing dietary cation-anion difference, which reduces the incidence of milk fever. Joyce *et al.* (1997) reported that serum Ca was significantly higher in cows fed anionic salts than cows fed control diet at 3 days after calving. Dietary anionic salts pre-partum increased total Ca.

MATERIALS AND METHODS

The study was undertaken at organized and unorganized farms of West Tripura District. Haemato-biochemical tests were carried out in the Department of Veterinary Medicine, Teaching Veterinary Clinical Complex (TVCC) and the Department of Veterinary Biochemistry of the College of Veterinary Sciences and Animal Husbandry, Selesih, Aizawl, Mizoram.

Therapeutic trial: The dry pregnant animals were divided into 3 groups comprising of 6 cows each. Blood and urine samples were collected on 14 days before expected date of parturition, within 2 days of parturition and 30 days after parturition. Haemato-biochemical parameters and urine pH analyzed as per standard methods (Table 1).

Therapeutic evaluation: Therapeutic efficacy was assessed on the basis of improvement in body condition score, haemato-biochemical parameters, urinary pH and dry matter intake.

RESULTS AND DISCUSSION

Therapeutic efficacy of anionic salts and commercial salt preparation (Hyporid™) in management of milk fever is shown in Table 1. In this study, 3 groups (Group 1, Group 2 and Group 3) of animals were taken having 6 no of animals in each group. Two types of anionic salts were used i.e. a mixture of Ammonium Chloride & Calcium Sulphate at 1:1 ratio and commercial anionic salt preparation Hyporid™. Group 1 was control group. Group 2 and Group 3 were fed with Ammonium Chloride and Calcium Sulphate and Hyporid™, respectively at the rate of 90 g twice a day for 3 weeks before expected date of calving.

After oral administration of these anionic salts supplementation, DCAD concentration level in feeds were -11.44 mEq/100 g of DM in case of Group 2 and -8.26 mEq/100 g of DM in case of Group 3. Since Group 1 was control group, no anionic salt preparation added in feeds. As a result DCAD concentration was +25.22 mEq/100 g of DM. Milk fever incidences in therapeutic trial were 33.33% in Group 1 and 0% in both Group 2 and Group 3 as depicted in Table 18. Similar findings also reported by Seifi *et al.* (2010), that diets with excess anions through anionic salts supplementation prevented milk fever, and diets with a relative excess of cations predisposed cows to milk fever. According to Gelfert *et al.* (2010), low DCAD diets induced a mild, compensated metabolic acidosis. Low DCAD by adding anionic salts improved Ca homeostasis by induced moderate metabolic acidosis in body where receptors for PTH became more efficient. PTH hormone is necessary for reabsorption of Ca from bones when there is sudden

Table 1: Therapeutic study model

Group (n=6)	Therapy	Duration
1	Positive Control i.e. healthy	On placebo
2	Anionic salts (NH_4Cl + $CaSO_4$)	NH_4Cl @ 45g and $CaSO_4$ @ 45 g, orally, mix with feeds, twice daily from 3 weeks before parturition to day of parturition.
3	Hyporid™	Hyporid @ 90 g, Orally, mix with feeds, twice daily from 3 weeks before parturition to day of parturition.

fall in Ca level in blood after parturition to prevent milk fever.

Haematological changes in cows fed on rations supplemented with anionic salts: RBC level in Group 1 cows on day -14, +2 and +30 were 5.99±0.48 M/mm^3, 6.38±0.28 M/mm^3 and 6.22±0.11 M/mm^3, respectively. RBC level in Group 2 cows on day -14. +2 and +30 were 6.68±0.22 M/mm^3, 5.85±0.22 M/mm^3 and 6.87±0.14 M/mm^3 respectively. RBC level in Group 3 cows on day -14, +2 and +30 were 6.01±0.31 M/mm^3, 5.75±0.23 M/mm^3 and 6.22±0.12 M/mm^3, respectively. There were no significant differences ($p>0.05$) within as well as between groups on day -14, +2 and +30 except within Group 2 and between all groups on day +30.

PCV level in Group 1 cows on day -14, +2 and +30 were 30.23±1.58%, 30.80±1.42% and 27.63±0.77%, respectively. PCV level in Group 2 cows on day -14. +2 and +30 were 34.48±1.18%, 30.70±1.13% and 27.08±0.94% respectively. PCV level in Group 3 cows on day -14, +2 and +30 were 33.70±1.65%, 35.40±1.61% and 30.33±1.39%, respectively. There were no significant differences ($p<0.05$) within as well as between groups on day -14, +2 and +30 except within Group 2 on day -14, +2 & + 30 and between all groups on day +2.

Hb level in Group 1 cows on day -14, +2 and +30 were 8.32±0.39, 7.70±0.26 and 8.33±0.46 g/dl, respectively. Hb level in Group 2 cows on day -14. +2 and +30 were 9.90±0.28, 9.33±0.14 and 10.15±0.29 g/dl, respectively. Hb level in Group 3 cows on day -14, +2 and +30 were 9.13±0.39, 9.01±0.23 and 9.68±0.25 g/dl respectively. There were no significant differences ($p>0.05$) within all groups on day -14, +2 and +30 and significant differences ($p<0.05$) between all groups on day -14, +2 and +30.

WBC level in Group 1 cows on day -14, +2 and +30 were 11.78±0.69 m/mm^3, 9.28±0.36 m/mm^3 and 9.13±0.48 m/mm^3, respectively. WBC level in Group 2 cows on day -14, +2 and +30 were 12.28±0.49 m/mm^3, 12.15±0.46 m/mm^3 and 11.31±0.27 m/mm^3 respectively. WBC level in Group 3 cows on day -14, +2 and +30 were 10.60±1.32 m/mm^3, 11.18±0.88 m/mm^3 and 10.70±0.53 m/mm^3, respectively. There were significant differences ($p<0.05$) within Group 1 on day -14, +2 and +30 and between all groups on day +2 & +30 though all the values were in normal range. There were no significant differences ($p>0.05$) within Group 1 & Group 2 and between all groups on day -14.

There was moderate increase in RBC count on +30 might be due to restoration of normal physiological status after calving stress though all the values were in normal range. Similar findings were reported by Ingvartsen and Moyes (2015) and Sordillo *et al.* (2009) in exotic breed of cows. PCV values in present study were similar to earlier reports of Sivaraman *et al.* (2002) and Mirzadeh *et al.* (2010) in advanced pregnant cows. There was moderate decrease in concentration of Hbin Group 1 than Group 2 & Group 3 on day +2 & +30 might be due to occurrence of milk fever in Group 1. Similar type of findings also reported by Esposito *et al.* (2014) that low level of Ca in blood might cause immunosuppression lead to decrease level of haematological parameters. WBC level was significantly decreased in Group 1 after parturition might be due to occurrence of milk fever where lymphopenia and Eosinopenia was reported. These findings of present study corresponds with the findings of DeGaris and Lean (2008). Lymphopenia and Eosinopenia might have occurred due to development of anaemia in postpartum due to diminished immunologic status (Detilleux *et al.*, 2004).

Changes in Differentiate Leukocyte count (DLC): Lymphocytes % in Group 1 cows on day -14, +2 and +30 were 39.27±2.8%, 35.38±2.6% and 33.05±0.71% respectively. Lymphocytes % in Group 2 cows on day -14, +2 and +30 were 42.90±3.72%, 42.8±2.55% and 40.35±1.89% respectively. Lymphocytes % in Group 3 cows on day -14, +2 and +30 were 43.85±3.27%, 50.26±4.6% and 40.56±2.07% respectively. There were significant differences ($p<0.05$) within Group 1 on day -14, +2 and +30 and between groups on day +2 & +30. There were no significant differences ($p>0.05$) within Group 2 & Group 3 on day -14, +2 and +30 and between all groups on day -14.

Monocytes % in Group 1 cows on day -14, +2 and +30 were 12.12±1.20%, 11.92±0.95% and 8.15±0.39%, respectively. Monocytes % in Group 2 cows on day -14, +2 and +30 were 6.78±0.58%, 8.10±1.42% and 6.76±0.61%, respectively. Monocytes % in Group 3 cows on day -14, +2 and +30 were

8.58±0.66%, 7.32±0.87% and 6.13±0.55%, respectively. There were significant differences ($p<0.05$) within Group 1 on day -14, +2 and +30 and between all groups on day -14, +2 & +30. There were no significant differences ($p>0.05$) within Group 2 & Group 3 on day -14, +2 and +30.

Neutrophil % in Group 1 cows on day -14, +2 and +30 were 40.97±2.33%, 41.75±2.81% and 45.63±0.62% respectively. Neutrophil % in Group 2 cows on day -14, +2 and +30 were 39.98±2.45%, 37.07±2.08% and 39.17±1.76% respectively. Neutrophil % in Group 3 cows on day -14, +2 and +30 were 34.27±1.90%, 36.90±4.35% and 41.78±1.30% respectively. There were significant differences ($p<0.05$) within Group 1 on day -14, +2 and +30 and between all groups on day +30. There were no significant differences ($p>0.05$) within Group 2 & Group 3 on day -14 and +2 and between groups on day -14 & +2.

Eosinophil % in Group 1 cows on day -14, +2 and +30 were 7.65±1.21%, 5.92±1.06% and 12.90±1.01% respectively. Eosinophil % in Group 2 cows on day -14, +2 and +30 were 9.83±1.83%, 7.30±1.71% and 13.7±0.87% respectively. Eosinophil % in Group 3 cows on day -14, +2 and +30 were 13.30±2.30%, 7.63±1.23% and 11.52±1.94% respectively. There were significant differences ($p<0.05$) within all the groups on day -14, +2 and +30 but no significant differences ($p>0.05$) between all the groups.

The values of neutrophil, eosinophil and monocyte in present study were in agreement with earlier reports of Parrah *et al.* (2010) in advanced pregnant cows during summer season. There was significant decrease in Lymphocyte, Monocytes and Eosinophil in Group 1 when compared with Group 2 & Group 3 on day +2. There was gradual increase in the DLC might be physiological status of cows was improving though better improvement seen in the cows of Grpoup 2 & Group 3. These findings of present study corresponds with the findings of DeGaris and Lean (2008). Lymphopenia and Eosinopenia might have occurred due to development of anaemia postpartum due to diminished immunologic status (Detilleux *et al.*, 2004).

Biochemical changes in cows fed on rations supplemented with anionic salts: The serum total protein level in Group 1 cows on day -14, +2 and +30 were 5.9±0.14, 5.97±0.19 and 7.38±0.10 g/dl, respectively. The serum total protein level in Group 2 cows on day -14. +2 and +30 were 8.07±0.14, 7.28±0.09 and 7.98±0.09 g/dl, respectively. The serum total protein level in Group 3 cows on day -14, +2 and +30 were 7.07±0.07, 7.33±0.06 g/dl and 7.57±0.08, respectively. There were significant differences ($p<0.05$) within as well as between groups day -14, +2 and +30.

The serum Cholesterol level in Group 1 cows on day -14. +2 and +30 were 78.83±2.34, 80.83±7.16 and 104.02±1.53 mg/dl, respectively. The serum Cholesterol level in Group 2 cows on day -14. +2 and +30 were 73.73±0.74, 90.68±1.29 and 107.85±1.11 mg/dl, respectively. The serum Cholesterol level in Group 3 cows on day -14, +2 and +30 were 77.67±1.90, 105.4±1.9 and 121.22±3.28 mg/dl, respectively. There were significant differences ($p<0.05$) within as well as between groups on day -14, +2 and +30 and except between the groups on day -14.

The serum Triglyceride level in Group 1 cows on day -14, +2 and +30 were 14.32±0.24, 9.33±0.34 and 10.67±0.55 mg/dl, respectively. The Triglyceride level in Group 2 cows on day -14, +2 and +30 were 15.85±0.31, 13.9±0.37 and 15.63±0.48 mg/dl, respectively. The Triglyceride level in Group 3 cows on day -14, +2 and +30 were 16.19±0.44, 14.24±0.3 and 16.42±0.68 mg/dl, respectively. There were significant differences ($p<0.05$) within as well as between groups on day -14, +2 and +30 but no significant difference ($p>0.05$) between all groups on day -14.

TP, Cholesterol & Triglyceride level was significantly low in Group 1 in comparison with Group 2 and Group 3 might be due to occurrence of Milk Fever in the cows of Group 1 which lead to reduce hepatic pathway and less intake of feed (Bobe *et al.*, 2004). In Group 2 & 3, TP, Cholesterol & Triglyceride level were higher than Group 1 might be due to feeding of anionic salts which prevents the occurrence of Milk Fever and also increased the dry matter intake (DeGroot *et al.*, 2010; Wu *et al.*, 2014).

The serum BUN level in Group 1 cows on day -14, +2 and +30 were 10.69±0.37, 13.94±0.77 and 17.97±0.71 mg/dl, respectively. The BUN level in Group 2 cows on day -14, +2 and +30 were

10.04±0.17, 9.38±0.23 and 13.90±0.39 mg/dl, respectively. The BUN level in Group 3 cows on day -14, +2 and +30 were 8.95±0.31, 8.38±0.37 and 11.87±0.16 mg/dl, respectively. There were significant differences ($p<0.05$) within as well as between groups on day -14, +2 and +30.

In Group 1 BUN level increased after parturition might be due to level at the day of parturient might be attributed to dehydration and/or muscular proteolysis during the course of parturition which is similar to that of the findings of Ismail *et al.* (2011). But in Group 2 and Group 3 there was moderate decrease in BUN level might be due to feeding of anionic salts.

The serum Creatinine level in Group 1 cows on day -14, +2 and +30 were 1.22±0.01, 1.14±0.02 and 1.07±0.02 mg/dl, respectively. The Creatinine level in Group 2 cows on day -14. +2 and +30 were 1.22±0.01, 1.41±0.02 and 1.03±0.02 mg/dl, respectively. The Creatinine level in Group 3 cows on day -14, +2 and +30 were 1.17±.0.01, 1.27±0.02 and 1.12±0.02 mg/dl, respectively. There were significant differences ($p<0.05$) within as well as between groups on day -14, +2 and +30 and except between the groups on day -14.

Increased creatinine level in Group 2 & Group 3 2 days after parturition might be due to feeding of anionic salts made urine acidic which increased the loads on kidneys. But after that there was gradual decrease in Creatinine level though all the values were within normal range (Malendez and Poock, 2017).

Minerals status: The mean ±S.E. of minerals (Ca, P & Mg) and Electrolytes status (Na, K, Cl and S) are depicted in Table 2.

The serum Calcium (Ca) level in Group 1 cows on day -14, +2 and +30 were 7.81±0.10, 6.90±0.13 and 7.30±0.17 mg/dl, respectively. The Ca level in Group 2 cows on day -14. +2 and +30 were 9.46±0.18, 8.78±0.16 and 9.80±0.24 mg/dl, respectively. The Ca level in Group 3 cows on day -14, +2 and +30 were 9.70±.0.26, 9.81±0.24 and 10.60±0.18 mg/dl, respectively. There were significant differences ($p<0.05$) within as well as between groups on day -14, +2 and +30.

The serum Phosphorus (P) level in Group 1 cows on day -14, +2 and +30 were 7.13±0.08, 5.60±0.10 and 6.45±0.31 mg/dl, respectively. The P level in Group 2 cows on day -14. +2 and +30 were 7.10±0.09,

Table 2: Haematological changes (Mean±S.E.) in cows fed on rations supplemented with anionic salts

Parameters	Group (n=6)	Days			Sig. ($p<0.05$)
		14 days before Parturition (-14)	2 days after Parturition (+2)	30 days after Parturition (+30)	
RBC (M/mm^3)	Group 1	$5.99±0.48^{Aa}$	$6.38±0.28^{Aa}$	$6.22±0.11^{Aa}$	NS
	Group 2	$6.68±0.22^{Ab}$	$5.85±0.22^{Aa}$	$6.87±0.14^{Bb}$	S*
	Group 3	$6.01±0.31^{Aa}$	$5.75±0.23^{Aa}$	$6.22±0.12^{Aa}$	NS
	Sig. ($p<0.05$)	NS	NS	S**	
PCV (%)	Group 1	$30.23±1.58^{Aa}$	$30.8±1.42^{Aa}$	$27.63±0.77^{Aa}$	NS
	Group 2	$34.48±1.18^{Ac}$	$30.7±1.13^{Ab}$	$27.08±0.94^{Aa}$	S**
	Group 3	$33.70±1.65^{Ab}$	$35.4±1.61^{BAb}$	$30.33±1.39^{Ab}$	NS
	Sig. ($p<0.05$)	NS	S*	NS	
Haemoglobin (g/dl)	Group 1	$8.32±0.39^{Aa}$	$7.70±0.26^{Aa}$	$8.33±0.46^{Aa}$	NS
	Group 2	$9.90±0.28^{Bab}$	$9.33±0.14^{Ba}$	$10.15±0.29^{Bb}$	NS
	Group 3	$9.13±0.39^{ABa}$	$9.01±0.23^{Ba}$	$9.68±0.25^{Ba}$	NS
	Sig. ($p<0.05$)	S*	S**	S**	
WBC (m/mm^3)	Group 1	$11.78±0.69^{Aa}$	$9.28±0.36^{Ab}$	$9.13±0.48^{Ab}$	S**
	Group 2	$12.28±0.49^{Aa}$	$12.15±0.46^{Ba}$	$11.31±0.27^{Ba}$	NS
	Group 3	$10.60±1.32^{Aa}$	$11.18±0.88^{Ba}$	$10.70±0.53^{Ba}$	NS
	Sig. ($p<0.05$)	NS	S**	S**	

6.62±0.08 and 7.12±0.57 mg/dl, respectively. The P level in Group 3 cows on day -14, +2 and +30 were 6.30±.0.13, 5.0±0.04 & 6.36±0.07 mg/dl, respectively. There were significant differences ($p<0.05$) within as well as between groups on day -14, +2 and +30.

The serum Magnesium (Mg) level in Group 1 cows on day -14, +2 and +30 were 3.21±0.04, 3.04±0.10 and 3.48±0.36 mg/dl, respectively. The Mg level in Group 2 cows on day -14. +2 and +30 were 2.68±0.11, 2.46±0.13 and 3.32±0.06 mg/dl, respectively. The Mg level in Group 3 cows on day -14, +2 and +30 were 2.22±.0.08, 2.21±0.07 and 3.27±0.05 mg/dl, respectively. There were significant differences ($p<0.05$) within as well as between groups on day -14, +2 and +30.

Decreased Ca & P level after parturition was due to occurrence of Milk Fever. But in Group 2 & Group 3; Ca & P level were within normal range but higher in comparison with control group, which might be due to feeding of anionic salts causing increased PTH hormone activity leading to proper reabsorption of Ca and P from bone and absorption from gut by synthesis of activated form of Vitamin D_3. Our findings are similar with the findings of Chan *et al.* (2005), Leno *et al.* (2017) and Radostits *et al.* (2006). Mg level was higher in Group 1 compared to Group 2 & Group 3 after parturition might be due to increase renal tubular reabsorption (Goff, 2006).

Urinary pH: Urinary pH level in Group 1 cows on day -14, +2 and +30 were 7.73±0.13, 8.25±0.10 and 7.77±0.08, respectively. Urinary pH level in Group 2 cows on day -14. +2 and +30 were 7.17±0.06, 6.33±0.08 and 7.16±0.13, respectively. Urinary pH level in Group 3 cows on day -14, +2 and +30 were 7.23±0.11, 6.60±0.10 and 7.48±0.10, respectively. There were significant differences ($p<0.05$) within as well as between groups on day -14, +2 and +30 depicted in Table 3 and Figure 1.

Table 3: Changes in DLC (Mean ± S.E.) in cows fed on rations supplemented with anionic salts

Parameters	Group (n=6)	Days			Sig. ($p<0.05$)
		14 days before Parturition (-14)	2 days after Parturition (+2)	30 days after Parturition (+30)	
Lymphocyte (%)	Group 1	39.27 ± 2.8^{Aab}	35.38 ± 2.6^{Ab}	33.05 ± 0.71^{Aa}	S*
	Group 2	42.90 ± 3.72^{Ab}	42.8 ± 2.55^{Bb}	40.35 ± 1.89^{Bb}	NS
	Group 3	43.85 ± 3.27^{Aa}	50.26 ± 4.6^{Ba}	40.56 ± 2.07^{Ba}	NS
	Sig. ($p<0.05$)	NS	S**	S**	
Monocytes (%)	Group 1	12.12 ± 1.20^{Bb}	11.92 ± 0.95^{Bb}	8.15 ± 0.39^{Ba}	S**
	Group 2	6.78 ± 0.58^{Aa}	8.10 ± 1.42^{Aa}	6.76 ± 0.61^{ABa}	NS
	Group 3	8.58 ± 0.66^{Ab}	7.32 ± 0.87^{Aa}	6.13 ± 0.55^{Ab}	NS
	Sig. ($p<0.05$)	S**	S*	S*	
Neutrophil (%)	Group 1	40.97 ± 2.33^{Aa}	41.75 ± 2.81^{Aa}	45.63 ± 0.62^{Bb}	S*
	Group 2	39.98 ± 2.45^{Aa}	37.07 ± 2.08^{Aa}	39.17 ± 1.76^{Aa}	NS
	Group 3	34.27 ± 1.90^{Aa}	36.90 ± 4.35^{Aa}	41.78 ± 1.30^{ABa}	NS
	Sig. ($p<0.05$)	NS	NS	S*	
Eosinophil(%)	Group 1	7.65 ± 1.21^{Aa}	5.92 ± 1.09^{Aa}	12.90 ± 1.01^{Bb}	S**
	Group 2	9.83 ± 1.30^{Aab}	7.30 ± 1.71^{Aa}	13.7 ± 0.87^{Bb}	S**
	Group 3	13.30 ± 2.30^{Ab}	7.63 ± 1.23^{Aa}	11.52 ± 1.94^{Bb}	S*
	Sig. ($p<0.05$)	NS	NS	NS	
Basophil(%)	Group 1	0.00±0.00	0.00±0.00	0.00±0.00	NS
	Group 2	0.00±0.00	0.00±0.00	0.00±0.00	NS
	Group 3	0.00±0.00	0.00±0.00	0.00±0.00	NS
	Sig. ($p<0.05$)	NS	NS	NS	

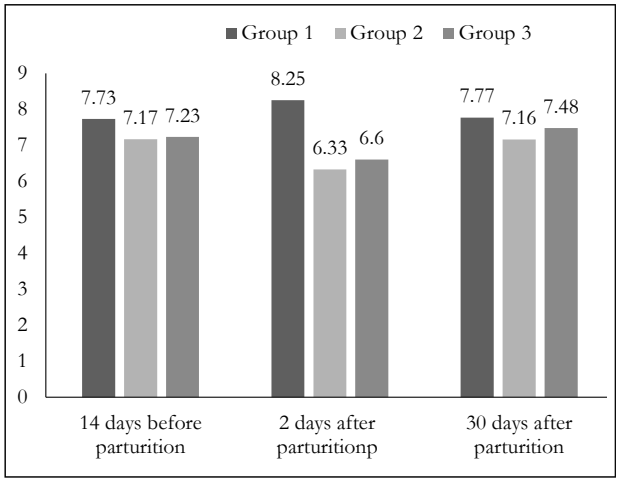

Figure 1: Changes in Urinary pH in therapeutic trial

In Group 1, urinary pH after parturition was alkaline. This result corroborated with the work of Block (1984) and Goff *et al.* (1991), who mentioned in their study that in alkalosis body tissue become less responsive to PTH and milk fever occurs. In our present study also we found that in all the milk fever cases animals were suffering from alkalosis as a result urinary pH became alkaline. In Group 2 and Group 3, urinary pH was acidic. Though anionic salts contain ammonium chloride & Calcium sulphate had more power to acidify than Hyporid™. These findings corresponded with the reports of Tucker *et al.* (1990); Oetzel (1993) and Wang *et al.* (1994), who reported anions i.e. chloride & sulphate can directly acidify biological fluids and alter acid-base balance strongly if included at high dietary concentrations causing decreased urine pH. These changes in urine pH might be due to the animals attempt to balance any change in the blood by excreting acidic or alkaline urine (Mohanrao *et al.*, 2016).

Body Condition Score (BCS): BCS in Group 1 cows on day -14, +2 and +30 were 3.63±0.06, 3.23±0.05 and 2.85±0.05, respectively. BCS in Group 2 cows on day -14. +2 and +30 were 3.40±0.06, 3.46±0.05 and 3.67±0.08, respectively. BCS in Group 3 cows on day -14, +2 and +30 were 3.53±0.07, 3.58±0.06 and 3.72±0.07, respectively. There were significant differences ($p<0.05$) within groups on day on -14, 2 & 30 and between groups on day 2 & 30 but no significant differences ($p>0.05$) between groups on day -14 depicted in Table 4 and Figure 2.

Table 4: Biochemical and Mineral status (Mean ± S.E.) in cows fed on rations supplemented with anionic salts

Parameters	Group (n=6)	Days			Sig. (p<0.05)
		14 days before Parturition (-14)	2 days after Parturition (+2)	30 days after Parturition (+30)	
Total Protein (g/dl)	Group 1	5.9 ± 0.14^{Aa}	5.97 ± 0.19^{Aa}	7.38 ± 0.10^{Ab}	S**
	Group 2	8.07 ± 0.14^{Cb}	7.28 ± 0.09^{Ba}	7.98 ± 0.09^{Bb}	S**
	Group 3	7.07 ± 0.07^{Ba}	7.33 ± 0.06^{Bb}	7.57 ± 0.08^{Ac}	S**
	Sig. (p<0.05)	S**	S**	S**	
Cholesterol (mg/dl)	Group 1	78.83 ± 2.34^{Aa}	80.83 ± 7.16^{Aa}	104.02 ± 1.53^{Ab}	S**
	Group 2	73.73 ± 0.74^{Aa}	90.68 ± 1.29^{Ab}	107.85 ± 1.11^{Ac}	S**
	Group 3	77.67 ± 1.90^{Aa}	105.4 ± 1.9^{Bb}	121.22 ± 3.28^{Bc}	S**
	Sig. (p<0.05)	NS	S**	S**	
Triglyceride (mg/dl)	Group 1	14.32 ± 0.24^{Ab}	9.33 ± 0.34^{Aa}	10.67 ± 0.55^{Ac}	S**
	Group 2	15.85 ± 0.31^{Ab}	13.9 ± 0.37^{Ba}	15.63 ± 0.48^{Bb}	S**
	Group 3	16.19 ± 0.44^{Ab}	14.24 ± 0.3^{Ba}	16.42 ± 0.68^{Bc}	S**
	Sig. (p<0.05)	NS	S**	S**	
BUN (mg/dl)	Group 1	10.69 ± 0.37^{Ba}	13.94 ± 0.77^{Bb}	17.97 ± 0.71^{Cc}	S**
	Group 2	10.04 ± 0.17^{Ba}	9.38 ± 0.23^{Aa}	13.90 ± 0.39^{Bb}	S**
	Group 3	8.95 ± 0.31^{Aa}	8.38 ± 0.37^{Aa}	11.87 ± 0.16^{Ab}	S**
	Sig. (p<0.05)	S**	S**	S**	

Table 4 contd....

Parameters	Group (n=6)	Days			Sig. (p<0.05)
		14 days before Parturition (-14)	2 days after Parturition (+2)	30 days after Parturition (+30)	
Creatinine (mg/dl)	Group 1	1.22 ± 0.01^{Aa}	1.14 ± 0.02^{Ab}	1.07 ± 0.02^{Ac}	S**
	Group 2	1.22 ± 0.01^{Ac}	1.41 ± 0.02^{Cb}	1.03 ± 0.02^{Aa}	S**
	Group 3	1.17 ± 0.01^{Ab}	1.27 ± 0.02^{Bc}	1.12 ± 0.02^{Ba}	S**
	Sig. (p<0.05)	NS	S**	S*	
Calcium (Ca) (mg/dl)	Group 1	7.81 ± 0.10^{Aa}	6.90 ± 0.13^{Ab}	7.30 ± 0.17^{Ac}	S**
	Group 2	9.46 ± 0.18^{Ba}	8.78 ± 0.16^{Bb}	9.80 ± 0.24^{Bc}	S**
	Group 3	9.70 ± 0.26^{Ba}	9.81 ± 0.24^{Ca}	10.60 ± 0.18^{Cb}	S**
	Sig. (p<0.05)	S**	S**	S**	
Phosphorus (P) (mg/dl)	Group 1	7.13 ± 0.08^{Bc}	5.60 ± 0.10^{Ba}	6.45 ± 0.31^{Ab}	S**
	Group 2	7.10 ± 0.09^{Bb}	6.62 ± 0.08^{Ca}	7.12 ± 0.57^{Bb}	S**
	Group 3	6.30 ± 0.13^{Ab}	5.0 ± 0.04^{Aa}	6.36 ± 0.07^{Ab}	S**
	Sig. (p<0.05)	S**	S**	S**	
Magnesium (Mg) (mg/dl)	Group 1	3.21 ± 0.04^{Cb}	3.04 ± 0.10^{Ba}	3.48 ± 0.36^{Bc}	S**
	Group 2	2.68 ± 0.11^{Ba}	2.46 ± 0.13^{Aa}	3.32 ± 0.06^{Ab}	S**
	Group 3	2.22 ± 0.08^{Aa}	2.21 ± 0.07^{Aa}	3.27 ± 0.05^{Ab}	S**
	Sig. (p<0.05)	S**	S**	S**	

*Significant at 5% (p<0.05), **Significant at 1% (p<0.01), No significant (p>0.05). n = No. of animals each group. Same symbol in superscript do not differ significantly. For row wise comparison small letter have been used in superscript. And for column wise comparison capital letter have been used in superscript.

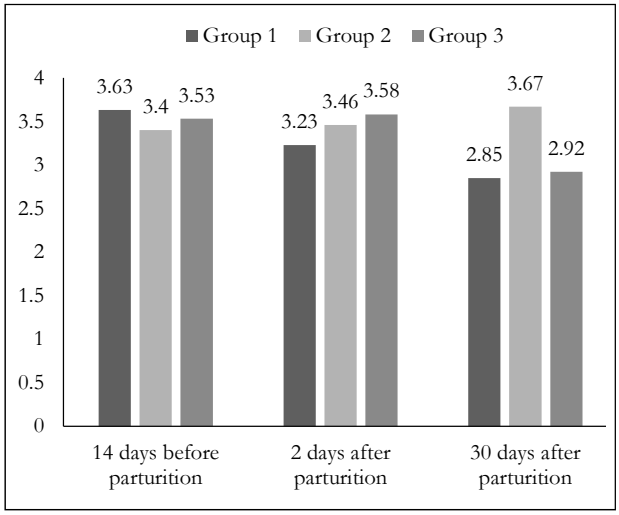

Figure 2: Changes in BCS in therapeutic trial

The findings our study were in agreement with that of DeGroot *et al.* (2010) and Wu *et al.* (2014), who reported that anionic salts supplementation in pre partum period increased the DMI & serum TP level which helped in improvement of BCS. But in Group 1, BCS was higher 14 days before parturition compared to other groups but decreased after parturition; might be due to occurrence of milk fever. This finding is similar to that of Ostergaard *et al.* (2003); Bewly and Schultz (2008), who reported that incidence of milk fever is increased in cows having high BCS in pre partum period.

Dry matter intake (DMI): DMI in Group 1 cows on day -14, +2 and +30 were 8.83±0.12 kg/day, 8.43±0.06 kg/day and 8.78±0.09 kg/day, respectively. DMI in Group 2 cows on day -14. +2 and +30 were 8.78±0.14 kg/day, 8.42±0.08 kg/day and 9.17±0.11 kg/day, respectively. DMI in Group 3 cows on day -14, +2 and +30 were 8.70±0.11 kg/day, 8.53±0.09 kg/day and 9.22±0.09 kg/day, respectively. There were significant differences (p<0.05) within groups on day -14, +2 and +30 and between groups on day +30 but no significant differences between groups on day -14 & +2 depicted in Table 5 and Figure 3.

Decrease in DMI intake 2 days after parturition in all groups might be due to calving stress. But there was increase in DMI on 30 days after parturition in Group 2 and Group 3 compared to Group 1. Similar findings were reported by DeGroot *et al.* (2010), that feeding

Table 5: Therapeutic efficacy of anionic salts and commercial salt preparation (Hyporid™) in management of milk fever

Group (n=6)	Therapy	DCAD (mEq/100g DM)	Incidence of milk fever
Group 1	Positive Control	+25.22	33.33%
Group 2	Anionic salts (NH_4Cl + $CaSO_4$)	-11.44	0%
Group 3	Hyporid™	-8.26	0%

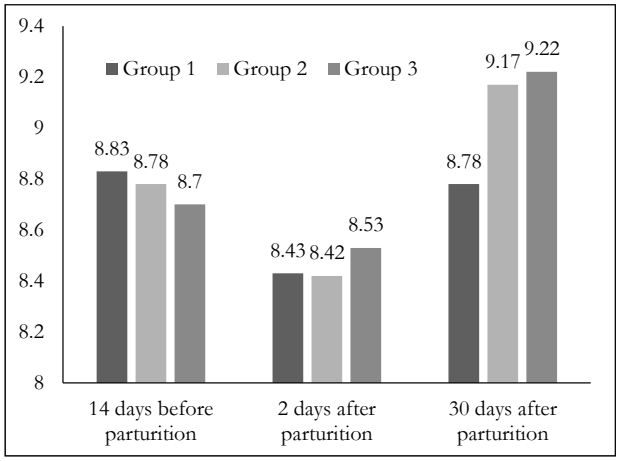

Figure 3: Changes in DMI (kg/day) in therapeutic trial

of anionic salts during prepartum period increased the DMI in post partum period without negatively affecting performance primiparous cows.

CONCLUSION

Pre-partum diet rich in anionic salt preparations (NH_4Cl @ 45 g and $CaSO_4$ @ 45 g, orally, mix with feeds, twice daily from 3 weeks before parturition to day of parturition) were found to be effective in preventing occurrence of Milk Fever; most common metabolic disease in dairy cows minimizing post-partum economic losses

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Research Article

Overcoming Constraints Through Innovative Agricultural Ventures in the Agro-Ecological Regions of Migrant Farmers

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ABSTRACT

Migration in agriculture is influenced by an intricate interplay of socio-economic as well as ecological factors and has emerged as a predominant marvel. India has a diverse array of agro-ecological regions, each presenting numerous opportunities for farmers to significantly improve their livelihoods. The Indo-Gangetic Plains (IGP) and the Western Dry Region were the focal points of this study, as Uttar Pradesh and Rajasthan were intentionally chosen for an in-depth investigation into both the constraints and innovative agricultural initiatives. In structuring the sampling approach, a stratified multistage sampling methodology was employed, encompassing 480 migrant and 480 non-migrant farmers. Constraints were analyzed using the Garrett ranking method, while text mining was employed to explore innovative agricultural practices among migrants. The findings unveiled a range of challenges faced by migrants at their usual places of residence (UPR), including limited employment opportunities, untimely availability of farm inputs, inadequate support from service providers, and soil salinization. Upon migration, destination-related challenges included irregular wages/ salaries, lack of affordable housing options, absence of insurance schemes, and instances of discrimination against local communities. The study further illuminated the income-generating activities in Rajasthan, primarily revolving around livestock management, leafy vegetable production, and oilseed cultivation. In Uttar Pradesh, the focus was on vegetable production, livestock management, and seed cultivation. These lucrative and innovative ventures were custom-tailored to the agro-ecological contexts of the migrants, providing a glimpse into the transformative potential of amalgamating tradition with innovation. Such insights offer valuable guidance to policymakers in empowering migrant populations in agriculture.

Keywords: Agro-ecological regions, Garrett ranking method, Income-generating activities migrants

INTRODUCTION

Agricultural migration, driven by a complex interaction of economic, social, and environmental factors, has become a prevailing phenomenon shaping global agricultural landscapes (FAO, 2016). As rural individuals and families seek improved livelihoods and opportunities, they traverse geographic boundaries and cultural terrains, often settling in agro-ecological regions distinct from their places of origin (Pei *et al.*, 2016). India possesses a rich tapestry of diverse agro-ecological regions, each offering a plethora of opportunities for farmers to substantially enhance their livelihoods (Ahmad *et al.*, 2017). The Indo-Gangetic Plains (IGP) located in Northern India are characterized by fertile soil, ample water resources, and a varied climate that encourages the cultivation of diverse crops and optimal land utilization. It not only sustains livelihoods but also fosters employment opportunities and drives rural development. However, recent times have witnessed challenges confronting farming and agricultural communities in IGP. Issues such as the overexploitation of groundwater, degradation of soil quality, and heightened susceptibility to erosion have emerged as key concerns (Chauhan *et al.*, 2012).

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Moreover, the erratic nature of rainfall patterns and the occurrence of extreme weather events, compounded by rising temperatures, adversely impact both crop growth and the availability of water resources (Pathak *et al.*, 2003). These climatic uncertainties have ramifications for sustainable agricultural practices. Anthropogenic practices like the burning of crop residues, intensive application of chemicals, and the fragmentation of land holdings exacerbate the existing challenges, further impeding the pursuit of viable and enduring agricultural systems.

The Western Dry Region, characterized by arid and semi-arid climates, fosters agricultural diversification through the cultivation of both traditional and climate-resilient crops (Machiwal *et al.*, 2019). The arid conditions prevalent in this region often lead to a reduced prevalence of certain pests and diseases, consequently diminishing the reliance on chemical pesticides. Indigenous farming techniques and practices developed by local communities are intricately aligned with the region's conditions, rendering them indispensable for the pursuit of sustainable agriculture. Beyond crop cultivation, livestock farming assumes a pivotal role in the livelihoods of the Western Dry Region's inhabitants, particularly through the utilization of drought-resistant animal breeds. These animals offer not only meat but also dairy and other valuable products, contributing to the multifaceted nature of the region's agricultural activities (Kant *et al.*, 2015). While the region exhibits a historical adaptation to climatic variability, the advent of extreme weather events linked to climate change had potentially disrupted the established agricultural cycles and yielded detrimental consequences for crop productivity. In this context, water scarcity, compounded by inefficient water management practices, improper ploughing, suboptimal irrigation techniques, and the looming specter of desertification poses significant challenges for farmers. Moreover, the task of connecting farmers in the Western Dry Region to markets is compounded by geographic isolation and inadequacies in transportation networks (Saini and Jirli, 2022). The absence of proper infrastructure, including well-maintained roads, adequate storage facilities, and accessible markets (Saini *et al.*, 2023), impedes farmers' ability to access essential inputs, efficiently transport their produce, and secure equitable prices for their crops.

Migration is being undertaken by farmers from both the IGP and the Western Dry Region due to various reasons. The intensity and impact of these factors can vary from region to region, but they together contribute to the phenomenon of agricultural migration (Deshingkar, 2004). In both regions, the decision to migrate is influenced by a combination of push and pull factors. Challenges and limitations within the existing agricultural practices constitute the push factors, whereas the promise of better economic opportunities, education, and improved living standards in other regions represents the pull factors (Lee, 1966). It is imperative to address constraints faced by migrant workers within specific agro-ecological contexts. These contexts encompass not only climatic, soil, and water parameters but also intricate socio-economic, cultural, and regulatory frameworks that significantly influence agricultural practices. The confluence of agro-ecological characteristics and migrant experiences creates a dynamic space where innovation becomes essential for overcoming obstacles and unlocking the latent potential of both individuals and regions.

To bridge this gap a study has been undertaken, to examine various facets of the challenges that arise from the convergence of migrants and agro-ecological zones. This research illuminates innovative agricultural ventures that have emerged as responses to these multifaceted challenges. These profitable and innovative ventures, which are tailored to the distinct characteristics of agro-ecological regions, offer a glimpse into the transformative potential of blending tradition with innovation.

MATERIALS AND METHODS

In this study, Uttar Pradesh and Rajasthan were purposely selected to investigate the constraint and innovative agriculture ventures. In the process of sampling design, a stratified multistage sampling approach was utilized. From the state of UP and Rajasthan, four districts were randomly selected in each state. These districts namely, Hanumangard, Nagaur, Pali and Banswara from Rajasthan, and Rampur, Unnao, Jhansi, and Varanasi from UP, as shown in Figure 1. In the first stage, four villages were randomly chosen from each selected district as the primary sampling unit. Subsequently, in the second stage, fifteen migrant and non-migrant farmers were randomly

selected from each village to investigate the occupational opportunities for the agricultural migrants. A respondent was considered an agricultural migrant if, within the last 5 years, his usual place of residence (UPR) was different from the location of the survey for a minimum of 6 months. Additionally, he must have received more than Rs. 4000 per month as the value of produce from agricultural activities; otherwise, they are classified as a non-migrant farmer (NSO, 2022). To gather data, a structured interview schedule was employed, and a total of 480 migrant and non-migrant farmers were interviewed face-to-face between January and June 2023.

Garrett technique was used to evaluate the constraints faced by the migrants at UPR and the destination place (Jirli and Saini, 2021). The orders of merit given by the respondents were converted into rank by using the formula. As per this method, respondents have been asked to assign a rank for all problems and such ranking has been converted into score value with the help of the following formula:

$$\text{Percent position} = \frac{Rij - 0.5}{N_j} \times 100$$

Where R_{ij} = Rank given for the i^{th} variable by j^{th} respondents

N_j = Number of variables ranked by N_j respondents

RESULTS AND DISCUSSION

The various challenges and barriers that migrant farmers face in their pursuit of sustainable and profitable livelihoods in the agricultural sector. They were exposed to challenges in their UPR as well as in their destination place as shown in Figure 2. A UPR is crucial for migrants in agriculture as it provides a foundation for their farming activities, access to resources, community support, and opportunities for long-term growth and prosperity. Table 1. shows the constraints faced by migrants at the UPR, which act as driving migrants from their native place.

The place of residence facilitates their seamless integration into the indigenous agricultural fabric, ultimately contributing to the establishment of a more sustainable and highly productive agricultural sector. Comprehensive investigation reveals that the primary challenges encountered in their native regions encompass the unavailability of employment opportunities, farm inputs were not available timely, lack of input from service providers, and salinization of soil. The inadequacies in infrastructure (Patel, 2014), coupled with the shifts in climate patterns (Pathak *et al.*, 2003), the allure of urban prospects drawing rural youth away (Som *et al.*, 2018), and the prevalent excessive use of chemicals and pesticides (Chauhan *et al.*, 2012), compound the array of challenges faced by

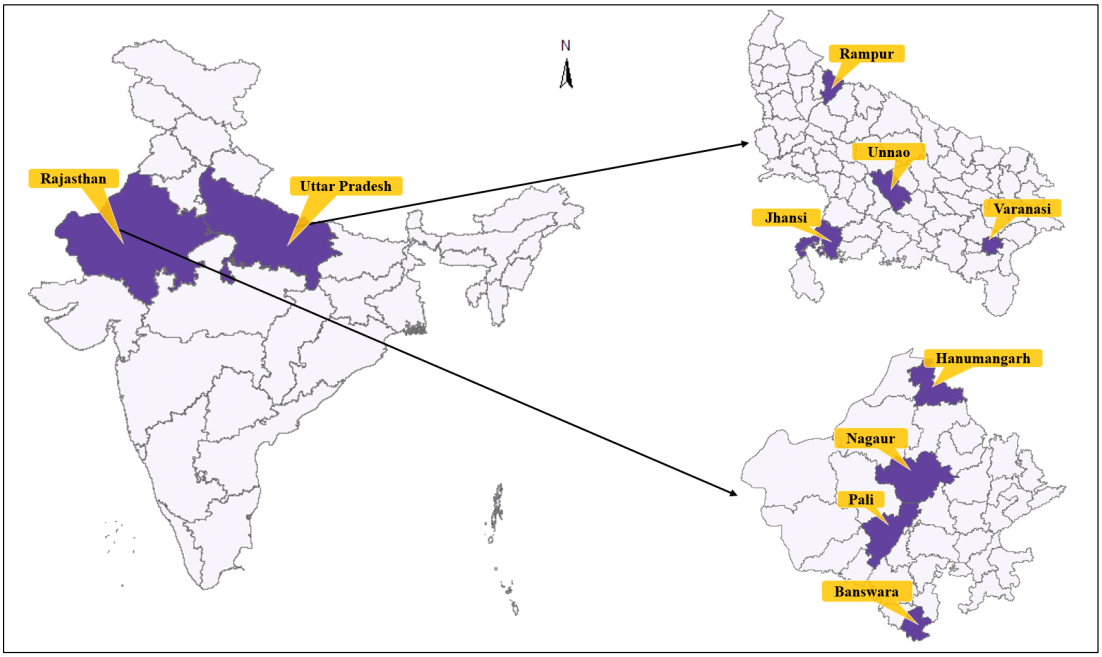

Figure 1: The study area for this research

Table 1: Constraints faced by migrants at the Usual Place of Residence (UPR)

Constraints at UPR	Items	Code	Total score	Rank
Livelihood insecurity	Unavailability of employment opportunities	LI1	85.8	1
	Seasonal unemployment	LI2	69.64	2
	Struggle to meet debt obligations	LI3	39.53	3
	Low Income	LI4	38.06	4
Resources unavailability	Farm inputs were not available timely	RU1	47.98	1
	Unavailability of credit facility	RU2	43.11	2
	Human resource unavailability	RU3	39.8	3
	Digital literacy training was not accessible	RU4	32.12	4
Unavailability of Services	Lack of input from service providers	US1	66.46	1
	Unavailability of medical facility	US2	56.34	2
	Education facilities are unavailable	US3	47.63	3
	A dearth of transportation facility	US4	22.57	4
Perceived environmental change	Salinization of soil	PE1	76.21	1
	Drastic temperature variability	PE2	45.7	2
	Irregular rainfalls	PE3	38.9	3
	Regular drought	PE4	32.19	4

migrants within their native localities. Consequently, these compounded adversities propel them towards embarking on migration journeys to new horizons in search of better opportunities and living conditions.

The destination place plays a decisive role in shaping the livelihoods and opportunities of migrants in agriculture. Table 2 shows the constraints faced by migrants at the destination place.

By leveraging the advantages of the destination place, migrants can improve their agricultural productivity, financial well-being, and overall quality of life. But at the destination place migrants faced challenges that were irregular wages/salary, house rental facilities unavailable, insurance schemes unavailable, and discrimination against a local group. Migrants often find themselves in labour markets characterized by fluctuations in demand and supply that result in exploitative labour practices and irregular salaries (Shonchoy and Junankar, 2014). The phenomenon of rapid urbanization and the concurrent surge in population within destination areas have collectively contributed to the scarcity of housing options that are both suitable and financially viable (Tacoli *et al*., 2014). Moreover, the lack of awareness, coupled with stringent eligibility criteria and administrative obstacles, acts as a formidable barrier to migrants' ability to avail themselves of fundamental services such as healthcare and social security (Bhagat *et al*., 2020). Migrants face barriers to social integration with the local community because of cultural differences, economic competition, and a perceived threat to existing resources (Bala, 2017).

Understanding and addressing these constraints are essential to devise effective strategies and policies that can support and empower migrant farmers in agriculture. Overcoming these obstacles can lead to better livelihood opportunities and contribute to the overall development of the agricultural sector in the region. Therefore, profitable start-ups and innovative ventures in Rajasthan and Uttar Pradesh were explored for migrants.

The study identified that revenue generation for farmers and agribusiness relies significantly on agro-climatic conditions and location-specific needs. Consequently, recommending a single package of practices did not lead to substantial earnings. However, the study explored employment prospects for migrant farmers in Rajasthan and Uttar Pradesh by examining the agricultural prospects of non-migrant farmers. It was observed that non-migrant farmers engaged in diverse agricultural practices (Padhan *et al*., 2023). Figure 3 illustrates the variety of practices adopted by non-migrant farmers. In Rajasthan, the top three income-

Table 2: Constraints faced by migrants at the destination place

Constraints at the destination place	Items	Code	Total score	Rank
Livelihood insecurity	Irregular wages/salary	LI1	56.18	1
	Difficulty in finding skilled work	LI2	44.89	2
	Unstable employment	LI3	40.26	3
	Exploitative labour practices	LI4	21.66	4
Resources unavailability	House rental facilities are unavailable	RU1	56.68	1
	The water facility was unavailable.	RU2	46.52	2
	Electricity was inaccessible.	RU3	37.57	3
	Unavailability of nutritious food	RU4	22.32	4
Unavailability of Services	Insurance schemes were unavailable	US1	76.01	1
	Benefits of MGNREGA unavailable	US2	53.33	2
	Medical facilities were unavailable	US3	40.01	3
	One nation one ration card was inaccessible	US4	33.65	4
Perceived risks	Faces discrimination against a local group	PE1	56.65	1
	Cultural differences with a local group	PE2	45.59	2
	Hazardous working sites	PE3	37.58	3
	Separation from family	PE4	33.18	4

Figure 2: Constraints faced by agricultural migrants at UPR (a) and destination place (b). *(LI: Livelihood Insecurity, PE: Perceived Risks, US: Unavailability of Services, RU: Unavailability of Resources)*

generation activities, based on their frequency of occurrence, were livestock management, leafy vegetable production, and oilseed production Figure 3(a). In Uttar Pradesh, the most frequently employed activities were vegetable production, livestock management, and seed production, as depicted in Figure 3(b).

The recommendations given by KVK professionals for sustainable revenue generation for migrant farmers are shown in Figure 4. In Rajasthan, the three highest profit-generating activities were protected cultivation, organic farming, and orchard establishment, displayed in Figure 4(a). On the other hand, KVK professionals in Uttar Pradesh suggested integrated farming, fruit production, and residue management as the top activities, as seen in Figure 4. (b). By analyzing the frequency of suggestions, this mapping offers a valuable understanding for prioritizing location-specific income-generation activities as recommended by stakeholders, allowing for informed decision-making and strategic planning in the agricultural sector.

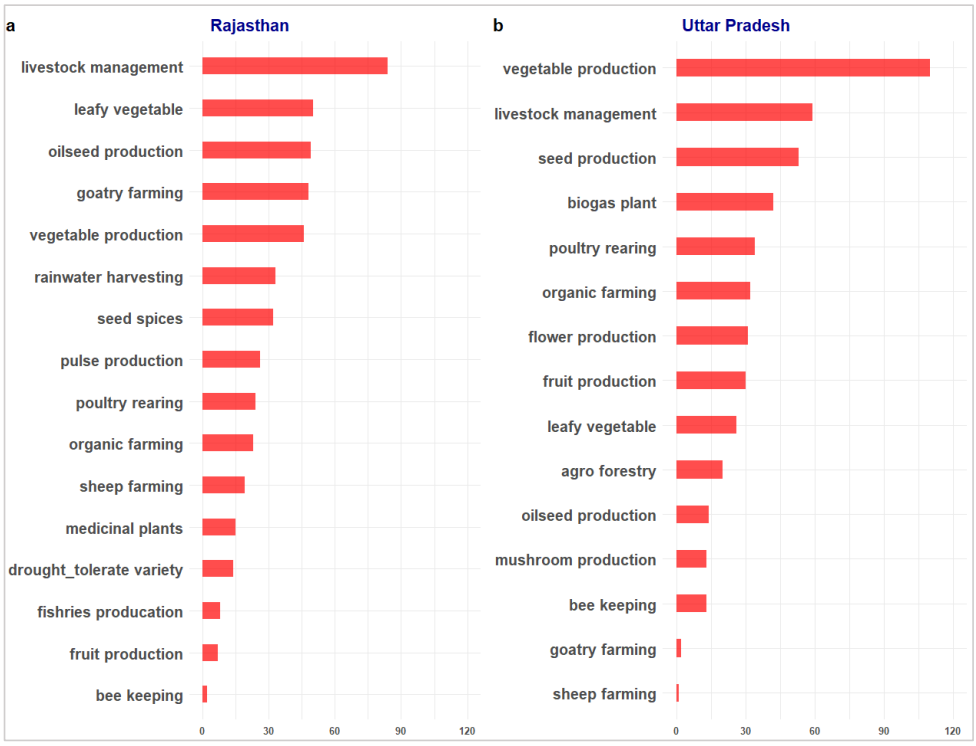

Figure 3: Agricultural practices in Rajasthan (a) and Uttar Pradesh (b) used by non-migrant farmers

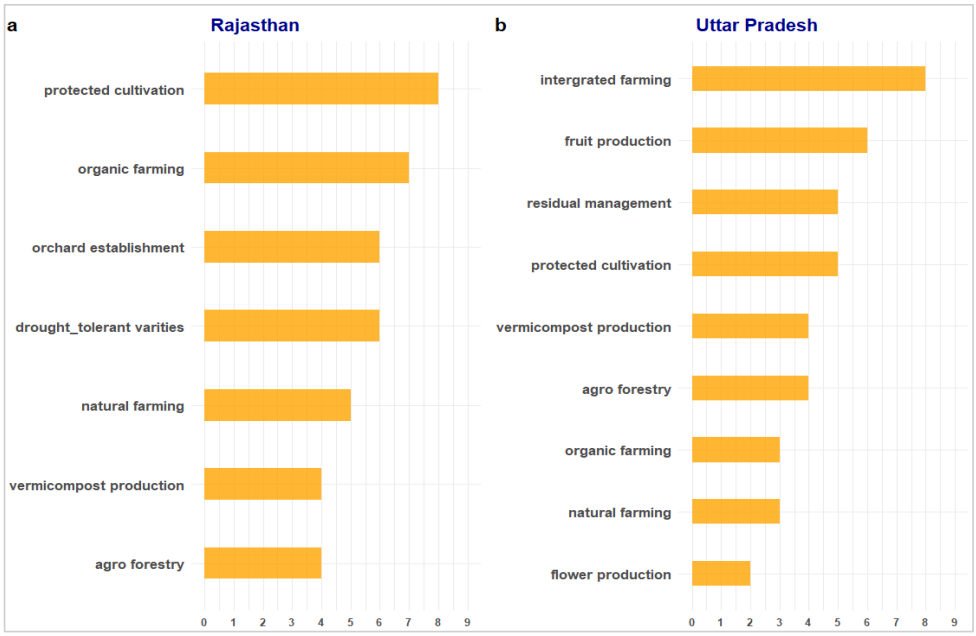

Figure 4: Emerging innovations suggested by KVK professionals of Rajasthan (a) and Uttar Pradesh (b) for migrant farmers

CONCLUSION

The accounts of migrant workers harnessing innovation to surmount constraints paint a vivid picture of their determination to thrive. By embracing localized solutions and adapting traditional practices, they not only enhance their own well-being but also contribute to the vitality of the agro-ecological regions they call home. Innovative agricultural ventures, painstakingly tailored to the unique characteristics of each agro-ecological context, have emerged as beacons of hope. These ventures, spanning value-added processing, precision agriculture, cooperative models, and sustainable resource management, exemplify the transformative potential of merging tradition with modernity. Through these endeavors, migrants have not only enhanced their economic prospects but also forged symbiotic relationships with the environments

they inhabit. This research highlights the imperative of understanding and addressing the complexities of agricultural migration in agro-ecological contexts. It underscores that the journey from constraints to innovation requires not only the empowerment of migrant workers but also the creation of an enabling ecosystem that nurtures creativity, collaboration, and sustainable growth. By recognizing the intimate relationship between migrant experiences and the agro-ecological environments they inhabit, the study unlocks the potential to usher in a new era of agricultural transformation—one where innovation flourishes, constraints are surmounted, and prosperity resonates through the fields and lives of migrant workers across diverse landscapes. Through collective effort and enlightened action, policymakers can sow the seeds of a brighter future for both migrants and the agro-ecological regions they cultivate.

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Research Article

Changing Role of Women After Male Out-Migration: A Study in Almora District of Uttarakhand, India

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ABSTRACT

The majorities of the rural population in the hills either survives on subsistence agriculture or migrate for better livelihood opportunities. The excessive rate of male out-migration has changed the demography and socio-cultural system of Uttarakhand leading to a number of changes in the lives of rural women. The study was conducted to know the changes in the lives of rural women after male out-migration. It was found that out of the 18 roles of women that were identified, there had been a significant change in eight roles. These were household chores, care for the elderly, caring of livestock, fetching firewood, attending social events, voting for local bodies, participation in developmental activities at the local level and value addition /post-harvest activities.

Keywords: Male out-migration, Roles of women, Rural area, Rural development, Rural women

INTRODUCTION

Ind-ia is an emerging economy and a developing country. The increasing trend of urbanization has significant implications for development process and migration is one of the most common outcomes of development process. The extent of rural-urban migration has increased significantly in India during recent times. On the economic front, better employment opportunities in the urban centers attract a sizeable proportion of workers from rural to urban areas, thus inducing rural-urban migration (Chakraborty and Kuri, 2013).

Migration is a demographic event, as its long term effects affect the socio-economic and cultural development of any region or country. Migration is a natural process that often happens depending on the socio-economic, demographic, cultural, political and environmental factors of the migrant people. People migrate because of various reasons like job transfers, lack of medical facilities, poor agricultural production and destruction of agricultural produce by wild animals, search for better livelihood opportunities, education and other facilities. Youth are becoming idle and inactive in the hill region due to lack of employment opportunities outside agriculture and absence of vocational training.

The increasing trend of male out-migration has affected the overall quality of rural life by increasing the responsibilities, hardships and workload of women. Women make significant contribution towards subsistence economy and socio-ecological sustainability of hill systems. Male out migration has resulted in women bearing the sole responsibility of managing the household, agriculture and livestock. The changing trend of increase in female work force participation is a positive sign and first step towards women's empowerment. On the other hand, prolonged separation due to migration results in emotional difficulties for women. Women experience marital separation or abandonment and it has a negative effect on most women by placing them in a financially precarious position. The financial outcomes of migration are mixed.

Male members of the family often migrate for jobs and this has resulted in a situation where the women are left with enormous responsibilities of taking

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care of the elderly, children, farm and animals. Consequently, a number of changes have been observed in the lives of rural women in terms of workload and overall responsibilities of running the household. Women who are left in charge of households have to continue to perform their traditional roles and also take on men's responsibilities. Hence, it is important to understand the altered situation of women. Thus, a study was taken up to find out the effect of male out migration on rural women.

The reviews suggested that male outmigration has both positive and negative facets. Women have to undertake more agricultural, as well as non-agricultural work, in addition to usual household activities. Women became more empowered after male out migration as they feel more financially responsible, and their decision-making ability has improved. But they also go through prolonged emotional stress and loneliness in the absence of men. Several difficulties were faced by women in managing the farm and non- farm activities, along with household chores and child rearing in the absence of men in the family.

A study conducted by (Khalaf, 2009) to find out the effects of male migration on women left behind in Lebanon concluded that the women became more empowered after male out migration and assume new roles. A study on labour migration and remittances in Uttarakhand revealed that male out migration has increased the workload of women, but has also improved their social status in the village and has provided freedom to them. This has enhanced the decision making ability of women (Anmol, 2010). A study entitled "Glimpses of Women's Lives in Rural Bihar: Impact of Male Migration" conducted by (Datta and Mishra, 2011) concluded that migration of men has brought about several changes in the role of women within and outside their household. Women have started doing more agricultural, as well as non-agricultural work, in addition to household activities.

The burden of work has increased tremendously for women who were agricultural laborers as they work in family farms and as sharecroppers. On the domestic front, they have the responsibility of taking care of children, and had burden of household tasks. Positive impact was that, after male migration, women were taking decisions in the household and managing household finances and remittances. In a study entitled "Labour migration in Indo-Gangetic Plains: Determinants and Impacts on Socio-Economic Welfare" concluded that women left behind in the village assume major role in various farm activities resulting in the "feminization of agriculture". It has also empowered the female members of migrant households in terms of enhancing their decision-making ability (Singh *et al.,* 2011).

A study on the effect of migration on agricultural productivity and women empowerment in Bihar and reported that level of women's employment had increased in migrant households of Bihar, particularly in poor households and work load of women has also increased. They observed that role of women changed from unpaid farm labour to managers of the households and they also faced problems in management of funds, technology and input-output marketing (Singh *et al.* 2012).

A study entitled "Social and economic impacts of labor migration on migrants' households in Tajikistan" (Khuseynova, 2013) found that migration had both positive and negative effects on households. Positive outcomes included improved health and nutrition status, increased purchasing power and diversified income and consumption patterns. Negative impact included very high dependency on remittances by household members, accidents, illness, difficulties faced by women in managing the household chores in the absence of men, difficulties in child rearing and their education and psychological impact on women. In a study titled "Male migration and problems faced by the family left behind: A case study of Tehsil Daska" found that children and family felt that migration increases budget allocations for health and educational requirements via remittances, but creates an emotional vacuum for the women left behind. They often go through prolonged emotional stress and loneliness in the absence of men. However, women feel more financially responsible, and more empowered in decision-making (Kouser *et al.,* 2014).

In a pilot study entitled "Outmigration in Uttarakhand" highlighted the impact of migration on women. Women work for an average eight to ten hours daily in various activities like cultivation, fodder collection, fuel collection animal husbandry, apart from

cooking and child care and taking care of old people in their households. In many cases, migration has overburdened women with agricultural activities and MNREGA work, which were earlier performed by the male members of the household (Mamgain and Reddy, 2015).

A study on recent trends in rural out-migration and its socio-economic and environmental impact in Uttarakhand Himalayas (Joshi, 2018) revealed that the trend of out migration has increased because of steady depletion of natural resources and climate change and this trend has enhanced the roles and responsibilities of women and increased their workload in farm and non-farm sectors. The increasing trend of male out-migration has contributed to social, economic and political empowerment of women. Male out migration has not only provided financial stability in terms of remittances but has also improved women's access to education, resources and nearby local institutions. It has also improved grass-root leadership, decision making ability and marketing networks of rural women. Furthermore, women have developed critical traditional knowledge to understand, visualize and respond to environmental changes including climate change.

The impact of male out-migration on women in Uttar Pradesh (Singh, 2018) revealed that male out-migration has both positive and negative facets. Migration has increased the household income, thereby increasing their social status in village. But economic gains are often offset by increase in workload of women within the household and on farm. Although decision-making has empowered women, lack of financial autonomy and inability to take decisions on important matters impedes their empowerment. In the study on "Evolving role of women in the context of male out migration: A study in a hill district of Uttarakhand" (Sharma, 2019) reported that women have made various strategies to cope with male out migration leading to numerous positive and negative outcomes in their lives.

MATERIALS AND METHODS

The study was conducted in Almora district of Uttarakhand. Almora was choosen purposely as, it has negative population growth rate (-1.64%) due to heavy out-migration from the district (Census 2011). Out of the 11 blocks in Almora district, Dwarahat block was selected randomly. There are 216 villages in Dwarahat block, out of which, two villages viz: TalliMirai and Kaphara were selected randomly. All women in the age group of 18-55 years (112 women) were respondents for the study. Agriculture is main source of livelihood in both the villages. In last few years, male out migration of 60-65 percent has been reported from TalliMirai village and about 45-50 percent from Kaphara village.

For data collection, Pre tested interview schedule containing both open ended and close ended questions was used. Pretesting of the interview schedule was done on 20 respondents of non- sampled village Okhaldunga in Bhimtal block in Nainital district of Uttarakhand state. On the basis of pre testing, necessary modifications were incorporated before undertaking the final data collection. All the respondents were interviewed personally by the researcher. Prior to interview, the respondents were briefed about the purpose of the study.

RESULTS AND DISCUSSION

On the basis of review of literature on male out-migration and its impact on the roles and responsibilities of women, a comprehensive list of roles played by women especially in hilly areas were identified. These include household chores, child care and education, care for elderly, caring for livestock, fetching water and firewood, marketing and purchase of household goods and for occupational purpose, dealing with institutions, attending social and political events, voting for local bodies, standing for political office, participation in development activities at local level, participation in employment related work, working in own farm, marketing activities and value addition/post harvest activities. Before- after situation with reference to these 18 roles is given in Table 1.

Women involvement in these 18 activities before and after migration of the male member was studied on a three point continuum. The mean values were calculated and Z test was applied to find out if there had been a significant change in any of these roles after male out-migration. Out of the 18 roles that were identified it was found that there had been a significant change in eight roles. These were household chores, care for elderly, care of livestock, fetching firewood, attending social events, voting for local bodies,

Table 1: Change in the role of rural women in migrant household

S.No.	Particulars	Mean		Z_{cal}	Inference
		Before migration	After migration		
1.	Household chores	2.91	2.96	-1.54	Significant
2	Child care and education	2.83	2.75	1.28	Not Significant
3	Care for elderly	2.83	2.58	3.22	Significant
4.	Caring for livestock	2.84	2.87	-0.43	Significant
5.	Fetching water	1.91	2.11	-2.00	Not significant
6.	Fetching firewood	1.40	1.42	-0.28	Significant
7	Marketing and Purchase for household	1.47	2.13	-7.56	Not significant
8	Marketing and Purchase for occupation	1.44	1.99	-6.05	Not significant
9	Dealing with institutions	1.35	1.31	0.61	Not Significant
10	Attending social events	2.70	2.43	3.03	Significant
11	Attending political events	1.22	1.17	0.78	Not Significant
12	Voting for local bodies	2.88	2.89	-0.15	Significant
13	Standing for political office	1.01	1.009	0.57	Not Significant
14	Participation in development activities at local level	1.69	1.46	2.51	Significant
15	Participation in employment related work	1.62	2.06	-4.76	Not significant
16	Working in own farm	2.91	2.88	0.68	Not Significant
17	Marketing activities	1.63	2.24	-7.03	Not significant
18	Value addition/ post harvest activities	1.54	1.29	3.90	Significant

At 5 % level of significance, $Z_{tab} = 1.95$

participation in development activities at local level and value addition/post harvest activities.

1. The before-after mean values were 2.91 and 2.96 respectively. Further, the Z_{cal} value (-1.54) was more than Z_{tab}. This indicates a significant increase in the household chores performed by women after migration of men. Prior to out migration, some chores like cleaning the area surrounding the dwelling and other tasks involving heavy labour were performed by men.

2. The mean value in case of care of elderly person was 2.83 prior to migration. This value decreased to 2.58 after migration of male family member. Also, the Z_{cal} value (3.22) was higher than the Z_{tab} value, which indicates that the change is statistically significant. It was observed that prior to migration, the elderly parents stayed with the family of the migrant household. However, after migration, they prefer staying with other son(s) who are still living in the village or nearby. This reduces the burden of caring for elderly in the migrant households.

3. The mean values for fetching firewood before and after migration were 1.40 and 1.42 respectively. Also, the Z_{cal} value (-0.28) was higher than the Z_{tab} value, which indicates that the change is statistically significant. In recent years, there had been a decrease in the use of firewood in rural households. This is mainly due to better economic conditions and government scheme like Pradhan Mantri Ujjwala Yojana. Some firewood however, is still collected for use during emergencies, cold season, etc. While this task was mainly performed by men prior to migration, it is now carried out by women.

4. The before - after mean values of caring for livestock were 2.84 and 2.87, respectively. Further, the Z_{cal} value (-0.43) was more than Z_{tab}. This indicates a significant increase in the care of livestock by women. Milking, feeding, cleaning of livestock is mostly done by women in the villages. In hilly areas, the cattle are left in fallow land or other places for feeding. Taking them to grazing lands was done by men prior to migration. Post

migration, this task is also carried out by women, thus increasing their workload. It has also been observed that women are rather reluctant to let go off the domestic animals despite workload as they fulfill nutritional requirements of the household members.

5. The mean value for attending social events was 2.70 prior to migration. This value decreased to 2.43 after migration of male family member. Also, the Z_{cal} value (3.03) was higher than the Z_{tab} value, which indicates that the change is statistically significant. It was observed that usually one member of the household attends social gatherings to represent the family. Except in case of close family relatives, usually men attend these social events. But, after migration women are assigned the task of representing the household. Due to limited mobility and household chores, they participate in social events/gatherings within the village only.

6. The before-after mean values were 2.88 and 2.89 respectively. Further, the Z_{cal} value (-0.15) was more than Z_{tab}. However, no change was observed in terms of women attitude towards voting in local elections.

7. The mean value for participation in development activities at local level was 1.69 prior to migration. This value decreased to 1.46 after migration of male family member. Also, the Z_{cal} (2.51) was higher than the Z_{tab} value, which indicates that the change is statistically significant. When the male members of the family are present, the women were actively engaged in village development activities (attending meeting, expressing their views, etc.) However, it was noticed that after migration of male member their engagement with development agencies and participation in development decisions making has diminished. This is due to added burden of household chores and lack of information. It may also be due to lack of need to find employment in some cases.

8. The mean value in case of value addition and post harvest activities was 1.54 prior to migration. This value decrease to 1.29 after migration of male family member. Also, the Z_{cal} value (3.90) was higher than the Z_{tab}, which indicates that the change is statistically significant. In rural areas, most women are engaged in some or the other post harvest/ value addition activities at household level. These activities include badi making, potato chips, pickle making, papad making, etc. After out migration of male members, there had been a reduction in these activities due to lack of time and additional workload on women.

CONCLUSION

Male out-migration from rural areas has resulted in women having to assume roles and responsibilities previously handled by men. This shift in household dynamics has significantly altered women's control over minor household expenditures and freedom of physical mobility. Prior to male out migration also, women in the hills played a significant and crucial role in agricultural and allied activities, but were given little credit. Male out migration has resulted in women bearing the sole responsibility of managing the household, agriculture and livestock. It was found that male out migration has had an impact on women's roles and responsibilities. A comprehensive list of roles were identified and they are included like household chores, child care and education, care for elderly, caring for livestock, fetching water and firewood, marketing and purchase for household goods and for occupation, dealing with institutions, attending social events, attending political events, voting for local bodies, standing for political office, participation in development activities at local level, working in own farm, marketing activities, value addition and post harvest activities. Out of these 18 roles, it was found that there had been significant changes in eight roles after male out migration. These were household chores, care for elderly, fetching firewood, care of livestock, attending social events, voting for local bodies, participation in development activities at local level and value addition/post harvest activities.

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Research Article

Taenia solium Taeniasis and Porcine Cysticercosis – An Overview

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ABSTRACT

Taenia solium taeniasis is a zoonotic disease of worldwide distribution. This disease is mostly found in developing countries where improperly cooked or under cooked pork is taken by humanbeing with poor sanitation (Tetsuya *et al.,* 2012). Among the eucestodes, the family Taeniidae (Ludwig, 1866) contains 8 valid species of taeniid tapeworms (Soulsby, 1982). Each of these parasites requires a vertebrate intermediate host to perpetuate their life cycle in nature. Larval stage of the tapeworm that develops in the intermediate host is known as metacestode. Except the species *Taenia multiceps*, other metcestodes of the genera *Taenia* are generally known as *Cysticercus*. Of the 8 valid taeniid species, *Taenia solium* (Linnaeus, 1758) and *T.saginata* (Goeze, 1782) are obligatory human parasites, and their corresponding metacestodes, i.e., *Cysticercus cellulosae* and *C.bovis*, are found in pig and cattle respectively. The disease entity involved by *Taenia solium* Taeniasis as adult obligatory parasitism in man and Cysticercosis as metacestode infection in intermediate host pig is focused through this article.

Keywords: Cysticercosis, Porcine, *Taenia solium,* Taeniasis

INTRODUCTION

Taeniasis due to *T. solium* has been considered a serious parasitic zoonosis (WHO, 1979). The infection is acquired mainly through the ingestion of pork that is not properly cooked or uncooked which are infected with viable *C. cellulosae*. The adult parasite is found in the human jejunum and remains within the host for several years. Man is the only natural final host of *T. solium*, however, the parasite could be experimentally established in gibbon (*Hylobates lar*) and baboon (*Papio ursinus*) too (WHO, 1979). Taeniasis due to *T. solium* is a non-fatal human intestinal disorder. The adult parasite provokes either recognizable or unrecognizable infection except for the passage of progllotids, which is usually noticeable. There exist individual reactions to infection that are either idiosyncratic, often psychological in nature, as the symptoms are not reported until the patient become aware of his/her parasitism.

Cysticercosis due to *C. cellulosae* is a porcine disease commonly acquired due to unhygienic feed or water intake by this animal along with the viable eggs of *T. solium*. In pigs, the cysts are distributed in the striated muscles like heart and tongue and skeletal muscle like forearm. The cysts are also found in liver, lungs and spleen, eye, conjunctiva and nervous system of pigs, which remain viable for a long time. However, the longevity of cysts is inconclusive due to lack of data. Man under accidental circumstances like poor sanitation, contaminated vegetables or unwashed hands (WHO, 1979) may get infected. There is also report of auto-infection in man (Parija, 1991). All these processes of infection lead to the development of human cysticercosis. Cysticercosis is generally asymptomatic but in man the disease takes the form of severe fatal opthalmocysticercosis, neurocysticercosis, dissemeinated cysticercosis and mixed cysticercosis (WHO, 1979). Taeniasis due to *T. solium* is generally asymptomatic in many carrier whereas neurocystcercosis and opthelmocysticercosis is still lethal in some remote areas of developing countries (Tetsuya *et al*., 2012).

T. solium taeniasis and porcine cysticercosis is mainly restricted to the regions of low socio-economically

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developed counties of central and southern Africa, Mexico and Central and South America and southern Asia including India. Human mortality due to cysticercosis in Mexico was found to be 1.9 and 3.5 per cent in autopsied cases (WHO, 1979). Porcine cysticercosis in Mexico alone was accounted for 3.08 per cent (Aluja, 1982), 6.6-11.0 per cent (Flisser, 1989), 0.54 percent (Carrasco, 1977) and 6.5 per cent (Sarti *et al.,* 1992). In Brazil and Chile, the infection was recorded to be 1.2 per cent (Figueiredo *et al.,* 1973) and 0.7-1.0 per cent (Schenone and Rojas, 1988) respectively.

The disease is well spread in Africa (Dada, 1980); China (Jing and Wang, 1985) and India (Raquib, 1966, Sarma, 1977; Varma, 1982; Deka *et al.,* 1985; Deka and Gaur, 1990, Parija, 1991; Plain 1991; D'Souza and Hafeez, 1998; Borkataki, 2004).

This is the only zoonosis where the relationship between man and animals is so obligatory for survival of the infectious agent (Parija, 1991). Pig as intermediate host is necessary for completion of life cycle in human being. Conventional diagnosis of porcine cysticercosis in order to control this important zoonosis - a break in the life cycle as well as an effective diagnosis is based on meat inspection at the selected predilection sites is highly essential measures. Moderate and severe infection can be detected by this method (D'Souza and Hafeez, 1998), however, a substantial portion of infected carcass is not detected (WHO, 1979) and often fails to detect mild cases (D'Souza and Hafeez, 1998). Human cysticercosis is usually diagnosed by different imaging systems, including that of radiological examination, supported by ELISA (Parija, 1991) to demonstrate the antibodies in serum and CSF. There has been some progress in the serodiagnosis of porcine cysticercosis (Kumar *et al.,* 1987; Pathak *et al.,* 1984; Pathak and Gaur, 1985; Prasanna *et al.,* 2001).

An effective and reliable and rapid diagnostic method for porcine cysticercosis is necessitated as detection and processing of infected carcass constitutes an important aspect of control measure. Cestode antigens prepared by traditional method for serodiagnosis give poor sensitivity and specificity owing to their complex nature of either metacestode components or adult parasites itself (Kagan, 1968). Geerts *et al.* (1981) and Pathak *et al.* (1984) reported marked cross reactivity between taeniid metacestodes and recommended the purification and isolation of specific antigens (Abdussalam *et al.,* 1976) for developing an effective test system.

CONCLUSION

Taenia solium taeniasis and porcine cysticercosis are the public health interventions which including veterinary, human health and environmental sectors. Different new control tools are available, there are opportunities to concentrate research attention on evaluation of novel control scenarios leading to the implementation of effective and sustainable control programmes and a reduction in the global burden of both the diareses in human as-well-as pig.

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Research Article

Efficiency of Farm Diversification in Haryana

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ABSTRACT

The present study aimed to assess the efficiency of farm diversification was conducted in Kaithal, Hisar and Bhiwani districts of Haryana during 2021 by selecting 180 farmers. The efficiency of farm diversification was assessed through Benefit Cost Ratio (BCR). In this study, enterprises which have shown higher BC ratio (>2) are sheep (3-3.8), piggery (2.4-2.66), apiary (2.55), mushroom (4.8), ber (5-6) and cauliflower (2.6-5). Kaithal district reported the highest farm diversification efficiency of 2.46 followed by Bhiwani (1.88) and then by Hisar (1.64). Availability of fertile soil, increased area under irrigation, better marketing and transportation facility were the major reasons for Kaithal to score the highest Benefit Cost ratio compared to Hisar and Bhiwani districts. The findings of the present study would act as supporting evidence for the potential enterprises that can contribute to achieve diversification in farming sector of Haryana.

Keywords: Farm diversification, Benefit – Cost Ratio, Enterprises, Haryana

INTRODUCTION

Green revolution in 1960s helped in increasing food production in the country. It primarily aimed to introduce high-yielding varieties (HYVs) of cereals to alleviate poverty and malnutrition (Nelson *et al.,* 2019). Green revolution was capable of mitigating hunger and malnutrition but it made negative impacts in terms of soil and water degradation (Davis *et al.,* 2019). In a study conducted in Haryana, soil was found to have waterlogging, salinity, soil erosion and rise of groundwater table linked to brackish water and alkalinity, affecting production and food security in the future (Singh, 2000).

Haryana state has promoted crop diversification by different means so as to move towards less water-intensive crops. As a result the farmers are slowly shifting away from regular rice-wheat crop cycles. Recognising the increasing importance of allied sectors, the committee on Doubling Farmers' Income (DFI, 2018) considers dairying, livestock, poultry, fisheries and horticulture as engines of high growth and has recommended a focused policy with an associated support system. Ensuring food and employment security in the midst of declining land productivity and profitability require in-depth investigation for determining alternative strategies. Continuous mono cropping-system threatens the sustainability of future agricultural production in terms of soil, water, climate and market parameters. Diversified farming system would enable farmers to use their resources efficiently with its ecological benefits. In this context present study has been undertaken to assess the efficiency of farm diversification in Haryana, aimed at exploring the potential of allied enterprises which can accelerate diversification options in the state.

MATERIALS AND METHODS

The present study was undertaken purposively in the state of Haryana. Increased rice-wheat mono cropping trend necessitates diversification on account of ecological concerns in the state. The study was conducted in three agro ecological zones of the state (HKA, 2018). One district from each agro-ecological zone was chosen (Kaithal from AEZ I, Hisar from AEZ II and Bhiwani from AEZ III) followed by two blocks each in every district and two villages of every block (Table 1).

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Table 1: Sampling plan

State	District	Block	Villages
Haryana	Kaithal	Kaithal	Devigarh Kailaram
		Siwan	Mallikpur Firozpur
	Hisar	Hiasr II	Ludhas Neoli kalan
		Hisar I	Satrod kalan Satrod khurd
	Bhiwani	Bhiwani	Devsar Dinod
		Bawanikhera	Siwana Kheri daulatpur

With the help of expert opinion and progressive farmers, fifteen farmers from each village was selected constituting 60 farmers from each district. Thus a total 180 farmers were contacted for the study.

Efficiency calculation: Benefit-cost analysis (BCA) is a technique for evaluating a farm enterprise by comparing the economic benefits of an activity with the economic costs of the same activity.

$$\text{Benefit cost ratio (BCR)} = \frac{\text{Total benefit derived from an entreprise}}{\text{Total cost involved}}$$

If an enterprise has a BCR greater than 1.0, it is expected to deliver a positive net present value to farmer. If BCR is less than 1.0, then costs outweigh the benefits. The efficiency study of farm enterprises can give a better image of the possible diversification options and economics calculated out of it. Assumptions followed for calculating efficiency measures of a district are described below:

1. Enterprises accounted only from households which came under the research sampling plan (10 diversified* and 5 non- diversified farms from a village i.e., 40 diversified and 20 non- diversified farms from a district).
2. An enterprise was considered when it has a minimum threshold level in terms of number say, minimum number of ten sheep/pig, minimum twenty boxes for apiary, minimum area of 1 acre for crop/fish farming etc.
3. It is assumed that yield and price of an enterprise (crop, dairy, fish, horticulture etc.) for a district is derived based on the average yield and price of an enterprise by considering all the adopters of the particular enterprise during the study period.
4. It is assumed that while calculating total cost required for establishing an enterprise, only variable cost was accounted. Because fixed cost such as land and infrastructure varies from farmer to farmer and therefore not included in the calculation
5. Efficiency of farm diversification is derived from following equation

Efficiency of farm diversification at district level = $(\Sigma(_{i=1})^n$ (BC ratio of an entreprise) / (Total number of diversified entreprises surveyed in a district)

n=Total number of entreprises in a district

Primary data: Collection of primary data was done with help of personal interviews, observation method and focused group discussion method. The objectives of dimension of the study were kept in view while constructing interview schedule. The respondents were contacted at their door step or farm or working premises for interview.

RESULTS AND DISCUSSION

The term efficiency refers to the peak level of performance that uses the least amount of inputs to achieve the highest amount of output. In this study, efficiency is calculated using benefit cost ratio. Efficiency measure of diversified farms will give a better assessment of net income that can be derived out of establishing an enterprise. It will give a better idea to the farmers by giving an awareness about the cost required for establishing an enterprise and benefits derived out of it under a particular agro-ecological zone.

Comparison of efficiency of farm diversification across three agro eco regions (represented by three districts) is depicted in Table 5. In Kaithal district, the Benefit-Cost ratio ranges between 1.33 and 6 with sheep farming (3), poultry farming (1.33), piggery (2.4), apiary (2.25), mushroom farming (4.8), green gram (1.35), guava (1.75) and carrot (1.6). Ber and cauliflower had

*Diversified farmer: A farmer with minimum ten years of farming experience who has diversified his farming during last five to fifteen years

Table 2a: Benefit:Cost ratio of selected farm enterprises in Kaithal district

Enterprises	Farming system among non-diversified farmers*			
	Productivity (kg/ac)	Cost of cultivation (Rs. /ha)	Gross income (Rs. /ha)	Net income (Rs. /ha)
Cotton	800	74100	108680	34580
Sorghum	1200	49400	62244	12844
Rice	2200	61750	103246	41496
Wheat	2500	49400	117325	67925
Mustard	1000	24700	135850	111150
Potato	7500	74100	185250	111150
Dairy	8L/buffalo/day	60000/buffalo/year	84000/buffalo/year	14000/buffalo/year

*Rs. /ha unit accounted only for field crops and horticultural crops

Table 2b: Benefit:Cost ratio of selected farm enterprises in Kaithal district

Enterprises	Farming system among diversified farmers*				
	Productivity (kg/ac)or L/day	Cost of cultivation (Rs. /ha)	Gross income (Rs. /ha)	Net income (Rs. /ha)	B:C ratio
Cotton	800 (55/kg)	74100	108680	34580	1.47
Sorghum	1200 (21/kg)	49400	62244	12844	1.26
Rice	2200 (19/kg)	61750	103246	41496	1.67
Wheat	2500 (19/kg)	49400	117325	67925	2.37
Mustard	1000 (55/kg)	24700	135850	111150	5.50
Potato	7500 (10/kg)	74100	185250	111150	2.5
Dairy	8L/buffalo/day (35 /L)	60000/buffalo /year	84000/buffalo /year	14000/buffalo /year	1.4
Sheep farming	20 kg (3000 Rs./lamb)	25000 (for 25 ewes)	75000 (second year onwards)	50000	3
Guava plantation	7000 (8 Rs/kg)	86450	138320 (after 2 years of planting)	51870	1.75
Apiary	60 kg/box/year (150 Rs/kg)	200000 (50 boxes)	450000	250000	2.25
Poultry farming	1.5 kg/bird (80 Rs/ bird)	1200000 (for 20000 birds)	1600000	400000	1.33
Mushroom	3 kg/bag (160 Rs/kg)	20000 (for 200 bag of 10 kg wt.)	96000	76000	4.8
Green gram	450(60 Rs/kg)	49400	66690	17290	1.35
Cauliflower	15000(10 Rs/kg)	74100	370500	296400	5
Carrot	8000 (6 Rs/kg)	74100	118560	44460	1.6
Pig farming	200 kg/pig (180 Rs/kg)	300000 (20 pig)	720000	420000	2.4
Ber cultivation	30000 (10 Rs/kg)	123500	741000 (2 years after planting)	617500	6

*Rs. /ha unit accounted only for field crops and horticultural crops

Table 3a: Benefit:Cost ratio of different farm enterprises in Hisar district

Enterprises	Farming system among non-diversified farmers*			
	Productivity (kg/ac)	Cost of cultivation (Rs. /ha)	Gross income (Rs. /ha)	Net income (Rs. /ha)
Cotton	1000	74100	135850	61750
Sorghum	1200	49400	62244	12844
Rice	2000	61750	103246	41496
Wheat	2500	49400	117325	67925
Mustard	1300	24700	176605	151905
Potato	7500	74100	185250	111150
Dairy	7L/buffalo/day	60000/buffalo/year	73500/buffalo/year	13500/buffalo/year

*Rs. /ha unit accounted only for field crops and horticultural crops

Table 3b: Benefit:Cost ratio of different farm enterprises in Hisar district

Enterprises	Farming system among diversified farmers*				
	Productivity (kg/ac)or L/day	Cost of cultivation (Rs. /ha)	Gross income (Rs. /ha)	Net income (Rs. /ha)	B:C ratio
Cotton	1000	74100	135850	61750	1.83
Sorghum	1200	49400	62244	12844	1.26
Rice	2200	61750	103246	41496	1.67
Wheat	2500	49400	117325	67925	2.37
Mustard	1300	24700	176605	151905	7.15
Potato	7500	74100	185250	111150	2.5
Dairy	7L/buffalo/day	60000/buffalo/year	73500/buffalo/year	13500/buffalo/year	1.23
Sheep farming	20 kg (3500 Rs./lamb)	25000 (for 25 ewes)	95000 (second year onwards)	70000	3.8
Guava plantation	6500 (8 Rs/kg)	86450	128440 (after two years of planting)	41990	1.46
Ber	27500 (10 Rs/kg)	123500	679250 (2 years after planting)	555750	5.5
Poultry farming	1.5 kg/bird (75 Rs/bird)	1200000 (for 20000 birds)	1500000	300000	1.25
Fish farming	4750 kg/ha (100 Rs/kg)	300000 (1 ac)	475000 (1 ac)	175000	1.58
Green gram	500 (60 Rs/kg)	49400	74100	24700	1.5
Cauliflower	14000 (8 Rs /kg)	74100	276640	202540	3.73
Carrot	7500 (6 Rs/kg)	74100	111150	37050	1.5

*Rs. /ha unit accounted only for field crops and horticultural crops

the highest BC ratio of 6 and 5 respectively. In Hisar district, the Benefit-Cost ratio ranges between 1.25 and 5.5 with sheep farming (3.2), fish farming (1.58), poultry farming (1.25), green gram (1.5), guava (1.46) and carrot (1.5). Ber and cauliflower had the highest BC ratio 5.5 and 3.73, respectively. No respondents had adopted piggery, mushroom and kinnow enterprises in Hisar district which could be due to prevailing culture, preference and climate. In Bhiwani district, the Benefit-Cost ratio ranges between 1.2 and 5 with sheep farming (3.8), fish farming (1.42), poultry farming (1.13), piggery (2.66), green gram (1.2), guava (1.37), carrot (1.4) and kinnow (2). Ber had the highest BC ratio of 5. In the surveyed localities of Bhiwani, none

Table 4a: Benefit:Cost ratio of different farm enterprises in Bhiwani district

Enterprises	Farming system among non-diversified farmers*			
	Productivity (kg/ac)	**Cost of cultivation (Rs. /ha)**	**Gross income (Rs. /ha)**	**Net income (Rs. /ha)**
Cotton	1000	74100	135850	61750
Sorghum	1200	49400	62244	12844
Pearl millet	1200	49400	62244	12844
Rice	2000	61750	93860	32110
Wheat	2500	49400	117325	67925
Mustard	1000	24700	135850	111150
Potato	7500	74100	185250	111150
Dairy	8L/buffalo/day	60000/buffalo/year	84000/buffalo/year	14000/buffalo/year

*Rs. /ha unit accounted only for field crops and horticultural crops

Table 4b: Benefit -Cost ratio of different farm enterprises in Bhiwani district

Enterprises	Farming system among diversified farmers*				
	Productivity (kg/ac)or L/day	**Cost of cultivation (Rs. /ha)**	**Gross income (Rs. /ha)**	**Net income (Rs. /ha)**	**B:C ratio**
Cotton	1000 kg (55 Rs/kg)	74100	135850	61750	1.83
Sorghum	1200 kg (21 Rs/kg)	49400	62244	12844	1.26
Pearl millet	1200 kg (21 Rs/kg)	49400	62244	12844	1.26
Rice	2000 kg (19 Rs/kg)	61750	93860	32110	1.52
Wheat	2500 kg (19 Rs/kg)	49400	117325	67925	2.37
Mustard	1000 kg (55 Rs/kg)	24700	135850	111150	5.50
Potato	7500 kg (10 Rs/kg)	74100	185250	111150	2.5
Dairy	8L/buffalo/day (35 Rs. /L)	60000/buffalo /year	84000/buffalo /year	14000/buffalo /year	1.4
Sheep farming	20 kg (3200 Rs/lamb)	25000 (for 25 ewes)	80000 (second year onwards)	58000	3.2
Guava plantation	6000 (8 Rs/kg)	86450	118560 (after 2 years of planting)	32110	1.37
Kinnow	8000 (10 Rs./kg)	98800	197600 (after 4 year of planting)	98800	2
Poultry farming	1.5 kg/bird (70 Rs/ bird)	1200000 (for 20000 birds)	1350000	150000	1.125
Fish farming	4500 kg/ha (100 Rs/kg)	300000 (1 ha)	450000 (1 ha)	150000	1.42
Green gram	400 (60 Rs/kg)	49400	59280	9880	1.2
Cauliflower	13000(6 Rs/kg)	74100	192660	118560	2.6
Carrot	7000 (6 Rs/kg)	74100	103740	29640	1.4
Pig farming	200 kg/pig (200 Rs/kg)	300000(20 pig)	800000	500000	2.66
Ber cultivation	25000 (10 Rs/kg)	123500	617500 (2 years after planting)	49400	5

*Rs. /ha unit accounted only for field crops and horticultural crops

of the respondent had adopted apiary and mushroom enterprises. This warrants aggressive campaign to motivate both the farmers and consumers through appropriate mix of extension techniques.

In comparison of efficiency of farm diversification among the three agro-ecoregions, Kaithal reported the highest diversification efficiency of 2.46 followed by Bhiwani (1.88) and then by Hisar (1.64). Highest efficiency of Kaithal district might be due to nearness to NCR, rainfed areas, progressive farmers and facilities like all - weather road, transportation and marketing *etc.* The canal irrigation also plays a critical role in obtaining better farm efficiency in Kaithal district. Hisar and Bhiwani districts faced issues in terms of shortage of marketing facilities, larger proportion of dry areas, less inclination of farmers towards diversified farming, inadequate transportation facilities in comparison to Kaithal district.

In this study, the enterprises which reported higher BC ratio (>2) were sheep (3-3.8), piggery (2.4-2.66), apiary (2.55), mushroom (4.8), ber (5-6), cauliflower (2.6-5). Ber, which reported the highest BC ratio among all enterprises, is receiving special attention of the horticulture department of the state government. Ber is a dryland crop that requires few inputs to be grown. In the five districts of Hisar, Jind, Gurgaon, Kaithal and Sirsa, the state government has established eight exclusive ber nurseries (Business Standard 2013).

An integrated strategy to livestock production would be a better alternative to meet the demands of the nation's ever-growing population and nutritional security. In this perspective, pig farming can be an important component. Pig, together with broiler, is the most promising source of meat producers and efficient feed converters, as it can use a wide range of feed stuffs, including grains, forages, broken feeds and waste and convert them into useful nutritious meat. However, the sluggish growth of indigenous pigs, religious taboos, lack of knowledge among farmers and limited infrastructure make it difficult to pursue this farming on a commercial scale. Although Haryana is more important for piggery enterprises because of its proximity to the Delhi market, this enterprise, like other livestock operations in the state, has not gained widespread acceptance due to a lack of understanding about its production parameters/economic feasibility. As a result, government efforts should be increased to offer momentum to the enterprise (Sahu *et al.,* 2018).

In view of its ecological services bee keeping should be an ideal component of farm diversification as it also contributes additional income to farmers. Different cropping patterns due to different soil types, irrigation facilities, temperature, relative humidity and

Table 5: Comparison of efficiency farm diversification across three districts of Haryana

Farm enterprises	Kaithal (n=40)		Hisar (n=40)		Bhiwani (n=40)		Total (n=120)	
	No. of adopted respondents	BC ratio	No. of adopted respondents	BC ratio	No. of adopted respondents	BC ratio	No. of adopted respondents	BC ratio
Sheep	2	3	3	3.2	7	3.8	12	3.35
Fish	0		3	1.58	1	1.42	4	1.5
Poultry	1	1.33	3	1.25	3	1.13	7	1.24
Piggery	2	2.4	0		4	2.66	6	2.53
Apiary	5	2.25	0		0		5	2.25
Mushroom	5	4.8	0		0		5	4.8
Green gram	10	1.35	5	1.5	3	1.2	18	1.35
Guava	2	1.75	7	1.46	4	1.37	13	1.53
Ber	4	6	4	5.5	2	5	10	5.5
Kinnow	0		0		4	2	4	2
Cauliflower	12	5	9	3.73	8	2.6	29	3.78
Carrot	8	1.6	6	1.5	4	1.4	18	1.5
Average/efficiency		2.46		1.64		1.88		2.61

the prevailing agro-climatic conditions in Haryana are particularly conducive for Apis mellifera beekeeping. It can be preferred by farmers due to its lower investment and labour requirement. The trade centre, which will be established in Kurukshetra, will combine over 5,000 beekeepers from across the state, assisting them with marketing and sales of other agricultural products. The IBDC centre in Ramnagar, Kurukshetra district, has established a small honey processing (capacity of 2 MT, eight hours) and bottling (180 bottles/hour) unit, high quality beehive manufacturing unit (8,000-10,000 beehives per year), high quality comb foundation manufacturing unit (540 sheets/hour), quality control lab, a bee diseases and diagnostic lab, value addition lab, an Apiary of Apis mellifera to multiply nucleus bee colonies and human resource development activities. Lack of insurance coverage with respect to bees and bee boxes, indiscriminate use of pesticides, problems during migration of honey bee colonies, harmful radiations from mobile towers, less awareness about Government support, are found to be the major limiting factors in pursuing beekeeping (Singh, 2022).

Farmers were offered with mushroom cultivation training as part of the National Horticulture Mission's Mushroom Production Program. Farmers are getting subsidised inputs (pasteurised compost and mushroom spawn) from the Horticulture Department. Under a public-private partnership (PPP), CCS Haryana Agriculture University has established a compost spawn and mushroom production centre on its campus (Deswal, 2018). The HAIC Agro Research & Development Center has established a Mushroom Research & Development Project in Murthal (Sonepat) in Haryana. This project aims to carry out agro-based projects that are directly beneficial to Haryana's farmers and entrepreneurs (HAIC, 2022).

Poultry appears to be a new way of life and livelihood. As landholdings in Haryana decline due to increased residential colonies and industry, it has secured good returns and appropriate use of wasteland. Due to the inadequate hygienic conditions maintained by the poultry farmers, it suffers from fly menace, odour, and pollution. The state is attempting to alleviate the litter problem by generating power from hen droppings. The Central Poultry Development Organisation (CPDO), Northern Region, which is headquartered at Chandigarh also supports poultry development in the state (Singh, 2019). The state has four government poultry farms, one each in Ambala, Rohtak, Bhiwani, and Hisar.

The other major enterprise which contributes to the net incremental benefit is Fisheries. Farmers in the state of Haryana have started making more profit by delving into shrimp aquaculture, in places which was often left barren due to the rise in salt water level. Pradhan Mantri Matsya Sampada Yojana of the Department of Fisheries, which is proving to be very beneficial for the fish farmers.

Horticulture also contributes to total income remarkably. Haryana's farmers have an advantage over those in other states due to their proximity to Delhi, where there is a significant demand for fruits, vegetables, and flowers, while also catering to the local market. A Center of Excellence for Vegetables as part of Indo-Israel Agriculture Project was established in Karnal to boost up the horticulture sector in Haryana. Despite the Haryana government's assistance and endorsement, the promotion and development of protected horticulture is lacking (Sirohi *et al.*, 2002). In Haryana, post-harvest losses range from 3 to 18 percent, with only 2 per cent of fruits and vegetables processed. The value of commodities can be raised by converting them to various products using traditional or modern processing techniques, consequently increasing the storage life of the produce (Kumar *et al.*, 2016).

Sheep are maintained under the extensive system of natural vegetation on degraded common grazing lands and which generates substantial employment. Schemes exist in Haryana for establishing their infrastructure (Scheme for providing employment opportunities by establishment of piggery, sheep and goat unit 2021-22, Animal husbandry and Dairying department, Government of Haryana). The foundation stock of sheep is relatively cheap and the flock can be multiplied rapidly. The central sheep breeding farm located at Hisar provides technical support to sheep farmers.

In the state, there is a well-connected infrastructure of veterinary institutions that serve to the needs of livestock owners by offering veterinary and breeding services. Furthermore, self-sufficiency in fodder

production and proximity to the National Capital Region with extensive marketing prospects make animal husbandry operations an appealing choice for self-employment to the state's unemployed.

CONCLUSION

In this study, enterprises which have shown higher BC ratio (>2) are sheep (3-3.8), piggery (2.4-2.66), apiary (2.55), mushroom (4.8), ber (5-6) and cauliflower (2.6-5). Kaithal district reported the highest farm diversification efficiency of 2.46 followed by Bhiwani (1.88) and then by Hisar (1.64). Availability of fertile soil, increased area under irrigation, better marketing and transportation facility were the major reasons for Kaithal to score the highest Benefit Cost ratio compared to Hisar and Bhiwani. As poultry, piggery, fishery, apiary, mushroom, ber, cauliflower and sheep farming were found to generate substantial income and also suitable for farm diversification, designing need centric extension interventions with adequate incentive structures would accelerate the adoption of these enterprises at farm level. Grass root extension machinery should be strengthened to sustain the development perspective among the farmers. Capacity building along with demonstration will make them aware about the necessity and scope of diversification.

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Research Article

Exploring the Factors Influencing Occupational choices of Rural Rajbanshi Youth from Dairy Farm Families

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ABSTRACT

Agriculture not only provides economic security but also contributes to the overall development of the country. However, it has been losing its appeal as a career choice. Youths are an important part of rural society, vital to agriculture and rural development can play an important role in revitalizing it. Therefore, a study was conducted in the year 2022 in Cooch Behar to identify the factors influencing the occupational choices of rural Rajbanshi youths of dairy farm families. Cooch Behar district has a majority population of the Rajbanshi community in West Bengal. Four blocks were selected randomly with a sample size of 200 respondents. Using the Participatory Rural Appraisal (PRA) technique, seven factors were identified that influence their occupational choices. The Paired Comparison Technique was used to prioritize these factors based on the respondents' preferences. Education level and financial remuneration were the most influential factors, while land availability was perceived to be the least influential.

Keywords: Dairy farming, Occupational choices, Paired comparison, Rajbanshi, Youths

INTRODUCTION

Agriculture is currently facing several issues that are driving farmers away from farming (Nag *et al.*, 2018). Due to several risk factors, this sector has not been financially rewarding in recent decades (Hari *et al.*, 2013) as a result people are not interested in farming-based enterprises (Kumar *et al.*, 2022). To revitalise Indian agriculture, a shift from agriculture to agribusiness is required (Ray *et al.*, 2021), and the youth population can play an important role in this. India is a country with the highest youth population. Youths are an important segment of rural society as they play a significant role in rural development (Chinchmalatpure and Tekale, 2019), however, they are less interested in farming activities (Sharma, 2007) because it has been considered a backward sector (Chaudhary *et al.*, 2015).

Despite numerous challenges, agriculture has been and continues to be the single most important source of income for the rural masses of West Bengal. Villages and rural areas are home to approximately 68.13 percent of the state's total population (Census, 2011). It is home to a variety of ethnic groups and backward communities whose traditional occupation has been agriculture since ancient times. '*Rajbanshi*' literally means "royal community", which is an indigenous ethnic group belonging to the Scheduled Caste. This community is majorly found in North Bengal, Assam, Arunachal Pradesh, Meghalaya, and various North-Eastern parts of India. Like others, the Rajbanshi youth faces various challenges in their personal lives. The problem of unemployment has become a complex issue for them. Many Rajbanshi youth were compelled to move out to other states in search of jobs (Chowdhury *et al.*, 2017). During the nationwide lockdowns, many people who had left their villages to find jobs in cities had to return due to difficult circumstances. This led to a critical situation called "reverse migration." As a result, many of these workers got involved in agriculture and related activities in their villages. Therefore, it was vital to

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understand the factors which affect the occupational choices of rural Rajbanshi youths to gain a better understanding of their lives and the decisions they make regarding their livelihoods.

For shaping a career, it is necessary to go through a good career choice process (Ray *et al.,* 2020). Occupational choices are the selection of a particular career path by an individual. It can have a significant impact on one's future, as it determines the kind of work, they perform, their income level, and overall quality of life. Almost every person would therefore face the occupational choice challenge at some point in their lives (Sharif *et al*., 2019). Before choosing an occupation is influenced by various aspects (Kazi *et al*., 2017) such as the context in which they live, their personal aptitudes, and their educational attainment (Bandura *et al*., 2001; Watson *et al*., 2010). The present study pertains to the objective of finding out the most important factors influencing the occupational choices of rural Rajbanshi youth belonging to dairy farm families in the Cooch Behar district of West Bengal. The findings of this study can have significant implications for stakeholders involved in the development of the agriculture sector and youth employment in rural areas.

MATERIALS AND METHODS

The study was conducted in the year 2022 in the Cooch Behar district of West Bengal. The study used multistage random sampling. West Bengal was chosen purposefully due to 2nd highest SC population in the country. Cooch Behar district was chosen as it has the majority of Rajbanshi people. Two subdivisions (Cooch Behar Sadar and Dinhata) and four blocks (Cooch Behar I, Cooch Behar II, Dinhata I, and Dinhata II) were selected using random sampling techniques. The respondents were between the age group of 15-29 (NYP, 2014) with at least 50 per cent income from dairy farming. Thus, a sample of 200 youths, with 50 from 4 blocks were the respondents of the study. Seven factors were identified using the Participatory Rural Appraisal (PRA) technique. The factors were-Education level (A), Financial remuneration (B), Skills and abilities (C), Personal interest (D), Status expectation and Prestige (E), Influence of the family member (F) and Land availability (G). Paired comparison technique (Edward, 1969) was followed to arrange the hierarchy of different factors pertaining to occupational choices by the Rajbanshi youth. The 7 factors were presented to the respondents in n(n-1)/2 i.e., 21 pairs in all possible combinations. They were asked to select one stimulus over the other from each pair which is judged as a more important factor. The steps involved in the process were as follows:

i. Construction of F-matrix (Frequency of factor preference)

ii. Construction of P-matrix (dividing the cell entries of the F-matrix by 200)

iii. Construction of rearranged P-matrix (Factors ranked by ascending column sum from left to right)

iv. Construction of Z-matrix (Sum of all the columns divided by 7)

v. Checking the internal consistency (Computing the Absolute average Discrepancy)

$$AD = \frac{\sum |Pij - Pij'|}{\frac{n(n-1)}{2}}$$

Where, Pij = Empirical proportions

Pij' = Expected proportions

n = number of stimuli

RESULTS AND DISCUSSION

Internal consistency presents the comparison of empirical (P_{ij}) and expected proportion ($P_{ij'}$). The calculated discrepancy between the empirical and corresponding theoretical proportion was 1.041.

$$AD = \frac{\sum |Pij - Pij'|}{\frac{n(n-1)}{2}} = \frac{1.041}{21} = 0.0496$$

Where, P_{ij}-$P_{ij'}$=1.041

n(n-1)/2 = 21

As the computed average absolute discrepancy (AD) value is quite low i.e., 0.0496, which interprets the scale to be internally consistent. It may be concluded that the responses given by the respondents on the different pairs of factors affecting their occupational choices were highly consistent and dependable.

The hierarchical arrangement of factors that determine the occupational choices of rural Rajbanshi youth provides a comprehensible indication of their

Table 1: F-matrix of seven factors affecting the occupational choices

Factors	Education level (A)	Financial remune-ration (B)	Skills and abilities (C)	Personal interest (D)	Status expectation and Prestige in society (E)	Influence of the family member (F)	Land availa-bility (G)
Education level (A)	0	78	70	53	52	57	57
Financial remuneration (B)	122	0	76	77	69	72	45
Skills and abilities (C)	130	124	0	79	88	158	51
Personal interest (D)	147	123	121	0	96	117	77
Status expectation and Prestige in society (E)	148	131	112	104	0	129	71
Influence of the family member (F)	143	128	42	83	71	0	55
Land availability (G)	143	155	149	123	129	145	0

Table 2: P-matrix corresponding to F-matrix

Factors	Education level (A)	Financial remune-ration (B)	Skills and abilities (C)	Personal interest (D)	Status expectation and prestige in society (E)	Influence of the family member (F)	Land availa-bility (G)
Education level (A)	0.5	0.39	0.35	0.265	0.26	0.285	0.285
Financial remuneration (B)	0.61	0.5	0.38	0.385	0.345	0.36	0.225
Skills and abilities (C)	0.65	0.62	0.5	0.395	0.44	0.79	0.255
Personal interest (D)	0.735	0.615	0.605	0.5	0.48	0.585	0.385
Status expectation and Prestige in society (E)	0.74	0.655	0.56	0.52	0.5	0.645	0.355
Influence of the family member (F)	0.715	0.64	0.21	0.415	0.355	0.5	0.275
Land availability (G)	0.715	0.775	0.745	0.615	0.645	0.725	0.5
Sum	4.665	4.195	3.35	3.095	3.025	3.89	2.28

Table 3: Rearranged P-matrix: smallest to highest column sum

Factors	Land availa-bility (G)	Status expectation & prestige in society (E)	Personal interest (D)	Skills and abilities (C)	Influence of the family member (F)	Financial remun-eration (B)	Education level (A)
Land availability (G)	0.5	0.645	0.615	0.745	0.725	0.775	0.715
Status expectation and prestige in society (E)	0.355	0.5	0.52	0.56	0.645	0.655	0.74
Personal interest (D)	0.385	0.48	0.5	0.605	0.585	0.615	0.735
Skills and abilities (C)	0.255	0.44	0.395	0.5	0.79	0.62	0.65
Influence of the family member (F)	0.275	0.355	0.415	0.21	0.5	0.64	0.715
Financial remuneration (B)	0.225	0.345	0.385	0.38	0.36	0.5	0.61
Education level (A)	0.285	0.26	0.265	0.35	0.285	0.39	0.5
Sum	2.28	3.025	3.095	3.35	3.89	4.195	4.665

Table 4: Z-matrix: Scale value of seven factors

Factors	Land availability (G)	Influence of the family member (E)	Status expectation and prestige in society (D)	Personal interest (C)	Financial remun-eration (B)	Skills and abilities (F)	Education level (A)
Land availability (G)	0	0.372	0.292	0.659	0.598	0.755	0.568
Influence of the family member (E)	-0.372	0	0.05	0.151	0.372	0.399	0.633
Status expectation and Prestige in society (D)	-0.292	-0.05	0	0.266	0.215	0.292	0.628
Personal interest (C)	-0.659	-0.151	-0.266	0	0.806	0.305	0.385
Financial remuneration (B)	-0.598	-0.372	-0.215	-0.806	0	0.358	0.568
Skills and abilities (F)	-0.755	-0.399	-0.292	-0.305	-0.358	0	0.279
Education level (A)	-0.568	-0.643	-0.628	-0.385	-0.568	-0.279	0
Sum	-3.244	-1.243	-1.059	-0.42	1.065	1.83	3.061
Average	-0.463	-0.178	-0.151	-0.06	0.152	0.261	0.437
Add largest negative deviation (+0.463)							
Scale value	0	0.286	0.312	0.403	0.616	0.725	0.901

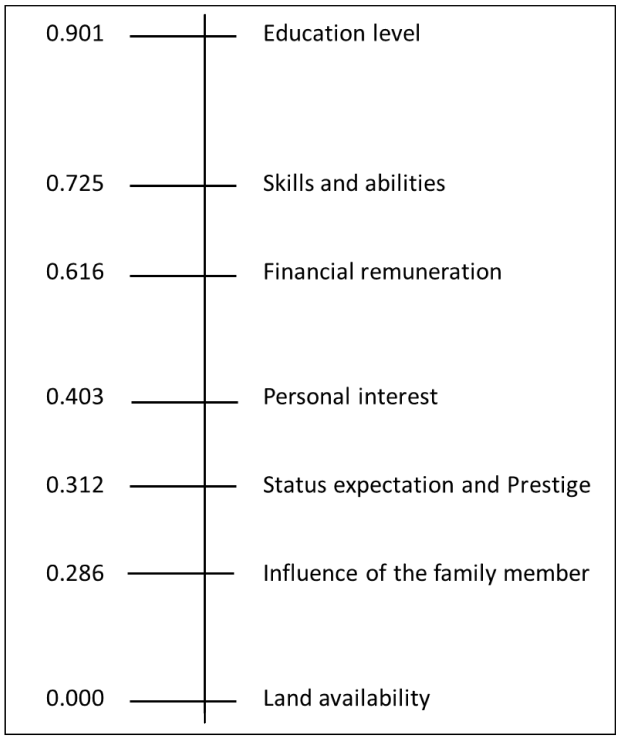

Figure 1: Hierarchy of the factors affecting the occupational choices

respective levels of significance. The scale value in the hierarchy (Figure 1) of the factors depicts that among the seven factors considered, the most influential was the education level of the youth, followed by skills and abilities, financial remuneration, personal interest, status expectation and prestige, influence of the family and land availability.

Among the seven factors, 'education level' was the most important factor (scale value 0.901) perceived by the respondents. The education level of a person is the highest degree of formal education achieved which is capable to impact career opportunities. It was observed that the Rajbanshi youth with higher education tend to have higher-level jobs, which may be a reason for their reluctance towards dairy farming.

The second factor perceived was 'skills and abilities' (scale value 0.725). It was often seen that if a youth had skills and abilities in a particular field, they are inclined to pursue that field as an occupation. The importance of skills and abilities cannot be underestimated in the dairy farming industry. According to Nyamwange (2016) a specialization is required at a workplace to be selected for a desired occupation.

'Financial remuneration' was the third important factor (scale value 0.616) affecting the occupational choice of the rural Rajbanshi youth as perceived by them. Financial remuneration means the monetary compensation received in exchange for work or services rendered. Financial security plays a crucial role in occupational choices, and youth often prefer

occupations with higher financial remuneration. Rural youth are more fascinated by urban life and are reluctant to seek jobs in the agricultural and allied sectors.

'Personal interest' was perceived as the fourth factor (scale value 0.403). One often prefers to work in a field that aligns with their interests and allows one to pursue their passions, but the Rajbanshi youths were unable to find a job that aligns with their personal interests. This might be the reason to be ranked 'Personal interest' as fifth being an important factor.

'Status expectations and prestige' in any society hold responsible for the choice of a suitable job for the youth. The factor has less influence (scale value 0.312) on the occupational choices of Rajbanshi youth as compared to the above-mentioned factors. Status expectation and prestige are the social and cultural factors shaping an individual's perception of the value, importance, and respect associated with certain careers, occupations, and educational achievements. According to Bhattacharya (2013), in the modern and fast-changing world, youths seek a career that ultimately leads them towards good status in their society.

The sixth important factor perceived was 'influence of the family members' (scale value 0.286). This can range from direct encouragement to support for a particular career path. Some Rajbanshi youth may be unwilling to pursue a career in this field due to the influence of family members. A study conducted by Rani (2014) explored the impact of parenting style on career choice and revealed that parents play a key role in career development. So, changing the mindset of parents can have a significant impact on the career choices and development of individuals interested in dairy farming. The seventh and least important factor affected the occupational choices of the Rajbanshi youth was 'land availability' (Scale value 0.000). Land availability can have an impact on career choices, as the availability of land an affect the types of job opportunities that exist in a particular area. Singh *et al.* (2015) observed that there was a non-significant correlation between land holding and participation in agriculture and dairy farming.

CONCLUSION

The findings suggest that education level and financial remuneration were the two most significant factors affecting the occupational choices of rural Rajbanshi youth. However, the influence of family members, skills and abilities, personal interest, status expectations and prestige also had some impact on the occupational choices of the youth. Farming gives young people the chance to interact with the environment and develop their social skills. To involve these youth in dairy farming, it is essential to provide them with adequate education and training in the field of agriculture and dairy farming. Moreover, emphasizing the financial benefits and incentives associated with dairy farming could also encourage them to pursue this occupation. Additionally, creating awareness programs about the importance of dairy farming in the community and promoting it as a lucrative and respectable profession could positively influence the youth's perception of dairy farming as a viable career option. Suitable Government policies can provide support and assistance to rural farmers could incentivize the youth to pursue dairy farming.

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Research Article

Knowledge Scale to Define Students 'Knowledge About Environment, Recycling, Plastic, and Plastic Waste'

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ABSTRACT

The environment is becoming a widely debated topic in our everyday lives. All life on Earth is linked with its surroundings, from the tiniest microbes to the greatest creatures. Humans are part of nature, and their survival is dependent on healthy ecosystems. At the same time, human activities harm the health of the environment for current and future generations as a result of pollution, climate change, and disasters. The present study was carried out in Uttarakhand at Udham Singh Nagar district. Purposive and random sampling technique was done based on convenience and availability and 30 students were selected. point-biserial correlation coefficient used as a index of item discrimination. The reliability of the test was calculated by the Spearman-Brown formula. The reliability coefficient of the scale was 0.841 found to be highly significant.

Keywords: Environment, Disasters, Microbes

INTRODUCTION

The environment is becoming a widely debated topic in our everyday lives. All life on Earth is linked with its surroundings, from the tiniest microbes to the greatest creatures. Humans are part of nature, and their survival is dependent on healthy ecosystems. At the same time, human activities harm the health of the environment for current and future generations as a result of pollution, climate change, and disasters. Over the last few decades, scientific advancements and growing environmental concerns have raised public awareness of environmental issues (Decamps, 2000; Thapa, 2001).

Plastic items have been ingrained in our everyday lives, and as a result, the polymer is mass-produced on a vast scale across the world. Plastic is produced more than 150 million tonnes per year on average across the world. Packaging films, wrapping materials, shopping, and rubbish bags, fluid containers, clothes, toys, home, and industrial items, and construction all use it. When plastic is burned, it emits a variety of toxic compounds, including dioxin, the most deadly molecule known to science. Apart from these issues, research done by the Public Interest Research Group in Delhi, India, found that plastic recycling is highly hazardous, uneconomical, dirty, and labor-intensive. Plastic recycling causes skin and respiratory issues as a result of exposure to and inhalation of hazardous vapors, including hydrocarbons and residues generated during the manufacturing process of plastics. Worse, recycled plastic declines in quality, necessitating the use of additional new plastic to recreate the original product (Kumar, 2005).

Approximately 70 per cent of plastic packaging items are projected to be turned into plastic garbage in a short period. In the country, 9.4 million TPA of plastic trash is produced, equating to 26,000 TPD2. About 60 per cent of this gets recycled, with the informal sector accounting for the majority of it. Even though India's recycling rate is far better than the worldwide average of 20 per cent, approximately 9,400 tonnes of plastic trash is still landfilled or contaminating streams and groundwater resources. Some plastics do not degrade at all, while others might take up to 450 years to decompose. Plastic pollution is one of the

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most important aspects of today's environmental concerns to the outside world, as well as a possible threat. Toxic plastic pollutes the whole ecosystem, kills wild creatures, poisons seafood and the seabed offers significant health risks, and may even contribute to global warming. It's also possible that it'll create new species that aren't suitable for living organisms on the ground. In these conditions, plastic pollution is a major problem that deserves additional investigation (Hossain, 2008).

Environmental education is one of the most powerful techniques for changing public perceptions, knowledge, and attitudes towards the environment. Because schools and colleges educate young generations who are anticipated to be future leaders in a variety of fields and decision-makers, schools play a critical role in environmental education for the general public. If students develop good attitudes about the environment as a result of their education, they will take an active role in saving the environment and its resources, preserving them for future generations. Individuals with a good attitude toward the environment have positive thoughts, attitudes, and actions regarding the activities of living beings in their daily lives (Turkum, 1998).

REVIEW OF LITERATURE

Abin Peter (2012) conducted a study to determine the effectiveness of peer-mediated teaching on school children's knowledge of the dangers of plastic use at a selected school in Salem. Pre-test knowledge of the hazards of plastic use revealed that a comparable number of children (30%) had inadequate information, somewhat adequate knowledge, and none had adequate knowledge. During the post-test, 100% of the students demonstrated appropriate knowledge. Overall, the pre-test knowledge was 7.11+0.99, or 31.3 per cent, and the post-test mean score was 18.35+0.04, or 83.4 percent, indicating a 51.09 per cent difference. At the $P \leq 0.001$ level ($t=33.58^{**}$), there was a highly significant difference between pre and post-test scores of the level of knowledge in all categories and overall level of knowledge.

A study was conducted on knowledge and attitudes, as well as an operation on the topic of hazardous environment among informal educational pupils (grades 5-8) in the Educational Region No. 5. It was discovered that pupils have a firm knowledge of pollution and a positive attitude. While knowledge and attitude vs. attitude and environmental operation are closely connected. It was discovered that there was a substantial disparity between the environment and the problem of pollution of natural resources among pupils in upper secondary school (Siriporn Hongpan, 1984).

Jintana Lert-tawesin (1984) conducted a study on traffic cops' knowledge and awareness of the dangers of air and sound pollution in Bangkok. It was discovered that traffic cops are highly knowledgeable about pollution. The environmental awareness of traffic cops of various ages and levels of education would vary. The traffic cops are fully aware of the dangers of air and sound pollution. Regardless of their age, rank, or experience, traffic cops are acutely conscious of air and sound pollution.

A study was conducted to assess the knowledge, attitude, and practices of students regarding plastic waste management. Karimnagar town (Andhra Pradesh) has a population of 5.2 lacks. It has 267 students in the community. Out of 267 students, 47 were selected by systematic random sampling. A total of 500 study subjects were selected from these communities and the data were collected by one-to-one interviews using pre-tested pre-designed proforma. The result of this study is 30 per cent of students dispose of the plastic properly. Others need proper health education regarding plastic disposal (Krishna, 2000).

A descriptive study about the hazards of plastics to the marine environment was conducted in South America and the findings (90%) reveal that marine life is at the peak of destruction due to the tons of plastics that are thrown as wastes into the seas (Kurdi, 2006).

Cross-sectional research was conducted at one of Wardha's senior secondary schools. A random sample of students was taken, and it was shown that 37.89 per cent of them were aware of Wardha's ban on plastic bags. Students (35.79%) were aware of the penalty for using plastic bags. The school was the most common source of knowledge (83.15%), followed by television and radio (80%), and parents (24.21%). Students (65.26%) agreed to a ban on the use of plastic

bags, while 69.48 percent agreed to organize a campaign to raise awareness about the negative effects of plastics in everyday life (Khanam *et al.*, 2019).

The research comprised 563 students enrolled in professional courses. A questionnaire was used to measure their knowledge in terms of general aspects, negative consequences, and reuse of plastics 46 percent of students were assessed to be knowledgeable. Although the students have a strong understanding of the negative consequences of plastics (Srinivasan *et al.,* 2019).

MATERIALS AND METHODS

The objective of the study is to develop a scale and measure knowledge assessment of students towards the environment, recycling, plastic and plastic waste. The methodology adopted to reach the objectives of the study is discussed in the following heads.

Selection of the locale, sample design, and sample size: The present study was carried out in Uttarakhand at Udham Singh Nagar district Purposive and random sampling technique was done based on convenience and availability and 30 students were selected.

Item construction: Listing of items on the environment, recycling, plastic, and plastic waste was done using primary and secondary sources of information. A total of 62 items were developed.

Validity: The content validity of the measuring instrument was examined with the assistance of ten experts from the Department of Family Resource Management, who were asked to rate the clarity of the scale's items (i.e. 62). There were four categories on the score sheet: clear, ambiguous, correct, and incorrect. Items that received 80 percent or more of the judges' approval as clear and correct were kept, while others were eliminated. Following an expert review of the content validity, a total of 40 items were determined to be clear and correct, while the other items were judged to be ambiguous and incorrect and were eliminated.

Item analysis: The preliminary test containing 40 knowledge items (Table 1) was administered to 33 students of Udham Singh Nagar (Uttarakhand). For this purpose, the score of one was assigned to the correct response and zero to each incorrect response.

Table 1: Item discrimination index range

Index range	Discrimination level
0.19 and below	Poor item, Item should be eliminated or needed to be revised.
0.20 -0.29	Marginal item, needs some revision
0.30-0.39	Reasonably good item but possibly for improvement
0.40 and above	Very good item

Final selection of items: One objective criterion namely point biserial correlation was considered for the final selection of items in the knowledge scale.

Point biserial correlation coefficient: For establishing the internal consistency of each item, the point biserial correlation coefficient (rpbi) was estimated. The formula of point bierial correlation is as follows:

$$\text{rpbi} = \frac{Mp - Mq}{St}\sqrt{\text{pq}}$$

Where, rpbi = Point-biserial correlation coefficient, Mp = whole-test mean for students answering the item correctly (i.e., those coded as 1s), Mq = whole-test mean for students answering item incorrectly (i.e., those coded as 0s), St = Standard deviation for the whole test, p = proportion of students answering correctly (i.e., those coded as 1s), q = proportion of students answering incorrectly (i.e., those coded as 0s). The item with rpbi value equal to more than 0.4 was considered for the selection in the final knowledge test given in Table 1. Finally, 13 items were selected in the knowledge scale by considering the objective criteria as stated above.

Reliability: The reliability of the knowledge test was determined by the following method:

Split-half method: The final knowledge scale was administered to a sample of 33 students of the Udham Singh Nagar district. Thereafter, the scale was divided into two halves. The reliability of the test was calculated by the Spearman-Brown formula. The reliability coefficient of the scale was 0.841 found to be highly significant.

$$R = \frac{2\text{r}}{1 + r}$$

Where R= reliability coefficient of the scale and r= the correlation between two halves of the scale.

Table 2: Item analysis of statements selected for testing knowledge about the environment, recycling, plastic, and plastic waste

Items	Point biserial correlation coefficient	S= Item selected/ R= Item rejected
World Environment Day was first celebrated with the slogan "only one earth."	0.049	R
The 5th of June has been celebrated as World Environment Day.	0.37	S
"Ecosystem restoration" is the theme of World Environment Day 2021.	0.44	S
Nitrogen oxide, sulphur dioxide, nitrogen dioxide are the main constituent of acid rain	0.13	R
CO_2 is mainly responsible for the greenhouse effect	-0.18	R
Refrigerators are the main source of CFC gas	0.63	S
Chlorine is responsible for turning Taj Mahal yellow	0.095	R
SMOG is derived from smoke and fog	-0.06	R
The logo and symbol of WWF (Worldwide Fund for Nature) is Giant Panda	0.62	S
Re-processing material to make another product is called recycle	0.01	R
The international recycling logo consists of three chasing arrows	0.44	S
Recycling is the only way that decreases the amount of waste	0.22	R
Recycled paper banned for use in food containers	0.18	R
Aluminum cans can be recycled	0.05	R
Cardboard boxes can be recycled plastic bags can be recycled	0.11	R
Plastic bags can be recycled	0.34	R
Cartons can be recycled	0.65	S
Plastic straws and utensils can be recycled	0.59	
Bubble wraps can be recycled	-0.39	R
Paper can be recycled	0.150	R
Storing and using hot food items in plastics is injurious to the health	0.41	
Plastic waste can harm the environment	0	R
90% of trash in the ocean is plastic	0.19	R
Most plastic wastes come from packaging	0.05	R
Carry bags made of virgin or recycled plastic should not be less than fifty microns in thickness	0.58	S
Toothpaste and cosmetics contain microplastic	0.32	R
Single-use plastic is a disposable material that can be used only once before it is either thrown away or recycled	0.28	R
India has announced its commitment to eliminate single-use plastic by 2050	0.45	S
Bakelite is the first synthetic plastic	0.42	S
Plastic is easy to recycle	0.21	R
Plastic waste is disposed of by recycling, incineration, and landfill	0.52	S
Project REPLAN launched by Khadi and Village Industries Commission (KVIC) aims to reduce the consumption of plastic bags	0.11	R
Burning of plastic results in the formation of a class of flame retardants called halogens	0.49	S
Asia is the world leader in plastic pollution	0.15	R
Plastic bag causes pollution	0.63	S
Do you use eco-friendly bags instead of plastic bags	0.37	R
When food is stored in plastic containers, especially pickles, acid and fatty foods, the plastic decomposes, allowing harmful carcinogens to enter the body.	0.34	R
Plastic bags harm and even kill cattle that come across and consume them during pasture.	0.082	S
Plastic is a renewable source of energy	0.37	R
Plastic takes millions of years to decompose naturally	0.37	R

Interpretation and distribution of respondents knowledge towards the environment, recycling, plastic, and plastic waste: The standardized knowledge test was administered to the selected 30 respondents. The results were interpreted by giving a '1' score for each correct response and '0' for incorrect answers respectively. The maximum obtainable score of a respondent was '12'. The sum of all the scores on each item was the total knowledge score of the individual respondent about the environment, recycling, plastic and plastic waste. The total score of each respondent was calculated and based on the mean and quartile deviation; the respondents were grouped as low, medium, and high knowledge categories.

Knowledge assessment of students towards environment recycling, plastic and, plastic waste in Table 4 reveled that 96.66 per cent respondents had the knowledge about the theme of world Environment Day 2021, 83.33 per cent of respondents had the knowledge about the main source of CFC gas, 73.33 per cent had the knowledge about the logo and symbol of Worldwide fund for Nature, 83,33 per cent had the knowledge about the recycling logo, 80 per cent had the knowledge about the cartons can be reclyed, 50 per cent had the knowledge about the plastic straws and utencils can not be recycled, cent percent respondents had the knowledge of storing and using hot food items in plastic harmful to health, 50 per cent of respondents had the knowledge of plastic thickness, 60 per cent had the knowledge of India's commitment towards elimination of single use plastic, 86.66 per cent had the knowledge about the first synthetic plastic, 83.33 per cent had the knowledge about plastic waste is disposed of by recycling, incineration, and landfill, 66.66 per cent had the knowledge of burning of plastic results in the formation of a class of flame retardants called halogens and 93.33 percent had the knowledge about the pollution through plastic bags.

Table 3: Level of respondent's knowledge on the environment, recycling, plastic, and plastic waste (N=30)

Range	Level of knowledge	Details of respondents (%)
Above 12	High	Nil
10-12	Medium	60
Below 10	Low	40

RESULTS AND DISCUSSION

From 40 knowledge items, 13 items having significant bi-serial correlation were selected as shown in Table 1. When the knowledge scores were analyzed it was observed that majority 60 per cent of the respondents were having medium scorers and 40 per cent were low scorers (Table 2).

Table 4: Frequency and percentage distribution of respondents (N=30)

Items	Frequency	Percentage	Mean ± SD
"Ecosystem restoration" is the theme of World Environment Day 2021.	29	96.66	0.96±0
Refrigerators are the main source of CFC gas	25	83.33	0.83±0.70
The logo and symbol of WWF (Worldwide Fund for Nature) is Giant Panda	22	73.33	0.73±0.70
The international recycling logo consists of three chasing arrows	25	83.33	0.83±0.70
Cartons can be recycled	24	80	0.8±0.40
Plastic straws and utensils can be recycled	15	50	0.5±0.50
Storing and using hot food items in plastics is injurious to the health	30	100	1±0
Carry bags made of virgin or recycled plastic should not be less than fifty microns in thickness.	15	50	0.5±0.50
India has announced its commitment to eliminate single-use plastic by 2050	18	60	0.6±0.49
Bakelite is the first synthetic plastic	26	86.66	0.86±0.34
Plastic waste is disposed of by recycling, incineration, and landfill	25	83.33	0.83±0.37
Burning of plastic results in the formation of a class of flame retardants called halogens	20	66.66	0.66±0.47
Plastic bags can cause pollution	28	93.33	0.93±0.25

CONCLUSION

It is concluded from the above findings that the developed knowledge test was found to be valid and a reliable tool that could be used for assessing the knowledge level of students about the environment, recycling, plastic and plastic waste. Further, specific findings of this knowledge test revealed that the majority of respondents possessed a moderate level of knowledge about the environment, recycling, plastic and plastic waste.

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Research Article

An Evaluation of Entrepreneurs' Knowledge of ARYA Enterprises

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ABSTRACT

The Present Study Was conducted in 3 districts of Odisha. 12 villages covering 6 blocks of 3 districts namely Puri, Nayagarh and Cuttack in the year 2022 to know the farmers' knowledge on ARYA enterprises. 120 numbers of respondents were selected by snowball sampling method. The data were analysed by using frequency, mean, rank order, correlation and multiple regression. According to the study, most farmers are more knowledgeable about certain aspects of their individual enterprises, such as maintaining fingerling stock, preparing beds, watering and gathering mushrooms, establishing beehives, and caring for chicks. The study reveals that 5 independent variables i.e.; gender, innovativeness, extension contacts, extension participation and economic motivation strongly correlate with the knowledge of the agripreneurs.

Keywords: Agripreneurs, ARYA, Fishery, Honey bee, Mushroom, Poultry

INTRODUCTION

Agriculture and allied sectors are the heart of social development of our country. Youth are the most potent segment of the population of the country. They are the hopes of tomorrow and the backbone of the rural community (Murthy, 2019). Youth involvement is strongly realized for agricultural reforms so that it can keep pace with changing global economy. About half of the Indians are under the age of 25 and 65 per cent are under the age of 35 (Rani and Roy, 2017). Unfortunately, farming is no longer viewed as a prospective employment option for the youngsters of the country due to various constraints that this sector faces today (Som *et al.,* 2018). So, attracting youth and retaining them in the agricultural sector remains a universal challenge.

India being the youngest nation in the world has massive youth resources to supply to the agriculture sector but unfortunately, youth participation in agriculture is declining (Mahawar, 2021). Successful entrepreneurship promotion has the possibility of attracting and retaining youth in rural areas through technology-supported agribusiness development (Gowda *et al.,* 2023). Agriculture-based business development is a crucial strategy to reduce outward migration because a huge number of rural youngsters are moving to cities in search of employment (Singh *et al.,* 2014; Singh *et al.,* 2016; Nian *et al.,* 2019; Ray *et al.,* 2022).

Today, agriculture needs to be perceived as an enterprise and the farmer as an agripreneur. There is a wide range of scope that needs to be explored by young people because they have the creativity and desired innovation needed to reshape agriculture. What is currently needed is to formulate appropriate policies and strategies for attracting and retaining young people in this sector so that Indian agriculture can experience a new stature in the hands of young and enthusiastic farmers (Pulla, 2021). Realizing the prominent role of rural youth in agricultural development especially from the point of view of food security of the country, ICAR has initiated a scheme on "Attracting and Retaining of Youth in Agriculture (ARYA)". Initially, ARYA project was implemented through KVKs in 25 states of the country (Sharma *et al.,* 2021). The growth of entrepreneurship among rural youth would be supplementary and complementary for rural youth in

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particular and the country in general. Their enthusiasm and skill in constructive performance are met and simultaneously they can earn enough for proper maintenance and improvement in their socio-economic status. Present-day agriculture requires intelligence and hard work, strong will and commitment and hence, the future strategy should motivate the youth to become job providers and agents of change rather than to remain as job seekers (Paroda, 2019).

MATERIALS AND METHODS

The research study was purposively undertaken in the Odisha district of Nayagarh, Cuttack and Puri under the presumption that the greatest number of the respondents would be present there due to their relative ease of accessibility. From each district, two blocks were selected. Khandapada and Nayagarh blocks were selected from Nayagarh district. Narasinghpur and Niali blocks from Cuttack district and from Puri, Nimapada and Satyabadi blocks were selected. Farmers between the ages of 20 and 40 comprised the study's sample. A total number of 120 people were chosen for the study.

The data was collected with the help of a well-structured pre-tested interview schedule and the quasi-experimental research design was followed for the analysis of data. Frequency, mean score, rank order, correlation and multiple regression are the statistical tools used for the data analysis.

RESULTS AND DISCUSSION

The knowledge of maintenance of fingerlings stock, mushroom production, rearing of honey bee and poultry production had been increased due to different demonstrations by field officers and officials of KVK.

Table 1 intimated that the respondents ranked maintenance of fingerling stocks first rank followed by feeding of fingerlings and maintenance of water level.

Table 1: Distribution of respondents according to their knowledge developed in fish fingerling production

S. No.	Statement	Mean score	Rank
1	Maintenance of fingerlings stock	2.10	I
2	Feeding of fingerlings	2.07	II
3	Maintenance of water level	2.07	II

Similar to the finding of the present study, past study revealed that the pressing training needs of fish growers were found to be high demand for water quality parameters, fish feed formulation and fish processing (Ifejika *et al.,* 2013). Knowledge on feeding of fingerlings and maintenance of water level is low so fish growers need training in this regard.

Table 2: Distribution of respondents according to their knowledge developed in mushroom production.

S. No.	Statement	Mean score	Rank
1	Preparation of spawn	2.20	II
2	Preparation of bed for mushroom cultivation	2.34	I
3	Watering in mushroom bed	2.34	I
4	Harvesting of mushroom	2.34	I
5	Marketing of mushroom	2.15	III

The cultivation of mushrooms as a subsidiary occupation among rural youth is promoted by KVKs (Sohi *et al.,* 2021).

Table 2 indicates that the respondents give first rank to preparation of bed for mushroom cultivation, watering in mushroom bed along harvesting of mushrooms. Preparation of spawn was given the second rank. Then marketing of mushroom was given third rank because mushroom is a perishable food item that can not remain fresh for many hours which ultimately reduces the market value as a result market channel becomes weak and preparation of spawn need proper training and design of spawn production house and advance technology which need a heavy capital.

Table 3 stated that respondents' knowledge about establishment of a hive was increased because it was

Table 3: Distribution of respondents according to their knowledge developed in rearing of honey bee

S. No.	Statement	Mean score	Rank
1	Establishment of hive	2.13	I
2	Proper rearing of queen	2.03	III
3	Maintenance of honey bees during off-season	2.06	II
4	Maintenance of honey bees during stress period	2.06	II

given first rank. The maintenance of honey bees during off off-season and maintenance of honey bee during stress period were given second rank followed by proper rearing of queen which was given third rank because of a lack of proper training and practical knowledge.

Table 4: Distribution of respondents according to their knowledge developed in backyard poultry production

S. No.	Statement	Mean score	Rank
1	Preparation of poultry shades	2.21	I
2	Feeding of poultry birds	2.05	II
3	Care of chicks	2.21	I

From Table 4 it was clear that the knowledge of beneficiaries about the preparation of poultry shades and care of chicks was increased more than feeding the poultry birds.

The findings of the present study somehow deviate from the past study of (Oyeyinka *et al.,* 2011) reported that respondents showed a high level of knowledge in feeding poultry birds, improved housing practices and daily routine operations.

It was highlighted in Table 5 that gender and economic motivation had positively correlated with the knowledge of the farmers at a 0.05 level of significance and innovativeness, extension contact and extension participation positively correlated at a 0.01 level of significance. Regression analysis depicts that extension contact, extension participation and economic motivation were significant at 0.01 level of significance the reason being the extension contact, public participation and motivation of being economically stable will increase the knowledge level of the farmer respondents. The more the farmer is exposed to the cosmopolite society the more will increase knowledge of the farmer. Age was significant at 0.05 level of significance indicating that age is a factor for which knowledge is being enhanced this was because youth have more power to learn the subject and were very enthusiastic to act upon what they learned.

Table 5: Correlation and regression of socio-economic variables with knowledge

Variables	Coefficient of correlation	Regression coefficient
Age	-.077	.037*
gender	.218*	.438
education	.164	.357
caste	.052	.933
Family size	.058	.796
Family type	-.025	.421
Source of income of the family	.113	.807
Annual income	-.018	.541
innovativeness	.240**	.716
Mass media utilization	.091	.131
Extension contact	.311**	.003**
Extension participation	.332**	.000**
Economic motivation	.201*	.009**

R Square= 0.470** significant at the 0.01 level, * significant at the 0.05 level

CONCLUSION

In the present study, it was found that the majority of farmers have knowledge in maintenance of fingerling stock for fish growers, preparation of bed for mushroom production, watering in mushroom bed along with harvesting of mushroom for mushroom growers, establishment of hive for apiary entrepreneurs, preparation of poultry shades and care of chicks for poultry growers. It was also found that male farmers with ideas of new innovations had great extension contacts, highly motivated and more social participation at 0.01 level. At a level of 0.05, youths also appeared to have a positive influence on subject knowledge. So from the above analysis we can say that ARYA schemes initiated by the government for youth agripreneurs are directed in a productive and refining way which in near future will mitigate unemployment, and migration as well and can lead youths to be job producers rather than job seekers.

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Research Article

Exploring the Demographics and Traits of Women Entrepreneurs of Self-help Groups in Chittoor District of Andhra Pradesh

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ABSTRACT

The research was conducted to examine the demographics and traits of SHG women entrepreneurs in Chittoor district of Andhra Pradesh. The research utilized an *ex post facto* research design and simple random sampling technique to select the sample. The findings of the study concluded that significant majority of the SHG women entrepreneurs were found middle aged (65.00%), educated up to high school (35.00%), belonged to Other Backward Classes (51.25%), with nuclear family type (76.25%), possessed small family size (65.00%) and were landless (55.00%). Significant proportion of the SHG women entrepreneurs received training (71.25%), possessed no membership in any organisation (72.50%), annual income ranged between 50,000-1,00,000 (63.75%) and fell within the medium category in terms of various variables such as extension contact (85.00%), mass media exposure (75.00%), economic motivation (92.50%), management orientation (76.25%) and availability of market facilities (82.50%).

Keywords: Women entrepreneurs, Self help groups, Profile, Simple random sampling

INTRODUCTION

Ancient history proclaims that India's culture was an entrepreneurial culture. Entrepreneurship and entrepreneurs had been the engine of economic growth and promotion of equitable development. Advancement of entrepreneurship among women is a major step to increase women participation in the growth of economic development. Provision of economic opportunities among women can improve the social, educational and health status etc. of them and also their families. Self Help Groups have become the vehicle of change in the rural areas, with the ultimate goal of converting household women as enterprising women thus transforming the lives of the marginalized.

In India, the Self Help Groups are nurtured by banks, NGOs and co-operatives. SHGs enhance equality of status of women as decision-makers, participants, and beneficiaries in the democratic, social, cultural and economic spheres of life. The financial status of women, particularly in rural areas is found to be poor and opportunities of increasing income are extremely low. For the sustainable development of the country, economic empowerment of women is necessary. Self Help Groups (SHGs) are regarded as one of the simple community based group approaches that fosters the empowerment of women through the entrepreneurship.

Chittoor district ranks third in terms of the number of Self Help Groups (SHGs) within the state of Andhra Pradesh. The SHG members in this district have undertaken a range of micro- enterprises. Therefore, it is crucial to examine the characteristics of SHG women and their impact on the entrepreneurial activities of these women-led Self Help Groups. This research paper specifically emphasizes on the profile of SHG women.

MATERIALS AND METHODS

The research was carried out within the Chittoor district of Andhra Pradesh, and it adhered to an ex post facto research design. Four mandals of Chittoor district and

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two villages from each of the selected mandals *viz.,* Kothapalle and Chinna tippa samudram villages from Madhanapalle mandal, Kuppam GPT and Kangundi villages from Kuppam mandal, Peruru and Avilala villages from Tirupati Rural mandal and Gollapalle and Venkatagiri from Bangarupalem mandal were purposively selected based on the presence of highest number of women Self Help Groups, from which 80 women entrepreneurs were selected by using simple random sampling method. Primary data was collected using a pre-tested interview schedule, and various statistical techniques such as arithmetic mean, standard deviation, frequencies, and percentages were applied. The results were then meaningfully interpreted and relevant conclusions were drawn.

RESULTS AND DISCUSSION

The results of all the selected profile characteristics of women entrepreneurs of Self Help Groups were presented in Table 1.

1. Age: The results from Table 1 revealed that a significant majority (65.00%) of the SHG women entrepreneurs fell into middle age category followed by young (21.25%) and old (13.75%) age categories respectively.

The probable reason for the above result might be attributed to the fact that, young women might had a preference for pursuing higher education or seeking employment in urban areas, potentially leading to reduced interest in entrepreneurial endeavors. In contrast, older women though had a strong desire to contribute financially to their families, their age could be a limiting factor. While middle-aged women often had a mix of family and work responsibilities, making them more inclined to seek economic empowerment and support through SHGs. Hence, most of the SHG women entrepreneurs belonged to middle age category. These findings were in conformity with the findings of Bhoj *et al.* (2014).

2. Education: The results from Table 1 depicted that 35.00 per cent of the SHG women entrepreneurs were educated up to high school followed by primary school (20.00%), read and write (16.25%), illiterates (11.25%), equal percentage (5.00%) of the SHG women entrepreneurs had education level up to middle school and intermediate level and equal percentage (3.75%) of the SHG women entrepreneurs were found under can read only and graduate and above level categories.

The findings unveiled that a significant portion of the women entrepreneurs in the Self Help Groups (SHGs) had their education up to high school level. This trend might be attributed to lack of awareness among these SHG women regarding the necessity and significance of seeking higher education. Additionally, it could be because of limited encouragement from parents, influenced by traditional perspectives on education. While few respondents were illiterates, due to a combination of their own lack of literacy and the challenging financial circumstances of their families, that hindered their access to better education opportunities. These individuals acknowledged not having higher educational qualifications, but they emphasized that their determination and hard work played pivotal roles in successfully managing their enterprises. This finding was in compliance with the findings of Sharma and Hussain (2018).

3. Caste: The results from Table 1 showed that most of the SHG women entrepreneurs (51.25%) hailed from Other Backward Caste category followed by Scheduled Caste /Scheduled Tribe category (30.00%) and general category (18.75%). This distribution of women entrepreneurs across different caste categories sheds light on the diverse participation within SHGs and emphasizes the notable presence of OBC women in these entrepreneurial endeavours because of being more in number. Similar types of findings were also reported by Subbaiah and Srinivas (2020).

4. Family type: The results from Table 1 indicated that significant majority of the SHG women (76.25%) were found to have nuclear family system and remaining (23.75%) owned joint family system in the study area.

The reason for the above results can be attributed to gradual decline of the joint family system in favour of nuclear families. This might have been influenced by various factors such as scattered land holdings, increased cost of living and differing interests among family members. As a result, households are becoming smaller and more independent, which may have repercussions for the distribution of entrepreneurial activities.

5. Family size: The results from Table 1 indicated that most of the SHG women (65.00%) were found

to possess small family size followed by medium family size (26.25%) and large family (8.75%) in the study area.

This might be attributed to the reality that, smaller households frequently exhibit enhanced resource management capabilities. With a reduced number of children, families have the scope to allocate a greater portion of their resources towards education, healthcare, and various opportunities, ultimately resulting in an improved overall quality of life. Changing cultural norms and values can impact family size. In some cultures, there is a historical preference for larger families, while in others, smaller families are becoming more accepted. Similar types of findings were also reported by Bhushan *et al.* (2015).

6. House type: The results from Table 1 showed that most of the SHG women entrepreneurs (80.00%) were having pucca houses followed by kaccha houses (12.50%) and mixed type of houses (7.50%).

The possible reason for the above trend might be attributed to the fact that SHG women who have managed their finances and savings effectively might be more capable of investing in permanent housing structures.

7. Family Land holding size: The findings from Table 1 cleared that majority of the SHG women (55.00%) were found landless followed by marginal land holding size (30.00%), small land holding size (7.50%), medium land holding size (5.00%) and large land holding size (2.50%). In regions with more population density and land fragmentation, it might be more common for families to have smaller land holdings, leading to marginal and small landholding size categories.

8. Family occupation: The results from Table 1 depicted that majority of the SHG women family occupation (48.75%) was labourers followed by business (26.25%), agriculture (23.75%) and service sector (1.25%).

The results showcasing the majority of SHG women families being engaged in labor- intensive work, followed by business activities, agriculture, and the service sector, offer a comprehensive snapshot of the economic landscape within these communities. Similar types of findings were also reported by Manikonda (2014).

9. Material possession: The results from Table 1 indicated that majority of the SHG women (65.00%) were under medium level of material possession category followed by low (33.75%) and high (1.25%) levels of material possession categories.

This result showed the diverse economic backgrounds within the SHG population, with a significant portion falling within a middle range of material possessions. The medium category might encompass individuals and families with access to basic amenities and possessions but with chance for improvement in terms of assets and resources. These findings emphasize the need of targeted interventions by SHGs and other development agencies to improve the material well-being of this substantial group.

10. Social participation: The results from Table 1 showed that significant majority of the SHG women (72.50%) were having no membership in any organisation and remaining SHG women (27.50%) possessed membership in one organisation whereas none of the SHG women were having membership in multiple organisations.

This indicates that a substantial proportion of SHG women primarily channel their social and community interactions through their participation in the SHG. This smaller yet notable percentage of membership in one organisation indicates that a segment of SHG women actively participate in a broader range of community or interest-based organisations beyond their SHG. This diverse engagement could encompass a variety of associations, such as community welfare groups, cultural organisations, or educational initiatives. This absence of multiple memberships might be attributed to several reasons, including time constraints, personal commitments, or the prioritization of one primary organisational affiliation, which in this case is the SHG.

11. Annual income: The results from Table 1 showed that most of the SHG women (63.75%) found to had an annual income of Rs. 50,000-1,00,000 followed by an income of below Rs. 50,000 (27.50%), Rs. 1,00,000-2,00,000 (6.25%) and more than Rs. 2,00,000 (2.50%).

It suggests that a considerable number of SHG women have managed to establish viable businesses and generate a moderate level of income, which could contribute positively to their economic empowerment and household financial stability.

12. Extension contact: The results from Table 1 indicated that significant majority of the SHG women (85.00%) were under medium level of extension contact category followed by high (13.75%) and low (1.25%) levels of extension contact category in the study area.

This result suggests that a significant proportion of SHG women maintain a moderate level of interaction and engagement with extension services. This level of contact encompasses regular consultations, training sessions, or advisory support from extension agents or advisory services. The prevalence of medium-level extension contact indicates that SHG women in the study area are actively seeking and receiving valuable information and assistance to support their initiatives, likely contributing to the success and sustainability of their endeavors. Similar types of findings were also stated by Grandhi (2016).

13. Mass media exposure: The results from Table 1 depicted that significant majority of the SHG women (75.00%) were found having medium level of mass media exposure followed by high (13.75%) and low (11.25%) levels of mass media exposure.

This result indicates that a significant portion of SHG women had access to and engage with various forms of mass media, such as television, radio, newspapers, and digital platforms, at a moderate frequency. This level of exposure suggests that SHG women are likely to be regularly informed about a wide range of topics, including current events, health, education, and economic opportunities. The prevalence of medium-level mass media exposure highlights the potential for SHG women to stay informed and engaged with the broader world, contributing to their knowledge base and decision-making abilities. Similar types of findings were also stated by Devi *et al.* (2019).

14. Training received: The results from Table 1 depicted that significant majority of the SHG women (71.25%) were received training related to their enterprises and remaining (28.75%) SHG women were not received training related to their enterprises.

Thus it can be summarized that most of the SHG women were received training related to their enterprises in the study area. It indicated that a substantial proportion of SHG women had actively sought or been provided with opportunities to enhance their knowledge, skills, and capabilities relevant to their businesses. This training encompassed a wide range of topics, including product development, marketing strategies, financial management, and business planning.

15. Economic motivation The results from Table 1 depicted that almost all the SHG women (92.50%) were found to possess medium level of economic motivation and equal percentage of SHG women (3.75%) under low and high levels of economic motivation categories.

This result suggested that a significant portion of SHG women possessed moderately fair level of motivation when it comes to economic pursuits. It indicates a balanced approach, where women are likely motivated by a mixture of factors such as financial stability, entrepreneurship opportunities, and the desire to improve their economic well-being. The findings were in accordance with Bhushan *et al.,* (2015).

16. Management orientation: The results from Table 1 cleared that most of the SHG women (76.25%) were found under medium level of management orientation category followed by high (18.75%) and low (5.00%) levels of management orientation categories.

This result suggests that a significant proportion of SHG women exhibited a balanced approach to management and leadership within their SHGs. A moderate level of management orientation indicates that SHG women were likely to participate actively in group activities, contribute to decision-making processes and share leadership responsibilities within their SHGs. This balanced approach fosters a collaborative and inclusive atmosphere within the SHGs, which can contribute to their overall effectiveness and sustainability. Similar types of findings were also reported by Asha *et al.* (2018).

17. Market facilities: The results from Table 1 revealed that significant majority of the SHG women (82.50%) were found to possess medium level of market facilities available followed by high (11.25%) and low (6.25%) levels of market facilities available.

This result indicates that a significant proportion of SHG women had access to market infrastructure and resources that support their economic activities. A medium level of market facilities suggests that these women likely had access to local markets or trading

Table 1: Distribution of SHG women entrepreneurs according to their profile (n=80)

S. No.	Variables	Category	Frequency	Percentage
1.	Age	Young age	17	21.25
		Middle age	52	65.00
		Old age	11	13.75
2.	Education	Illiterate	09	11.25
		Can read only	03	03.75
		Can read & write	13	16.25
		Primary school	16	20.00
		Middle school	04	05.00
		High school	28	35.00
		Intermediate	04	05.00
		Graduate and above	03	03.75
3.	Caste	Scheduled Caste/ Scheduled Tribe	24	30.00
		Other Backward Caste	41	51.25
		General	15	18.75
4.	Family type	Nuclear family	61	76.25
		Joint family	19	23.75
5.	Family size	Small (up to 4 members)	52	65.00
		Medium (5-8 members)	21	26.25
		Large (More than 8 members)	07	08.75
6.	House type	Kaccha house	10	12.50
		Mixed house	06	07.50
		Pucca house	64	80.00
7.	Family Land holding size	Landless	44	55.00
		Marginal (below 01 ha)	24	30.00
		Small (01-02 ha.)	06	07.50
		Medium (02-04 ha)	04	05.00
		Large (above 04 ha)	02	02.50
8.	Family Occupation	Labour	39	48.75
		Agriculture	19	23.75
		Business	21	26.25
		Service	01	01.25
9.	Material Possession	Low (up to 5)	27	33.75
		Medium (6-10)	52	65.00
		High (above 10)	01	01.25
10.	Social Participation	No membership in any organization	58	72.50
		Membership in one social organisation	22	27.50
		Membership in more than one organisation	0	0
11.	Annual income	Below Rs. 50,000	22	27.50
		Rs. 50,000-1,00,000	51	63.75
		Rs. 1,00,000-2,00,000	05	06.25
		More than Rs. 2,00,000	02	02.50

Table 1 contd...

S. No.	Variables	Category	Frequency	Percentage
12	Extension contact	Low	01	01.25
	Mean = 9.64	Medium	68	85.00
	S.D. = 0.86	High	11	13.75
13	Mass media exposure	Low	09	11.25
	Mean = 7.31	Medium	60	75.00
	S.D. = 2.89	High	11	13.75
14	Training undergone	Yes	57	71.25
		No	23	28.75
15	Economic motivation	Low	03	03.75
	Mean = 21.05	Medium	74	92.50
	S.D. = 1.22	High	03	03.75
16	Management orientation	Low	04	05.00
	Mean = 60.64	Medium	61	76.25
	S.D. = 2.09	High	15	18.75
17	Market facilities	Low	05	06.25
	Mean = 8.54	Medium	66	82.50
	S.D. = 1.01	High	09	11.25

centers where they can sell their products or source materials for their businesses. This access is essential for entrepreneurship, as it enables women to connect with customers, suppliers, and other businesses, facilitating economic transactions and opportunities for further expansion.

CONCLUSION

The findings of the study revealed that majority of the SHG women entrepreneurs were middle aged, educated up to high school, belonged to Other Backward Classes, with nuclear family type, possessed small family size and were landless. Most of the SHG women entrepreneurs received training, had no membership in any organisation and annual income ranged between 50,000-1,00,000. Majority of the SHG women entrepreneurs fell within the medium category in terms of various variables such as extension contact, mass media exposure, economic motivation, management orientation and availability of market facilities. These findings provide valuable insights into the demographic, educational, and socioeconomic profiles of the SHG women entrepreneurs, besides shedding light on the factors that influence their entrepreneurial activities. The study highlights the need for encouraging the women by providing interest based, need based, situation and demand based training programmes besides motivating them towards social participation. There is a need for widening the scope of market facilities. This information can be instrumental in designing targeted support programs and policies to empower and encourage entrepreneurship among the women self help groups.

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Research Article

Attitude of Beneficiary Farmers towards National Horticulture Mission in Rajasthan

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ABSTRACT

Horticulture has emerged as an important sector of diversification agriculture. Recognizing the vast potential of horticulture in stimulating the growth of Indian agriculture, government of India had launched a scheme of National Horticulture Mission for the holistic development of this sector. The study was undertaken to measure the attitude of beneficiary farmers towards National Horticulture Mission in Semi-arid Eastern Plain Zone (IIIA) of Rajasthan. From this IIIA zone two districts were selected for the research study. A total of 240 beneficiary farmers were included in the sample of study. Study shows that majority of beneficiary farmers had average to above average attitude towards NHM in the selected districts. Statement wise attitude of beneficiary farmers indicated that "NHM helps the farmers to improve their personal and socio-economic status" was most important statement about which majority of the beneficiary farmers had most favourable attitude and was ranked first. Beneficiary farmers had least favourable attitude towards "NHM helps the farmers to adopt high value inputs" and was ranked twenty four. It was observed that there was no significant difference between the beneficiary farmers of Jaipur and Tonk districts about attitude towards NHM and there was no significant correlation between ranks of attitude statements assigned by beneficiary farmers of NHM of Jaipur and Tonk districts.

Keywords: Attitude, Beneficiary farmers, National horticulture mission

INTRODUCTION

India is mainly an agriculture based country where majority of the people are engaged in agriculture. Indian agriculture is an important factor for sustainable development and poverty alleviation. Even today agriculture sector is the main source of livelihood and food security for a greater part of population in India. Horticulture has emerged as an important sector of diversification agriculture. It emerged as a growth engine of agriculture and making a significant contribution to agricultural GDP. Diversified and boosted growth in agricultural is dependent upon the development of horticulture sector. It plays a pivotal role in improving the productivity of land, generating employment, enhancing exports and improving the economic conditions of the farmers.

Recognizing the vast potential of horticulture in stimulating the growth of Indian agriculture, government of India had launched a scheme of National Horticulture Mission for the holistic development of this sector. It is a centrally sponsored scheme, launched by the Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India during 2005-06 (10^{th} five-year plan). NHM plays a crucial role in promoting growth in horticulture and helps in augmenting growth in Indian agriculture. NHM playing a important role in increase in area as well as productivity of horticultural crops through motivation of farmers, providing subsidy, providing guidance and other facilities. It also plays an important role in improving the living standard of the farmers. Under NHM scheme include production and

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productivity improvement of horticulture crops by supplying quality planting material, nurseries, rejuvenation of senile orchards, protected cultivation, cold storage facilities, integrated nutrient management, integrated pest management, production of organic farming and deploying honeybees for enhancing productivity through cross pollination from integral components of schemes. Attitude of people is a pre-condition for acceptance or rejection of an idea. Attitude is relatively stable and cannot change easily. It is always important to find out the attitude of farmers towards NHM.

MATERIALS AND METHODS

Semi-arid Eastern Plain (IIIA) Agro Climatic Zone was selected for the study purpose. This Agro Climatic Zone comprises of four districts namely- Jaipur, Ajmer, Tonk and Dausa. Out of these Jaipur and Tonk districts were selected for the research study on the basis of maximum number of beneficiary farmers under selected activities of NHM. From Jaipur district 6 tehsils were selected namely; Amber, Chomu, Shahpura, Jhotwara, Sambhar and bassi. From Tonk district also 6 tehsils were selected namely; Newai, Malpura, Tonk, Uniara, Todaraisingh and Deoli, those having maximum number of beneficiaries of under selected activities of NHM. A list of beneficiary farmers under selected activities of NHM (farmers benefited from the year 2014 to 2016) from selected districts were prepared. From that list 30 per cent of beneficiary farmers were selected by using simple random sampling in proportionate from each tehsil and selected activities under NHM. These activities were selected on the basis of highest farmers taking benefits under NHM. Thus, a total of 240 beneficiary farmers were included in the sample of study.

The data were collected by using personal interview schedule. The collected data were analyzed by using following statistical tools. The arbitrary method was used to classify the respondents into five categories *viz.,* low, below average, average, above average and high level of attitude towards NHM. Further, for knowing the statement wise attitude of respondents mean percent score for each statement was calculated and ranked accordingly. In order to find out the significant difference between the respondents of selected districts about attitude towards NHM, 'Z' test was applied and interpretations was done accordingly and find out the significant relationship between ranks of attitude statements assigned by respondents of Jaipur and Tonk districts, Spearman's rank correlation test was applied and interpretations was done accordingly.

RESULTS AND DISCUSSION

To measure the attitude of beneficiary farmers towards NHM, scale developed by Gulkari (2013), was used with slight modification for data collection from the beneficiary farmers. Responses of respondents were taken on five-point continuums *viz.* strongly agree, agree, undecided, disagree and strongly disagree for all the statements. The data collected regarding these were analyzed.

***Level of attitude of beneficiary farmers towards NHM*:** To measure the level attitude of beneficiary farmers towards NHM, a schedule containing 24 statements was used. On the basis of arbitrary method the beneficiary farmers were grouped into five categories.

It is revealed from the Table 1 that majority (65.84%) of beneficiary farmers were having above

Table 1: Distribution of beneficiary farmers according to their level of attitude towards NHM

Level of attitude	Jaipur district (n_1=140)	Tonk district (n_2=100)	Overall (n=240)
Low (up to 43.2 score)	02(01.43)	03 (03.00)	05 (02.08)
Below average (from 43.3 to 62.4 score)	03 (02.14)	02(02.00)	05(02.08)
Average (from 62.5 to 81.6 score)	28(20.00)	23(23.00)	51(21.25)
Above average (from 18.7 to 100.8 score)	95(67.86)	63(63.00)	158(65.84)
High (above 100.8 score)	12(08.57)	09(09.00)	21(08.75)
Total	140(100.00)	100(100.00)	240(100.00)

(Figures in the parentheses indicates percentage)

average attitude, followed by 21.25 per cent were having average attitude, 08.75 per cent were having high attitude and 02.08 per cent farmers were having equally below average and low attitude towards NHM.

In case of district wise in Jaipur district majority (67.86%) of beneficiary farmers were having above average attitude, followed by 20.00 per cent were having average attitude, 08.57 per cent were having high attitude, 02.14 per cent were having below average attitude and only 01.43 per cent were having low attitude. In Tonk district majority (63.00%) of beneficiary farmers were having above average attitude, followed by 23.00 per cent were having average attitude, 09.00 per cent were having high attitude, 03.00 per cent were having low attitude and 02.00 per cent were having below average attitude. These findings are supported by Naik *et al.* (2016); Dayalan *et al.* (2018); Patel *et al.* (2018) and Smriti *et al.* (2019).

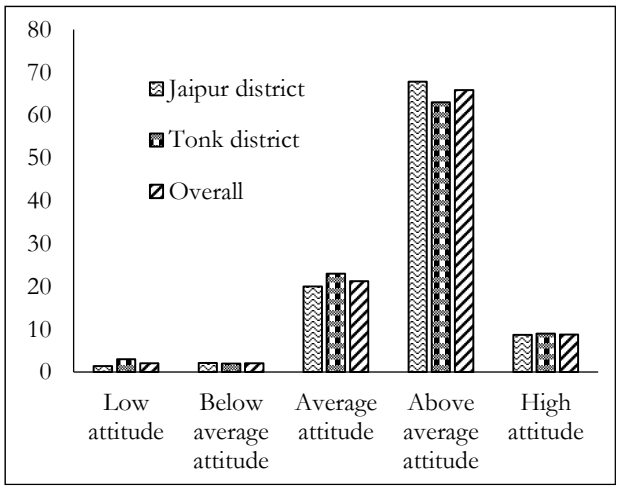

Figure 1: Distribution of beneficiary farmers according to their level of attitude towards NHM

Statement wise attitude of beneficiary farmers towards NHM: To find out the attitude of beneficiary farmers towards NHM total of twenty-four statements were considered in the attitude scale. For this, the Mean Percent Score (MPS) for each statement was calculated and ranked accordingly. An effort was also made to determine the relationship between the ranks of attitude statements assigned by beneficiary farmers of NHM of Jaipur and Tonk districts by applying Spearman's rank correlation test.

It is evident from data presented in Table 2 that 'NHM helps the farmers to improve their personal and socio-economic status' was most important statement about which majority of the beneficiary farmers of selected districts had most favourable attitude with overall MPS 79.58 and was ranked first. The another important statements about which beneficiary farmers had most favourable attitude were 'Officers always gives beneficial advise to beneficiary farmers under NHM programme' and 'Maximum profit can be achieved through export of the produce under NHM' with overall MPS 78.67 and was ranked second, 'NHM helps to increase the income as well as production of horticulture crops only' with overall MPS 78.08 and was ranked fourth.

In Jaipur district, the data presented in Table 2 that 'NHM has generated new employment opportunities in rural areas' was most important statement about which majority of the beneficiary farmers had most favourable attitude with MPS 80.57 and was ranked first. The other important statements were 'NHM encourages the farmers to take proper care of their orchards and nursery' with MPS 78.86 and was ranked second, 'NHM helps the farmers to improve their personal and socio-economic status' with MPS 78.00 and was ranked third, 'Increase in fruit production due to NHM will create marketing problems' with MPS 77.85 and was ranked fourth.

In Tonk district, it is evident from the data presented in Table 2 that 'NHM helps to increase the income as well as production of horticulture crops only' was most important statement about which majority of the beneficiary farmers had most favourable attitude with MPS 83.00 and was ranked first, followed by 'NHM helps the farmers to improve their personal and socio-economic status' with MPS 81.80 and was ranked second, 'Maximum profit can be achieved through export of the produce under NHM' with MPS 81.60 and was ranked third, 'Officers always gives beneficial advise to beneficiary farmers under NHM programme' with MPS 80.80 and was ranked fourth.

An effort was also made to determine the relationship between the ranks of attitude statements assigned by beneficiary farmers of NHM of Jaipur and Tonk districts by applying rank order correlation test. The rank correlation value (0.20) was less than tabulated value, so null hypothesis ($NH_{01.1}$) 'There is

Table: 2 Statement wise attitude of beneficiary farmers towards NHM

S. No.	Attitude statements	Jaipur district (n_1=140)		Tonk district (n_2=100)		Overall (n=240)	
		MPS	Rank	MPS	Rank	MPS	Rank
1.	NHM has generated new employment opportunities in rural areas	80.57	I	69.60	XIX	76.08	VIII
2.	NHM encourages the farmers to take proper care of their orchards and nursery	78.86	II	70.00	XVII	75.17	IX
3.	Activities implemented under NHM are not relevant to the needs of small and marginal farmers	73.28	XIV	71.60	XIV	72.50	XIII
4.	Plant saplings not received in time so plantation work delayed	55.14	XXIII	73.80	X	62.91	XXIII
5.	Increase in fruit production due to NHM will create marketing problems	77.85	IV	77.20	V	77.58	V
6.	NHM helps the farmers to improve their personal and socio-economic status	78.00	III	81.80	II	79.58	I
7.	NHM is a boon for small and marginal farmers	53.42	XXIV	48.60	XXIV	51.42	XXIV
8.	The procedure of getting the benefits from NHM is complex and time consuming	74.71	XI	69.80	XVIII	72.58	XII
9.	Small scale industries in fruit processing will be enhanced in rural areas due to NHM	77.28	VI	61.00	XXII	70.50	XVII
10	Only big farmers are benefited under various schemes of NHM	73.14	XV	50.80	XXIII	63.83	XXI
11.	Due to lack of proper publicity majority of the farmers have not received the benefits of NHM	77.71	V	71.80	XIII	75.25	VII
12.	NHM helps the farmers to adopt high value inputs	75.86	X	73.40	XI	74.75	XI
13.	Transformation of dry land agriculture is possible through NHM	69.28	XVIII	71.20	XV	70.08	XIX
14.	There is little works and more of propaganda done by the NHM	76.57	IX	76.00	IX	76.33	VI
15.	Fixed income in long term can be achieved only through crops under NHM	66.57	XX	77.00	VI	70.92	XIV
16.	NHM gives opportunity to the farmers to develop rapport with officers of development departments	71.00	XVI	62.00	XXI	67.25	XX
17.	Local farmers will not get proper rates because of huge import of fruits in market from outside	60.71	XXII	67.80	XX	63.67	XXII
18.	Planting of crops under NHM is difficult because correct knowledge and skill is not provided in the programme	68.86	XIX	73.20	XII	70.67	XV
19.	Subsidy procedure under NHM is typical	73.71	XIII	76.40	VIII	74.83	X
20.	NHM helps to increase the income as well as production of horticulture crops only	74.57	XI	83.00	I	78.08	IV
21.	Proper marketing facilities for horticulture crops is not available under NHM	70.71	XVII	70.60	XVI	70.67	XV
22.	Officers always gives beneficial advise to beneficiary farmers under NHM programme	77.14	VII	80.80	IV	78.67	II
23.	I think that benefits of hi-tech horticulture technology are only for big farmers	65.86	XXI	76.80	VII	70.42	XVIII
24.	Maximum profit can be achieved through export of the produce under NHM	76.71	VIII	81.60	III	78.67	II
	Total	71.96		71.49		71.77	

MPS = Mean Per cent Score, rs = 0.209^{NS}

rs = Rank order correlation NS = Non-significant

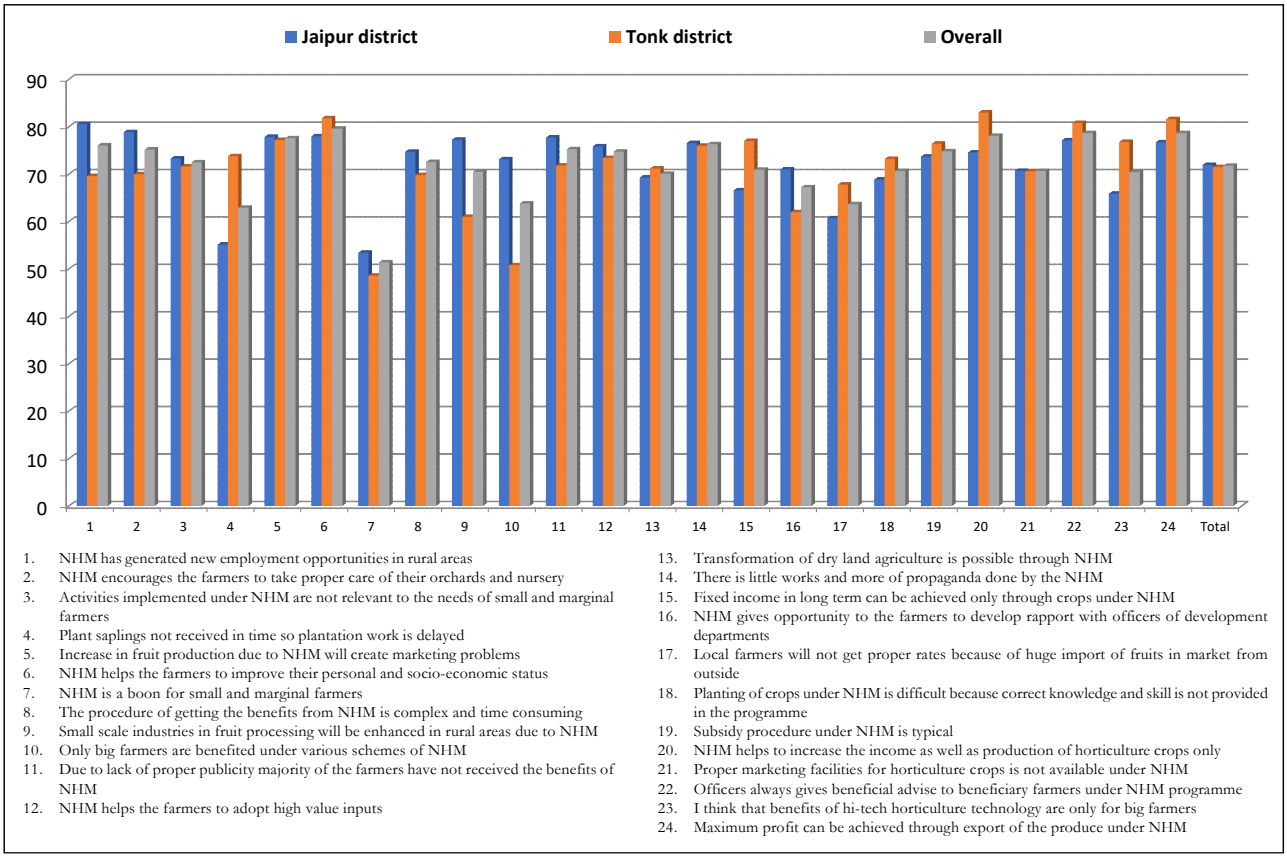

Figure 2: Statement wise attitude of beneficiary farmers towards NHM

no significant correlation between ranks of attitude statements about NHM assigned by beneficiary farmers of Jaipur and Tonk districts' was accepted and alternate hypothesis (RH_1) 'There is significant correlation between ranks of attitude statements about NHM assigned by beneficiary farmers of Jaipur and Tonk districts' was rejected. It means there is no significant relationship between ranks of attitude statements about NHM assigned by beneficiary farmers of Jaipur and Tonk districts. It might be because of the fact that attitude of beneficiary farmers depends on so many factors like socio-economic, environment and personal characteristics, so there is no relationship found in the ranks of attitude statements. These findings are supported by Mahadik *et al.* (2015) and Bhimawat and Choudhary (2017).

Frequency of attitude statements about NHM: Table 3 indicates that 72.08 per cent of beneficiary farmers of selected districts were either strongly agreed or agreed with the statement that 'NHM has generated new employment opportunities in rural areas'. It can be seen that 69.17 per cent of beneficiary farmers were either strongly agreed or agreed that 'NHM encourages the farmers to take proper care of their orchards and nursery'. The result indicates that 15.42 per cent of beneficiary farmers were either strongly agreed or agreed that 'Activities implemented under NHM are not relevant to the needs of small and marginal farmers'. It was observed that 39.17 per cent of beneficiary farmers were either strongly agreed or agreed that 'Plant saplings not received in time so plantation work delayed'. Only 01.66 per cent were either strongly agreed or agreed that 'Increase in fruit production due to NHM will create marketing problems' and also 81.67 per cent were either strongly agreed or agreed that 'The NHM helps the farmers to improve their personal and socio-economic status'.

It was observed that 19.17 per cent were either strongly agreed or agreed that 'NHM is a boon for small and marginal', whereas 68.33 per cent were either strongly agreed or agreed that 'Procedure of getting the benefits from NHM is complex and time consuming', 56.25 per cent were either strongly agreed or agreed that 'Small scale industries in fruit processing

Table 3: Frequency of attitude statements by the beneficiary farmers about NHM

S.No.	Statements	Jaipur district					Tonk district					Total				
		SA	A	UD	D	SD	SA	A	UD	D	SD	SA	A	UD	D	SD
1.	NHM has generated new employment opportunities in rural areas	35 (25.00)	81 (57.86)	19 (13.57)	3 (2.14)	2 (1.43)	20 (20.00)	37 (37.00)	23 (23.00)	12 (12.00)	8 (8.00)	55 (22.91)	118 (49.17)	42 (17.50)	15 (06.25)	10 (4.17)
2.	NHM encourages the farmers to take proper care of their orchards & nursery	24 (17.15)	92 (65.71)	19 (13.57)	2 (1.43)	3 (2.14)	36 (36.00)	14 (14.00)	27 (27.00)	10 (10.00)	13 (13.00)	60 (25.00)	106 (44.17)	46 (19.17)	12 (5.00)	16 (06.66)
3.	Activities implemented under NHM are not relevant to the needs of small and marginal farmers	2 (1.43)	17 (12.14)	35 (25.00)	59 (42.14)	27 (19.29)	7 (7.00)	11 (11.00)	25 (25.00)	31 (31.00)	26 (26.00)	9 (3.75)	28 (11.67)	60 (25.00)	90 (37.50)	53 (22.08)
4.	Plant saplings not received in time so plantation work delayed	00 (00.00)	73 (52.14)	28 (20.00)	39 (27.86)	00 (00.00)	10 (10.00)	11 (11.00)	13 13.00)	32 (32.00)	34 (34.00)	10 (4.17)	84 (35.00)	41 (17.08)	71 (29.58)	34 (14.17)
5.	Increase in fruit production due to NHM will create marketing problems	2 (1.43)	1 (00.71)	31 (22.14)	82 (58.57)	24 (17.15)	00 (00.00)	1 (1.00)	39 (39.00)	33 (33.00)	27 (27.00)	2 (00.83)	2 (00.83)	70 (29.17)	115 (47.92)	51 (21.25)
6.	NHM helps the farmers to improve their personal & socio-economic status	24 (17.14)	91 (65.00)	16 (11.43)	5 (3.57)	4 (2.86)	31 (31.00)	50 (50.00)	16 (16.00)	3 (3.00)	00 (00.00)	55 (22.92)	141 (58.75)	32 (13.33)	8 (3.33)	4 (1.67)
7.	NHM is a boon for small and marginal farmers	9 (6.43)	14 (10.00)	40 (28.57)	76 (54.29)	1 (00.71)	13 (13.00)	10 (10.00)	6 (6.00)	49 (39.00)	22 (22.00)	22 (09.17)	24 (10.00)	46 (19.17)	125 (52.08)	23 (9.58)
8.	The procedure of getting the benefits from NHM is complex and time consuming	23 (16.43)	81 (57.86)	21 (15.00)	5 (3.57)	10 (7.14)	15 (15.00)	45 (45.00)	24 (24.00)	6 (6.00)	10 (10.00)	38 (15.83)	126 (52.50)	45 (18.75)	11 (4.58)	20 (8.34)
9.	Small scale industries in fruit processing will be enhanced in rural areas due to NHM	23 (16.43)	80 (57.14)	34 (24.29)	1 (00.71)	2 (1.43)	8 (8.00)	24 (24.00)	43 (43.00)	15 (15.00)	10 (10.00)	31 (12.92)	104 (43.33)	77 (32.08)	16 (6.67)	12 (5.00)
10	Only big farmers are benefited under various schemes of NHM	6 (4.28)	13 (9.29)	29 (20.71)	67 (47.86)	25 (17.86)	11 (11.00)	43 (43.00)	33 (33.00)	7 (7.00)	6 (6.00)	17 (07.08)	56 (23.34)	62 (25.83)	74 (30.83)	31 (12.92)
11.	Due to lack of proper publicity majority of the farmers have not received the benefits of NHM	44 (31.43)	47 (33.57)	38 (27.14)	11 (7.86)	00 (00.00)	24 (24.00)	32 (32.00)	28 (28.00)	11 (11.00)	5 (5.00)	68 (28.33)	79 (32.92)	66 (27.50)	22 (09.17)	5 (2.08)
12.	NHM helps the farmers to adopt high value inputs	15 (10.71)	86 (61.43)	34 (24.29)	5 (3.57)	00 (00.00)	24 (24.00)	41 (41.00)	18 (18.00)	11 (11.00)	06 (06.00)	39 (16.25)	127 (52.92)	52 (21.67)	16 (6.67)	6 (2.50)
13.	Transformation of dry land agriculture is possible through NHM	22 (15.71)	63 (45.00)	22 (15.71)	24 (17.14)	9 (6.43)	21 (21.00)	40 (40.00)	22 (22.00)	8 (8.00)	9 (9.00)	43 (17.92)	103 (42.92)	44 (18.33)	32 (13.33)	18 (7.50)
14.	There is little works and more of propaganda done by the NHM	4 (2.86)	4 (2.86)	17 (12.14)	102 (72.86)	13 (09.28)	1 (1.00)	12 (12.00)	19 (19.00)	42 (42.00)	26 (26.00)	5 (2.08)	16 (6.67)	36 (15.00)	144 (60.00)	39 (16.25)

Table 3 contd....

S.No.	Statements	Jaipur district					Tonk district					Total				
		SA	A	UD	D	SD	SA	A	UD	D	SD	SA	A	UD	D	SD
15.	Fixed income in long term can be achieved only through crops under NHM	27 (19.29)	40 (28.57)	35 (25.00)	28 (20.00)	10 (7.14)	36 (36.00)	34 (34.00)	14 (14.00)	11 (11.00)	5 (5.00)	63 (26.25)	74 (30.83)	49 (20.42)	39 (16.25)	15 (6.25)
16.	NHM gives opportunity to the farmers to develop rapport with officers of development departments	6 (4.29)	84 (60.00)	36 (25.71)	9 (6.43)	5 (3.57)	19 (19.00)	32 (32.00)	02 (02.00)	34 (34.00)	13 (13.00)	25 (10.42)	116 (48.33)	38 (15.83)	43 (17.92)	18 (7.50)
17.	Local farmers will not get proper rates because of huge import of fruits in market from outside	00 (00.00)	54 (38.57)	41 (29.29)	31 (22.14)	14 (10.00)	12 (12.00)	9 (9.00)	29 (29.00)	28 (28.00)	22 (22.00)	12 (5.00)	63 (26.25)	70 (29.17)	59 (24.58)	36 (15.00)
18.	Planting of crops under NHM is difficult because correct knowledge & skill is not provided in the programme	7 (5.00)	26 (18.57)	28 (20.00)	56 (40.00)	23 (16.43)	10 (10.00)	11 (11.00)	8 (8.00)	45 (45.00)	26 (26.00)	17 (7.08)	37 (15.42)	36 (15.00)	101 (42.08)	49 (20.42)
19.	Subsidy procedure under NHM is typical	7 (5.00)	5 (3.57)	43 (30.71)	55 (39.29)	30 (21.43)	4 (4.00)	12 (12.00)	12 (12.00)	42 (42.00)	30 (30.00)	11 (04.58)	17 (07.08)	55 (22.92)	97 (40.42)	60 (25.00)
20.	NHM helps to increase the income as well as production of horticulture crops only	26 (18.57)	66 (47.15)	36 (25.71)	8 (5.71)	4 (2.86)	38 (38.00)	46 (46.00)	9 (9.00)	7 (7.00)	00 (00.00)	64 (26.67)	112 (46.66)	45 (18.75)	15 (6.25)	4 (1.67)
21.	Proper marketing facilities for horticulture crops is not available under NHM	6 (4.29)	13 (9.29)	38 (27.14)	66 (47.14)	17 (12.14)	1 (1.00)	17 (17.00)	28 (28.00)	36 (36.00)	18 (18.00)	7 (2.92)	30 (12.50)	66 (27.50)	102 (42.50)	35 (14.58)
22.	Officers always gives beneficial advise to beneficiary farmers under NHM programme	12 (8.57)	101 (72.15)	22 (15.71)	5 (3.57)	00 (00.00)	35 (35.00)	36 (36.00)	28 (28.00)	00 (00.00)	1 (1.00)	47 (19.58)	137 (57.09)	50 (20.83)	5 (2.08)	1 (00.42)
23.	I think that benefits of hi-tech horticulture technology are only for big farmers	3 (2.14)	39 (27.86)	28 (20.00)	54 (38.57)	16 (11.43)	14 (14.00)	5 (5.00)	9 (9.00)	27 (27.00)	45 (45.00)	17 (7.08)	44 (18.33)	37 (15.42)	81 (33.75)	61 (25.42)
24.	Max. profit can be achieved through export of the produce under NHM	29 (20.71)	81 (57.86)	16 (11.43)	5 (3.57)	9 (6.43)	23 (23.00)	62 (62.00)	15 (15.00)	00 (00.00)	00 (00.00)	52 (21.67)	143 (59.58)	31 (12.92)	5 (2.08)	9 (3.75)

SA – Strongly Agree, A – Agree, UD – Undecided, DA – Disagree, SDA – Strongly Disagree
(Figures in the parentheses indicates percentage)

will be enhanced in rural areas due to NHM', 30.42 per cent were either strongly agreed or agreed that 'Only big farmers are benefited under various schemes of NHM', 61.25 per cent were either strongly agreed or agreed that 'Due to lack of proper publicity majority of the farmers have not received the benefits of NHM', 69.17 per cent were either strongly agreed or agreed that 'farmers 'NHM helps the farmers to adopt high value inputs', 60.84 per cent were either strongly agreed or agreed that 'Transformation of dry land agriculture is possible through NHM', 08.75 per cent were either strongly agreed or agreed that 'There is little works and more of propaganda done by the NHM', 57.08 per cent were either strongly agreed or agreed that 'fixed income in long term can be achieved only through crops under NHM'.

The result of table also indicates that 58.75 per cent respondents were either strongly agreed or agreed that 'NHM gives opportunity to the farmers to develop rapport with officers of development departments', whereas 31.25 per cent were either strongly agreed or agreed that 'Local farmers will not get proper rates because of huge import of fruits in market from outside', 22.50 per cent were either strongly agreed or agreed that 'Planting of crops under NHM is difficult because correct knowledge and skill is not provided in the programme', 11.66 per cent were either strongly agreed or agreed that 'Subsidy procedure under NHM is typical', 73.33 per cent were either strongly agreed or agreed that 'NHM helps to increase the income as well as production of horticulture crops only', 15.42 per cent were either strongly agreed or agreed that 'Proper marketing facilities for horticulture crops is not available under NHM', 76.67 per cent were either strongly agreed or agreed that 'Officers always gives beneficial advise to beneficiary farmers under NHM programme', 25.41 per cent were either strongly agreed or agreed that 'I think that benefits of hi-tech horticulture technology are only for big farmers', 81.25 per cent were either strongly agreed or agreed that 'Maximum profit can be achieved through export of the produce under NHM'.

To find out the significance difference in attitude of beneficiary farmers towards NHM in Jaipur and Tonk districts, 'Z' test was done and the result results are presented in the Table 4.

Table: 4 Comparison between beneficiary farmers of selected districts according to attitude towards NHM (n=240)

Districts	Sample size	Mean score	S.D	"Z" Value
Jaipur	140	86.35	5.86	0.011^{NS}
Tonk	100	85.79	5.68	

NS= Non-significant

Calculated 'Z' value was found less than the tabulated value which is statistically non-significant. It means that beneficiary farmers of both districts had more or less or similar attitude towards NHM in the study area. It might be because of that in both districts beneficiary farmers were getting more benefits by NHM scheme, so it helps to develop favourable attitude towards NHM. These findings are supported by Mahadik *et al.* (2015).

CONCLUSION

It is concluded that majority of beneficiary farmers with a positive attitude towards NHM. NHM helps the farmers to improve their personal and socio-economic status and officers always gives beneficial advise to beneficiary farmers under NHM programme and maximum profit can be achieved through export of the produce under NHM were most important statement about which majority of the beneficiary farmers had most favourable attitude. There is no significant difference between the respondents of Jaipur and Tonk districts about attitude towards NHM.

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Research Article

Agricultural Diversification and Its Impact on Enhancing Farm Income

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ABSTRACT

The majority of the population relies on agriculture for both work and nutrition. Nevertheless, the industry confronts considerable obstacles including diminishing agricultural production, environmental deterioration, and regional inequities, which have compelled governments to give the sector's transformation priority. The promotion of high-value goods with the ability to boost production rates has emerged as a significant element of this change, with the goal of transforming traditional agriculture into a dynamic and commercial industry. Focusing on crop diversification, especially towards high-value cash crops like fruits and vegetables, is a viable approach to securing farm incomes, fostering job possibilities, increasing exports, and preserving natural resources. Numerous studies have shown that crop diversification and farm revenue are positively correlated. Cropping systems with more crop diversity and the production of high-value goods have the potential to increase farmers' incomes. Farmers may reduce the dangers of monoculture and get access to a variety of markets by diversifying the crops they plant on their farms. The performance of agriculture as a whole is improved through integrated farming systems, which mix several agricultural operations including crop production, animal husbandry, and fish farming. Contrarily, crop rotation increases soil fertility and health while lowering pest and disease occurrence. Agriculture diversification may be done sustainably by combining trees with crops and animals, a practice known as agroforestry. When pursuing crop diversification, it's critical to be aware of the hazards involved and differences in revenue results despite the possible advantages. Adequate market links, value addition, and storage and processing facilities are crucial to ensure that farmers can obtain fair prices for their diversified produce. Policymakers need to concentrate on providing the necessary support mechanisms, including training, knowledge dissemination, and financial assistance, to enable farmers to a successful diversification effort.

Keywords: Agricultural diversification, Farm income, Crop rotation, Mixed farming, Polyculture

INTRODUCTION

Agriculture serves as the cornerstone of the Indian economy due to its significant contribution to job creation and sustenance for a majority of the population. Despite directly employing over 50 per cent of the country's workforce, agriculture's share in the GDP has been steadily declining. Most people in India reside in rural areas, where agriculture remains the primary industry. As a result, a significant portion of the nation's land is dedicated to agricultural and horticultural activities. Enhancing productivity in agriculture and horticulture through mechanization and advanced technology could play a pivotal role in India's economic development. Agriculture provides employment and revenue and is a vital supplier of raw materials and a significant market for various industrial goods, such as fertilizers, pesticides, agricultural equipment, and consumer items, which significantly impact the rural economy.

However, concerns arise due to the increasing risks to farmers' incomes and the negative externalities associated with agriculture, including environmental degradation and regional inequalities. Despite a substantial number of people still engaged in agriculture

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and related industries, land and labor productivity concerns persist. Additionally, agriculture's contribution to the GDP has been declining over time. Consequently, policymakers have started focusing on transforming the agriculture sector to address these challenges, mitigate negative externalities, bridge inconsistencies, and enhance food security for the underprivileged and malnourished. This necessitates exploring alternative production methods or opportunities that can create jobs, increase economic growth, and increase incomes (Barghouti *et al.,* 2004).

Agricultural diversification refers to changes in crop, enterprise, and activity mix at the household level (Chand, 1999). One potential solution to stabilize and enhance farm incomes, create employment opportunities, promote exports, and conserve natural resources is by transitioning from cultivating low-value crops and cereals to selectively focusing on high-value cash crops like fruits and vegetables. This shift towards diversifying agriculture, aligning with the region's comparative advantage, is seen as a viable approach (Sharma, 2005).

Agricultural diversification is driven by improved rural infrastructure, technological advancements in agricultural production, and evolving food demand patterns. Such diversification towards high-value crops is expected to accelerate agricultural growth, foster rural entrepreneurship, and generate employment opportunities. India presents significant potential for diversifying agriculture towards high-value commodities. Embracing agricultural diversification as a strategy would facilitate value addition in agriculture and lead to better crop planning and improved earning opportunities for the farming community. It encompasses crops, new marketing, and agro-food-based industrial activities (Goletti, 1999). Table 1 presents a non-exhaustive list of the main benefits and main features of various agricultural diversification systems. (Lin 2011).

Agricultural diversification entails changes in the mix of crops, businesses, and activities within households (Chand, 1999). It involves transitioning from monoculture to a substantial variety of crops and livestock. Agricultural diversity is crucial for several reasons. Diversifying the crop mix can help mitigate the impact of risks on farmers' well-being, considering the prevalence of farmer suicides in various parts of India. Additionally, the globalization of agriculture through organizations like the WTO has presented new opportunities and challenges for Indian agriculture. The anticipated influx of subsidized and inexpensive food imports could have significant implications for the agricultural sector in India.

Many studies (Bravo Ureta *et al.,* 2014; Oladele, 2011; Weinberger and Lumpkin, 2007) have analyzed the relationship between agricultural diversification and income generation by investigating its contribution to rural incomes and the creation of employment opportunities. However, the contribution of systems of crop diversification has not been extensively delineated. This review aims at providing a better understanding of the contribution of agricultural diversification to income change.

Table 1: Types of diversified agricultural systems

Diversification types	Description of the diversification
Cropping pattern	Cropping pattern refers to the proportion of land under cultivation of different crops at different points in time. This indicates the time and arrangement of crops in a particular land area
High value crops	A change from a less lucrative and environmentally friendly crop or cropping system to a more lucrative and environmentally friendly crop or cropping system
Crop rotations	Crop rotation is the practice of growing a series of different types of crops in the same area across a sequence of growing seasons
Polyculture	Cultivating a field with two or more crop kinds and wild types. Agricultural variety in both space and time.
Mixed farming	The "mixed farming" approach combines agricultural output with cattle, poultry, fisheries, beekeeping, and other pursuits.
Agroforestry	Agroforestry is a sustainable management for the land that increases overall production, combines agricultural crops, tree crops, forest plants, and animals simultaneously, and applies management practices that are compatible with the cultural patterns of the local population.

MATERIALS AND METHODS

A scoping assessment was conducted to examine the impact of agricultural diversification on farm income. A scoping review is a "form of knowledge synthesis that addresses an exploratory research question aimed at mapping key concepts, types of evidence, and gaps in research related to a defined area or field by systematically searching, selecting, and synthesizing existing knowledge," according to Colquhoun *et al.* (2014).

In total, 200 titles were retrieved in the literature search, including titles from scientific articles, reviews, working papers, and books or book chapters. The eligibility assessment of the studies was performed independently by the author. The titles of the studies retrieved in the literature search were screened and divided into two categories, namely, (1) titles considered relevant for the analysis and (2) titles considered not relevant for the analysis. In total, 90 titles were considered relevant for the analysis, and the abstracts associated with these titles were read. From these 90 titles and associated abstracts, 48 studies were downloaded and read in full, whereas the remaining 42 abstracts were considered not relevant, or the studies associated with these abstracts were not accessible for download (even with institutional login). In addition to the studies identified through the literature search, 12 more studies listed in the reference section of the articles previously retrieved were added to the analysis because of their relevance to the topic of the review. This process is known as snowballing, and it has been used in systematic literature studies. It refers to using the reference list of an article or the citations to the article to identify additional articles (Wohlin, 2014).

In total, 60 studies were analyzed in depth and categorized according to the year of publication, country/region covered, type of study (analysis, review, working paper, and report). The process of identifying relevant titles, abstracts, and themes was subjective, based on the judgment of the author. The organization of the selected studies focused on the impact (positive, negative, and neutral) of crop diversification on each dimension of farm income. The resulting literature review offers no new data. Rather, its originality lies in linking separate literature fields, namely crop diversification with farm income.

RESULTS

This study assesses the contribution of agricultural diversification to income change. The main types of crop diversification strategies found in the literature reviewed were changes in cropping patterns including crop rotation, mixed cropping including livestock, polyculture, and crop rotations, diversification into high value crops, mostly fruits and vegetables, and implementation of agroforestry.

Cropping pattern and farm income: Multiple studies consistently show a positive relationship between crop diversity and farm income. For example, Bravo-Ureta *et al.* (2006) conducted research in El Salvador and Honduras (2004) in the Brazilian Amazon, and Makate *et al.* (2016) in Zimbabwe, all finding that crop diversity was associated with increased revenue. Bravo-Ureta *et al.* (2006) projected an average 21 per cent increase in farm income among the analysed sample in El Salvador and Honduras. Makate *et al.* (2016) emphasized the benefits of diversified cropping systems, such as crop rotations and intercropping, which led to improved output and higher farmer income.

Furthermore, cultivating high-value commodities, including vegetables and fruits, has positively impacted income. Douxchamps *et al.* (2015) found that diversification with vegetables and livestock increased family incomes in West Africa. Emana, Afari-Sefa. Huang *et al.* (2009) noted that fruit production in China increased earnings for households with older, poorer members. Similarly, studies by Joshi *et al.* (2004) in South Asian countries and Von Braun *et al.* (1989) in Guatemala emphasized the profitability of fruits and vegetables compared to cereals and their potential to enhance smallholder farmers' income.

While agricultural diversification and cultivating high-value crops have many benefits, several scholars have highlighted associated risks and benefits. Ashby (2001) emphasized the environmental threat posed by commercial farming systems, including the loss of genetic diversity and potential negative impacts from inputs. Ramasamy *et al.* (2008) argued for the necessity of integrated farming systems to generate sufficient income and employment for small and marginal farmers. Abdullah *et al.* (2019) highlighted the multiple revenue-generating activities of smallholder farmers, including crop diversification.

Table 2: Contribution of agricultural Diversification towards Enhancement of farm income

Diversification types	Type of benefit	Specific benefits of crop diversification	Sources
Cropping pattern	Increase income and employment	• Stabilizes farming income. • Improving access to food and livelihoods • Increased productivity • Risk reduction	Makate *et al.* (2016); Bravo-Ureta *et al.* (2006); Douxchamps *et al.* (2015); Dinssa (2015); Joshi *et al.,* (2004); Ashby (2001); Ramasamy *et al.* (2008); Abdullah *et al.* (2019); Devi and Prasher (2018)
High value crops		• Increases economic stability. • Impacting poverty alleviation	Thapa *et al.*/ (2018); Mukherjee (2015); Immink and Alarcon (1991); Mishra *et al.* (2014)
Crop rotations		• Financially benefits farmers. • Increases the soil's organic matter content. • Better nutrient availability and improves yields.	Chase and Duffy (1991); Lavoie *et al.*, (1991); Rahman (2009); Manjunatha *et al.* (2013); Havlin *et al.* (1990)
Polyculture		• Increased income for farmers. • Employment generation • Conservation of natural resources	Perz (2004); Makate *et al.* (2016); Devi and Prasher (2018); Chand (1996); Sharma (2000)
Mixed farming		• Enhance farm productivity, profitability, and nutritional security. • Leading to minimizing risk, increasing production, profit, and employment, and better utilization of resources	Radha *et al.* (2000); Ugwumba *et al.* (2010); Devasenapathy *et al.* (1995); Jayanthi *et al.* (2009); Gopinath *et al.* (2012); Dhaka *et al.* (2009); Channabasavanna and Biradar (2007)
Agroforestry		• Resource utilization • Enhancing farm income • Livelihood security of farmers	Manivannan *et al.* (2011); Waldron *et al.* (2017); Mbow *et al.* (2014); Sharma *et al.* (2016)

The idea of diversifying agriculture toward high-value cash crops, including fruits and vegetables, to stabilize farm incomes, increase employment opportunities, boost exports, and conserve natural resources, has been proposed by Vyas (1996). Jha *et al.* (2009) suggested that increased income leads to a shift in consumer preferences toward high-value food items, encouraging farmers to diversify their crop portfolio accordingly. Additionally, declining yield growth and falling prices of grains, pulses, and oilseeds have encouraged farmers to diversify into horticulture crops, as found by Joshi *et al.* (2004) and Birthal *et al.* (2006).

A multitude of studies has provided evidence that crop diversification yields tangible advantages at a broader scale, encompassing areas such as food and nutrition security, income generation, poverty reduction, and the creation of employment opportunities (Gunasena, 2001; World Bank, 1990). Diversification approaches have been identified by Hayami and Otsuka (1995) to alleviate poverty, generate employment, and preserve the environment. Birthal *et al.* (2006) and FAO (2011) have proposed crop diversification as a strategy for poverty alleviation in agriculture.

Various researchers have supported the positive impact of agricultural diversification on farm income. Barghouti (2004) and Pingali (2004) emphasized the opportunities for income growth, employment generation, and export promotion resulting from diversification toward high-value commodities. Perz (2004) discovered a significant positive correlation between crop diversification and farm income. Makate *et al.* (2016) researched Zimbabwe and established a beneficial relationship between crop variety and farm revenue. Similarly, Devi and Prasher (2018) observed improved growth performance for vegetable crops compared to cereals and pulses in Himachal Pradesh.

Different studies have demonstrated the positive implications of crop diversification for income, nutritional security, and poverty reduction. Mithiya *et*

al. (2018) found that horticulture cultivation in West Bengal generated higher returns per hectare and provided more employment opportunities than cereals and pulses cultivation. According to research by Thapa *et al.,* (2018), families in Nepal that grew high-value crops had higher average monthly per capita spending and lower rates of poverty. In contrast, Mukherjee (2015) discovered lower net revenues from growing high-value crops in West Bengal areas that had a wider variety of crops.

Various factors, including farm size and market participation, influence crop diversification's income benefits. Immink and Alarcon (1991) observed positive and negative effects on income for farmers in Guatemala who diversified from maize to potatoes, wheat, and vegetables, depending on farm size. Mittal and Hariharan (2016) highlighted the positive impact of agricultural diversity and sustainable intensification, leading to increased productivity, risk reduction, market participation, and poverty reduction.

High-value crops and farm income: Agriculture's cropping practices have changed to emphasize high-value cash crops and crops necessary for food security and greater farmer revenue. According to Thapa *et al.* (2018), households in Nepal that raised high-value crops such as vegetables, fruits, spices, or condiments spent an average of 28 per cent more per person each month than homes in non-growing agricultural settings. Furthermore, the headcount ratio of producers of high-value crops was 9 per cent lower, which may have an effect on the reduction of poverty.

However, Mukherjee (2015) conducted a study in West Bengal, India, and found that in more diversified villages, the total net income from growing high-value crops per person was smaller than in less diverse settlements. This suggests that the income generated from high-value crop cultivation may vary depending on the specific context and characteristics of the farming communities.

Similarly, depending on the size of the farm, Immink and Alarcon (1991) discovered that Guatemalan farmers' income was both favorably and adversely impacted by diversification into high-value crops, While farmers who diversified from maize to potatoes, wheat, or vegetables experienced overall revenue gains ranging from 7.8 to 23 per cent, small farmers with less than 1.5 hectares witnessed a 9 per cent decrease in overall income after switching from maize to potatoes.

In Indian agriculture, crop diversification holds significant potential for development. Mishra *et al.* (2014) highlighted the changing cropping pattern and the increasing preference of farmers toward high-value cash crops. The study revealed that the acreage in Indian agriculture had been skewed towards food grain crops, but the production of high-value crops has shown an upward trend.

Crop rotation and farm income: Several studies have investigated the economic and agronomic impact of crop rotation and crop diversification on farm performance. Chase and Duffy (1991) and Lavoie *et al.* (1991) found that crop rotation is associated with positive returns to land and investment and higher farm net income. This suggests that incorporating crop rotation into farming practices can financially benefit farmers.

Rahman (2009) and Manjunatha *et al.* (2013) focused on the efficiency gains of crop diversification compared to monoculture strategies. Their research revealed that farmers who implement crop diversification practices experience improved efficiency in their operations. This indicates diversifying crops can enhance overall farm performance and potentially lead to higher yields and profitability.

In addition to economic benefits, agronomic studies have demonstrated the positive impact of crop rotation on crop productivity. Havlin *et al.* (1990) highlighted that crop rotation improves soil fertility by increasing organic carbon or nitrate levels, which in turn enhances crop yields. Long-term studies have consistently shown crop rotation increases the soil's organic matter content, providing the upcoming crops with better nutrient availability and improving yields.

Polyculture and farm income: Crop diversification has been consistently associated with positive outcomes for farm income and overall agricultural performance. Perz (2004) found a significant positive relationship between crop diversification and farm income, while Makate *et al.* (2016) confirmed a beneficial association between crop variety and farm revenue in Zimbabwe. These findings suggest that diversifying crops can lead to increased income for farmers.

The growth performance of vegetable crops has shown improvement compared to cereals and pulses, as Devi and Prasher's (2018) study in Himachal Pradesh demonstrated. Chand (1996) also highlighted the positive impact of agricultural diversification through high-value crops on cropping patterns, farmer income, and employment in the same region. Sharma (2000) emphasized that diversification contributes to income growth, employment generation, income stability, and conservation of natural resources.

Furthermore, crop diversification has several additional advantages. It enhances farm efficiency, improves labor productivity, optimizes resource utilization, and protects soil fertility, as noted by Ashfaq *et al.* (2008); Mehta (2009) and Mukherjee (2012). The employment and revenue options for crop diversification benefit small and marginal farmers throughout the year (Chand, 1999). Crop diversification has been linked to the creation of high-value agricultural products as well as job prospects, according to Ryan and Spencer (2001).

Regarding specific crops, In the Farrukhabad region of Uttar Pradesh, Singh *et al.* (2001) discovered that agricultural diversification through horticulture, vegetables, and commercial crops presented great possibilities for employment and revenue development. Vegetable production, in particular, proved beneficial for marginal and smallholdings due to its labor-intensive nature. Furthermore, diversification strategies have been identified to alleviate poverty, generate employment, and preserve the environment (Hayami and Otsuka, 1995; Birthal *et al.*, 2006; FAO, 2011).

Agricultural diversification emerges as an environmentally sustainable, cost-effective, and simple approach to mitigating uncertainties small-scale farmers face (Mugendi, 2013). The diversification of agriculture in South Asian nations was examined by (Joshi *et al.*, 2004). and found that Cereals were less lucrative than high-value products like fruits, vegetables, animals, and fisheries. Livestock farming might help smallholder farmers in India's rural areas earn more money.

Mixed farming and farm income: Various studies have examined the benefits of integrated farming systems, highlighting their potential to increase farm income, productivity, and sustainability. Devasenapathy *et al.* (1995) observed that integrating crops such as groundnut, black gram, and maize with other farm enterprises like dairy, fish, poultry, and rabbit rearing resulted in higher net income than conventional cropping systems.

Jayanthi *et al.* (2009) emphasized that integrated farming systems can enhance farm productivity, profitability, and nutritional security while maintaining soil fertility by recycling organic waste from the involved enterprises, a valuable source of essential plant nutrients.

Ugwumba *et al.* (2010) studied the impact of integrated farming systems on farm income. They found that all integrated farming system combinations were more profitable than existing farming practices. They observed that integrating crops, livestock, and fish increased farmers' net income.

Radha *et al.* (2000) conducted a survey-based study on different agricultural and livestock-based farming systems and found that these systems generated more employment opportunities than arable farming. The net returns were also higher in farming systems that integrated agriculture with dairy, poultry, or sheep rearing.

Integrated farming systems have been recognized as an appropriate approach to minimize risk, increase production, profit, and employment, and better utilize resources (Dhaka *et al.*, 2009). Channabasavanna and Biradar (2007) reported that integrated farming systems in Karnataka state involving cropping, vegetables, fisheries, poultry, and goat rearing, resulted in higher productivity and profitability than conventional rice-rice systems.

Behera and Mahapatra (1999) included land-based enterprises such as dairy, poultry, fishery, mushroom cultivation, and biogas production to complement the cropping program and generate additional income and employment for small farmers in Odisha.

Ravisankar *et al.* (2006) found that integrated farming system components comprising field crops, vegetables, floriculture, poultry, fishery, and cattle in low-lying valley areas yielded significant net returns and a high benefit-cost ratio, generating additional employment opportunities.

Gopinath *et al.* (2012) highlighted the importance of integrated farming systems, particularly in rainfed areas, for sustaining productivity and profitability, especially for small and marginal farms facing the challenges of climate change.

Agroforestry and farm income: Integrated fish farming is a diversified and coordinated system and suggested that the integration of mono-crop agriculture with agroforestry, pisciculture, and animal husbandry is essential for resource utilization, enhancing farm income and livelihood security of farmers. (Manivannan *et al.*, 2011)

Availability of tree/shrub fodder leads to increases in milk production and returns. Selling other agroforestry products such as timber, firewood, and fruit, can increase and diversify income and food sources. (Waldron *et al.*, 2017; Mbow *et al.*, 2014; Sharma *et al.*, 2016)

CONCLUSION

Agricultural diversification and cultivating high-value crops have consistently provided potential benefits for small and marginal farmers. These practices, such as crop rotation, intercropping, and cultivating fruits and vegetables, contribute to increased farm income and improved agronomic performance. Additionally, integrated farming systems, which combine various agricultural and livestock enterprises, have been found to enhance income, productivity, employment generation, and sustainability. Studies have demonstrated the positive impact of crop diversification on farm income in different regions, including El Salvador, Honduras, Brazil, Zimbabwe, West Africa, Ethiopia, China, and South Asian countries. Culturing high-value commodities has been consistently associated with increased revenue and improved livelihoods for farmers. Furthermore, Crop diversification offers tangible advantages including macroeconomic employment generation, macroeconomic poverty reduction, and food and nutrition security. However, it is essential to acknowledge the potential risks and trade-offs associated with agricultural diversification. There have been raised concerns regarding the potential environmental consequences associated with commercial farming systems, including the loss of genetic diversity. Moreover, it is necessary to adopt integrated approaches that not only ensure sustainable income generation but also promote productive employment opportunities for small-scale farmers. Comparatively, cultivating high-value cash crops, such as fruits and vegetables, has shown to be profitable and encouraged by declining yield growth and falling prices of traditional staple crops. Furthermore, the adoption of diversified agricultural systems, including horticulture and sericulture, has been highlighted to enhance farmers' income, agricultural performance, and rural development. It is worth noting that the outcomes of crop diversification can vary depending on factors such as farm size, specific crop choices, and local conditions. In summary, while substantial evidence supports the positive correlation between crop diversity and farm income, implementing diversification strategies should consider the specific context and characteristics of farming communities. Careful consideration of local conditions, market dynamics, and sustainable farming practices is crucial to maximizing crop diversification benefits, ensuring long-term income stability, and promoting sustainable agricultural development.

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Research Article

A Comparative Correlation Analysis Study Between Beneficiary and Non-beneficiary Farmers Regarding Adoption of Onion Technology

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ABSTRACT

Onion is one of the important vegetable crop in area and production in Sikar district of Rajasthan. The present study was conducted in Sikar districts of Rajasthan. Sikar district compromised of 13 Panchayat Samities, out of which Laxmangarh, Fatehpur, Khandela and Piprali Panchayat Samities were selected purposively because Front Line Demonstrations on Onion were conducted by the KVK, Fatehpur (Sikar). A total sample of 100 farmers (beneficiary and non-beneficiary) were selected for the study to know about their profile and test their adoption regarding Onion production. After adoption the relationship between their personal profile and adoption was worked out through correlation. The results showed the Relationship between personal attributes of the beneficiary and non-beneficiary farmers with their adoption regarding Onion production technology revealed that age, occupation, education, land holding, farming experience, market orientation and extension contacts were positively and significantly correlated. In case of non-beneficiary farmers their age, occupation, education, land holding, farming experience, market orientation and extension contacts variables were positively and significantly correlated with adoption.

Keywords: Adoption, Correlation, Beneficiary, Non-beneficiary, Front line demonstrations, Onion and technology

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important commercial vegetable crops cultivated extensively in India and it belongs to the family Alliaceae. The primary centre of origin of the Onion is central Asia. Onion is one of the few versatile vegetable crops that can be kept for a fairly long time and can safely withstand the hazards of rough handling including long distance transport. It is liked for its flavour and pungency, which is due to the presence of a volatile oil "Allyl-prophyl-disulphide". The immature and mature bulbs are eaten raw or they may be cooked and eaten as vegetable and commonly used as condiments and spices for flavouring and enriching various cuisines. Sikar region stands at first rank in area of Onion in the state of Rajasthan. In this region the Onion crop is grown in an area of 20827 ha with an annual production of over 442010 tonnes. Sikar district is having maximum area of 10684 ha and production 300579 tonnes of Onion as compared to other districts of Sikar region. (Anonymous, 2019-20). The main objective of the FLD is to demonstrate newly released crop production and protection technology and its management practices on the farmer's field by the scientists themselves before taking it into main extension system of State Department of Agriculture under different ago-climatic zones.

MATERIALS AND METHODS

The present study was conducted in Sikar districts of Rajasthan. Due to the reason that it was having the highest area. Sikar district comprised of 13 Panchayat Samitis Out of which Laxmangarh, Fatehpur, Khandela and Piprali Panchayat Samities were selected

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purposively because Front Line Demonstrations on Onion were conducted by the KVK, Fatehpur (Sikar) in these Panchayat Samities. 16, 24 and 10 farmer's fields where FLDs were conducted in the year 2018-19, 2019-20 and 2020-21, respectively were included in the study as FLD beneficiaries. Similarly, 50 nearby farmers were also selected randomly from same villages who have not benefited from FLDs. These farmers of the villages were named as non- beneficiary farmers. Thus, the total sample size was of 100 respondents consisting of 50 beneficiary and 50 non-beneficiary farmers. An interview schedule was prepared and data were collected using personal interview method. Appropriate statistical tools were applied to interpret the results.

RESULTS AND DISCUSSION

The relationship between the adoption of farmers regarding Onion production technology and independent variables namely age, occupation, education, annual income, size of land holding, market orientation, farming experience and extension contacts was measured by computing "coefficient of correlation" (r). The data have been presented in Table 1. A critical examination of the data presented in Table 1 observed that the market orientation, size of land holding and occupation were positively and significantly correlated with adoption by the beneficiary farmers regarding Onion production technology at 0.05 level of probability whereas their income, age, education, farming experience and extension contacts were significantly correlated at 0.01 level of probability.

Table 1: Relationship between personal attributes of beneficiary and non-beneficiary farmers with their adoption regarding onion production technology (n=100)

Independent variables	Correlation coefficient Beneficiary farmers (n_1=50)	Correlation coefficient Non-beneficiary farmers (n_2=50)
Age	0.419**	0.441**
Occupation	0.306*	0.301*
Education	0.448**	0.304*
Income	0.575**	0.468**
Land holdings	0.327*	0.316*
Farming experience	0.498**	0.459**
Market orientation	0.351*	0.294*
Extension contacts	0.499**	0.318*

**Significant at the 0.01 level of probability
*Significant at the 0.05 level of probability

The data given in Table 1 explained that the age was positively and significantly related with the adoption by beneficiary and non-beneficiary farmers regarding Onion production technology at 1 per cent level of significance. It means that age had influenced the adoption of beneficiary farmers and non- beneficiary farmers. The findings of the study are in conformity with the findings of Badhala and Jat (2014); Yadav (2021) and Jangir *et al.* (2023).

The data given in Table 1 revealed that the occupation was related positively and non-significantly with the adoption by beneficiary and non-beneficiary farmers at 5 per cent level of significance. It means that the occupation has not affected the adoption of onion production technology. The findings of the study are in conformity with the findings of Badhala and Jat (2014) and Samota *et al.* (2019).

A perusal to the data in Table 1 observed that the education was related significantly with the adoption by beneficiary farmers at 1 per cent level of significance and non-beneficiary farmers regarding Onion production technology at 5 per cent level of significance. This might be due to the fact that all the respondents both beneficiary and non-beneficiary farmers were educated which might have improved their adoption regarding Onion production technology.

The findings of the study were in conformity with the findings of Jadav and Munshi (2004), Badhala and Jat (2014), Badhala and Bareth (2014) Godekar and Mazhar (2019); Yadav (2021) and Jangir *et al.* (2023).

The data given in Table 1 concluded that the income was non-significantly related with the adoption by beneficiary and non-beneficiary farmers regarding Onion production technology at 1 per cent level of significance. It means that income had not influenced the adoption by beneficiary and non- beneficiary farmers. The findings of the study are in conformity with the findings of Chavhan *et al.* (2019) and Jangir *et al.* (2023).

The data presented in Table 1 showed that the size of land holding of the beneficiary and non-beneficiary farmers was found non-significantly related with their adoption regarding Onion production technology at 5 per cent level of significance. It means that size of land holding had not affected the adoption.

The findings of the study are in conformity with the findings of Jadav and Munshi (2004); Meena (2010); Badhala and Jat (2014); Godekar and Mazhar (2019) and Jangir *et al.* (2023).

The data given in the Table 1 revealed that farming experience was positively and significantly related with the adoption by beneficiary and non-beneficiary farmers regarding Onion production technology at 1 per cent level of significance. It showed that farming experience has affected the adoption. The findings of the study are in conformity with the findings of Badhala and Bareth (2014).

A reference to the data in Table 1 explained that the market orientation was positively and significantly related with the adoption by beneficiary and non - beneficiary farmers regarding Onion production technology at 5 per cent level of significance. This might be due to the fact that all the respondents both beneficiary and non-beneficiary farmers were having good knowledge about market which might have improved their adoption regarding Onion production technology. The findings of the study are in conformity with the findings of Jadav and Munshi (2004)

A perusal of the data in the Table 1 observed that education was related significantly with the adoption by beneficiary farmers at 1 per cent level of significance and non - beneficiary farmers at 5 per cent level of significance regarding Onion production technology. The findings of the study are in conformity with the findings of Jadav and Munshi (2004); Badhala and Jat (2014); Badhala and Bareth (2014) and Jangir *et al.* (2023).

CONCLSION

In case of beneficiary farmers it was found that the occupation, land holding and market orientation were positively and significantly correlated with the adoption of the beneficiary farmers about Onion production technology at 0.05 level of probability and age, income, education, extension contacts and farming experience variables were positively and significantly correlated with the adoption level of the beneficiary farmers about Onion production technology at 1% level of significance. In case of non-beneficiary farmers it was found that occupation, land holding, education, extension contacts and market orientation variables were positively and significantly correlated with the adoption of non-beneficiary farmers about Onion production technology at 0.05 level of probability and age, income and farming experience variables were positively and significantly correlated with the adoption about Onion production technology at 1% level of significance.

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Research Article

Standardization of Technique for the Wet Preservation of Diseased Plant Specimens

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ABSTRACT

Experiments were conducted during 2019-20 and 2020-21 to standardize technique of wet preservation for plant specimens without losing actual disease symptoms of the plant tissues. Succulent leaf and hardy samples in triplicate for each disease were dipped in 4-5 per cent copper sulphate ($CuSO_4$) solution for 4-6 hours. Finally, the samples were stored in formalin and different concentration of sulfurous acid (H_2SO_3), sterilized distilled water and tap water. Observations were recorded at monthly interval on percent bleaching and visibility of disease symptom. The succulent samples of diseased leaves stored in 0.5 per cent H_2SO_3 solution and sterilized distilled water exhibited minimum bleaching (33.33% and 16.67% respectively) with highest visibility of disease symptoms amounting of 56.67 and 36.67 per cent respectively after 6 months. However, 1.0 per cent concentration of H_2SO_3 solution was found most effective to preserve the hardy diseased leaves and stem samples which cause least bleaching (6.67%) and exhibited highest visibility of actual disease symptom (83.33%) up to 6 months.

Keywords: Copper sulphate, Green colour, Plant specimen, Wet preservation

INTRODUCTION

It is very important to preserve a diseased plant sample as a record for reference in museums, precise comparative study in colleges during practical classes of botany or phytopathology, and for demonstration purposes. Various methods are used to preserve specimens of diseased plant or its parts for the preparation of herbarium which depends upon the type and purpose of specimen we have (Johnson, 1977; Morton, 2005; Australian National Botanic Gardens, 2016). Some specimens can be mounted on sheets of thick paper after drying properly whereas others stored in an airtight jar containing liquid preservative such as formalin, alcohol, glycerin, etc. (Simmons, 1995; British Columbia Ministry of Forests, 1996; Bean, 2006; Queensland Herbarium, 20016). Furthermore, colour retention of the preserved specimens is again a vital thing which should represent actual appearance under natural field conditions (Blaydes, 1937; Keefe, 1926). Green colour preservation of dried plant specimens exhibiting symptoms of viral diseases is significant since it comprises variations in colour such as mosaic, mottle, chlorotic spots, ring or band patterns, vein yellowing, vein banding to color break of flowers. But these symptoms may generally vanished or become unclear in the drying process with traditional method (Riker and Riker, 1936; Tuite, 1969).

Natural green colour of plant specimens is retained by specialized methods during wet preservation which is quite difficult in most instances. In addition to retain natural green colour, these special techniques can also preserve the brown, reddish-brown and yellow coloured portion of diseased leaf, stem or fruit. Studies have been done to preserve the natural color of plant tissues infected with virus using calcium chloride (Barradas and Silberschmidt, 1973; Bos, 1977; Horvath and Besada, 1980) or magnesium perchlorate (Hagborg, 1971). The principle involved in the process of preserving the green colour is described in literatures where samples were processed in saturated copper

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sulphate solution followed by stored in glycerin-formalin solution or any of the common media (Woods, 1897). Webb (1982) described the method to biologically fix and permanently retain the green colour of plant tissues comprising coniferous needles, leaves of holly, mosses, lichens and ferns. Most of the farmers and agricultural students unable to identify the disease in conventionally preserved dried or wet plant specimens exhibiting ambiguous symptoms due to bleaching of tissues. Therefore, experiment was conducted to preserve the plant or its parts for longer duration aiming to retain natural green colour of the specimen without damaging the disease symptoms.

MATERIALS AND METHODS

Samples of diseased plant parts from various field and fruit crops were collected from research farm of Dr. D R Bhumbla Regional Research Station of Punjab Agricultural University, Ballowal Saunkhri. Collected diseased samples were categorized in i. succulent (diseased leaf of wheat, pea, groundnut, greengram, mustard, turmeric, tomato, potato, paddy, maize, cucurbit etc.) and ii. hard (stalk of maize and sugarcane, stem and twig of brinjal, tomato, twig of citrus, mango guava, fruit of pomegranate, guava, apple, mango etc.) type. Five plant samples of each disease were chosen and washed in running tap water to remove dirt or soil adhered on it. Among these samples, three were finally selected for each disease and subjected for further treatments. These triplicate samples of each disease were presoaked in 4-5 per cent concentrations of copper sulphate ($CuSO_4$) solution for 4-6 hours depending upon type of sample (succulent samples of leaves in 4% for 4 hours & hardy samples in 5% for 5-6 hours) followed by six to eight serial washing (one hour for each wash) with autoclaved water (Woods 1897; Keefe, 1926). The finally washed samples of different presoaking treatments were stored in formaldehyde and sulphurous acid (H_2SO_3) solution of different concentrations and three replications were made for each disease sample. Samples were visually examined at one month intervals to observe percent bleaching of sample and visibility of disease symptom. The data of percent values for bleaching of sample and symptom visibility were recorded at monthly intervals. Data were transformed and analyzed in two factor ANOVA.

Table 1: Percent bleaching of preserved succulent samples

Treatments	Duration of preservation (month)								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Mean**
T1: Soaking in 5% $CuSO_4$ followed by washing + storing in 0.5% H_2SO_3	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	13.33 (21.14)	23.33 (28.78)	33.33 (35.22)	56.67 (48.85)	76.67 (61.21)	25.46
T2: Soaking in 5% $CuSO_4$ followed by washing + storing in 1.0% H_2SO_3	0.00 (0.00)	0.00 (0.00)	20.00 (26.07)	43.33 (41.15)	66.67 (54.99)	76.67 (61.21)	93.33 (77.71)	100.00 (90.00)	50.00
T3: Soaking in 5% $CuSO_4$ followed by washing + storing in 1.5% H_2SO_3	0.00 (0.00)	16.67 (23.85)	56.67 (48.93)	83.33 (66.64)	96.67 (83.85)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	69.17
T4: Soaking in 5% $CuSO_4$ for followed by washing + storing in distilled water	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	13.33 (21.14)	16.67 (23.85)	36.67 (37.22)	50.00 (44.99)	14.58
T5: Soaking in 5% $CuSO_4$ followed by washing + storing in tap water	0.00 (0.00)	3.33 (6.14)	16.67 (23.85)	26.67 (30.99)	36.67 (37.22)	46.67 (43.08)	56.67 (48.93)	63.33 (52.86)	31.25
T6: Washing + storing in 4% formaldehyde	6.67 (12.29)	23.33 (28.78)	43.33 (41.15)	70.33 (56.99)	86.67 (68.85)	96.67 (83.85)	100.00 (90.00)	100.00 (90.00)	65.83
T7: Washing + storing in distilled water	0.00 (0.00)	0.00 (0.00)	10.00 (14.99)	23.33 (28.78)	33.33 (35.22)	43.33 (41.15)	56.67 (48.93)	93.33 (81.14)	32.50
T8: Washing + storing in tap water	0.00 (0.00)	10.00 (14.99)	26.67 (30.99)	40.00 (39.15)	56.67 (48.85)	66.67 (55.07)	93.33 (81.14)	100.00 (90.00)	49.17
	T	**DOP**	**T x DOP**						
CD at 5%	3.41	3.41	9.66						
SEm±	1.22	1.22	3.45						

*T= Treatments, DOP=Duration of preservation in months; **Data in parenthesis is angular transformed value

RESULTS AND DISCUSSION

The effect of various treatments on preservation of samples up to eight months are depicted here as percent bleaching of samples (Table 1 and 3) and visibility of disease symptom (Table 2 and 4). Results exhibited that most of the samples in formalin get damaged and bleached as compare those which are kept in diluted H_2SO_3 solution.

The presoaking treatment in copper sulphate ($CuSO_4$) varied with type of samples. Sterilized distilled water kept the succulent samples of diseased leaves in good condition for 6 months with significant lowest bleaching (16.67%) but highest visibility of actual disease symptoms (56.67%) with 33.33 per cent bleaching was observed in 0.5 per cent of sulfuric acid solution. The samples which were stored in 1.5 per cent H_2SO_3 showed 100 per cent bleaching and zero visibility of actual disease symptoms after 6 months of preservation was recorded. Furthermore, only one treatment where samples preserved in sterilized distilled water exhibited less than 60 per cent bleaching even after 8 months of storage but visibility of actual disease symptoms was lesser (16.67%) than those preserved in 0.5 per cent of sulfuric acid solution (23.33%) (Table 1 and 2).

The 1 per cent concentration of H_2SO_3 solution was found to be effective to preserve the hardy diseased leaves and stem samples for 6-8 months. After six months of storage, minimum bleaching (3.33%) was recorded in those samples which were preserved in 0.5 per cent of sulfuric acid solution followed by its 1.0 per cent concentration and sterilized distilled water (6.67%). However, maximum visibility of actual disease symptoms (83.33%) was noticed with 1.0 per cent concentration of H_2SO_3 solution followed by those samples kept in sterilized distilled water (80%). Moreover, the samples which were stored in 1.5 per cent H_2SO_3 solution showed highest bleaching (76.67%) with poor visibility of actual disease symptoms (33.33%) after 6 months of preservation. Three treatments where samples preserved in 0.5 per cent, 1.0 per cent of sulfurous acid solution and sterilized distilled water respectively exhibited less than 20 percent bleaching (13.33%, 16.67% and 16.67%) even 8 months of storage. However, more than 60 per cent (66.67%) visibility of actual disease symptoms was reported in

Table 2: Percent visibility of actual disease symptoms on preserved succulent samples

Treatments	Duration of preservation (month)								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Mean**
T1: Soaking in 5% $CuSO_4$ followed by washing + storing in 0.5% H_2SO_3	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	73.33 (59.21)	63.33 (52.78)	56.67 (48.85)	46.67 (43.08)	23.33 (28.78)	70.42
T2: Soaking in 5% $CuSO_4$ followed by washing + storing in 1.0% H_2SO_3	100.00 (90.00)	100.00 (90.00)	66.67 (55.07)	26.67 (30.99)	16.67 (23.85)	10.00 (18.43)	3.33 (6.14)	0.00 (0.00)	40.42
T3: Soaking in 5% $CuSO_4$ followed by washing + storing in 1.5% H_2SO_3	100.00 (90.00)	66.67 (54.99)	33.33 (35.22)	13.33 (21.14)	3.33 (6.14)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	27.08
T4: Soaking in 5% $CuSO_4$ for followed by washing + storing in distilled water	100.00 (90.00)	100.00 (90.00)	66.67 (54.99)	56.67 (48.93)	50.00 (44.99)	36.67 (37.22)	26.67 (30.99)	16.67 (23.85)	56.67
T5: Soaking in 5% $CuSO_4$ followed by washing + storing in tap water	100.00 (90.00)	80.00 (63.93)	53.33 (46.92)	50.00 (44.99)	43.33 (41.15)	36.67 (37.22)	30.00 (33.21)	10.00 (18.43)	50.42
T6: Washing + storing in 4% formaldehyde	86.67 (68.85)	70.00 (56.99)	50.00 (44.99)	30.00 (33.21)	6.67 (12.29)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	30.42
T7: Washing + storing in distilled water	100.00 (90.00)	93.33 (77.71)	66.67 (54.99)	40.00 (39.23)	33.33 (35.22)	30.00 (33.21)	20.00 (26.57)	3.33 (6.14)	48.33
T8: Washing + storing in tap water	93.33 (77.71)	76.67 (61.92)	63.33 (52.78)	53.33 (46.92)	40.00 (39.15)	30.00 (33.21)	6.67 (12.29)	0.00 (0.00)	45.42
	T	**DOP**	**T x DOP**						
CD at 5%	2.92	2.92	8.26						
SEm±	1.04	1.04	2.95						

*T=Treatments, DOP=Duration of preservation in months; **Data in parenthesis is angular transformed value

Table 3: Percent bleaching of preserved hard samples

Treatments	Duration of preservation (month)								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Mean**
T1: Soaking in 5% $CuSO_4$ followed by washing + storing in 0.5% H_2SO_3	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	3.33 (6.14)	10.00 (18.43)	13.33 (21.14)	3.33
T2: Soaking in 5% $CuSO_4$ followed by washing + storing in 1.0% H_2SO_3	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	6.67 (12.29)	13.33 (21.14)	16.67 (23.85)	4.58
T3: Soaking in 5% $CuSO_4$ followed by washing + storing in 1.5% H_2SO_3	0.00 (0.00)	16.67 (23.85)	33.33 (35.22)	46.67 (35.22)	70.00 (56.99)	76.67 (61.22)	83.33 (66.14)	96.67 (83.85)	52.92
T4: Soaking in 5% $CuSO_4$ for followed by washing + storing in distilled water	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	3.33 (6.14)	6.67 (12.29)	10.00 (18.43)	16.67 (23.85)	4.58
T5: Soaking in 5% $CuSO_4$ followed by washing + storing in tap water	0.00 (0.00)	0.00 (0.00)	6.67 (12.29)	13.33 (21.14)	16.67 (23.85)	26.67 (30.99)	36.67 (37.22)	40.00 (39.23)	17.50
T6: Washing + storing in 4% formaldehyde	0.00 (0.00)	3.33 (6.14)	23.33 (28.78)	33.33 (35.22)	43.33 (41.15)	53.33 (46.92)	63.33 (52.78)	73.33 (59.00)	36.67
T7: Washing + storing in distilled water	0.00 (0.00)	0.00 (0.00)	6.67 (12.29)	10.00 (18.43)	13.33 (21.14)	20.00 (26.57)	26.67 (30.99)	33.33 (35.22)	13.75
T8: Washing + storing in tap water	0.00 (0.00)	6.67 (12.29)	13.33 (21.14)	26.67 (30.99)	43.33 (41.15)	53.33 (46.92)	60.00 (50.77)	60.00 (50.77)	32.92
	T	**DOP**	**T x DOP**						
CD at 5%	2.75	2.75	7.78						
SEm±	0.98	0.98	2.78						

*T= Treatments, DOP=Duration of preservation in months; **Data in parenthesis is angular transformed value

Table 4: Percent visibility of actual disease symptoms on preserved hard samples

Treatments	Duration of preservation (month)								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Mean**
T1: Soaking in 5% $CuSO_4$ followed by washing + storing in 0.5% H_2SO_3	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	66.67 (54.78)	53.33 (46.92)	46.67 (43.08)	43.33 (41.15)	33.33 (35.22)	67.92
T2: Soaking in 5% $CuSO_4$ followed by washing + storing in 1.0% H_2SO_3	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	83.33 (66.14)	73.33 (59.00)	66.67 (54.78)	90.42
T3: Soaking in 5% $CuSO_4$ followed by washing + storing in 1.5% H_2SO_3	100.00 (90.00)	73.33 (59.21)	66.67 (54.78)	63.33 (52.86)	43.33 (41.15)	33.33 (35.22)	26.67 (30.99)	6.67 (8.86)	51.67
T4: Soaking in 5% $CuSO_4$ for followed by washing + storing in distilled water	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	86.67 (72.29)	83.33 (66.14)	80.00 (63.43)	70.00 (56.79)	60.00 (50.77)	85.00
T5: Soaking in 5% $CuSO_4$ followed by washing + storing in tap water	100.00 (90.00)	80 (63.93)	73.33 (59.00)	66.67 (54.78)	63.33 (52.78)	56.67 (48.85)	50.00 (44.99)	46.67 (43.08)	67.08
T6: Washing + storing in 4% formaldehyde	96.67 (83.85)	86.67 (68.85)	66.67 (84.78)	53.33 (46.92)	46.67 (4308)	40.00 (19.15)	36.67 (37.22)	30.00 (33.21)	57.08
T7: Washing + storing in distilled water	100.00 (90.00)	100.00 (77.71)	100.00 (61.22)	100.00 (54.78)	63.33 (52.78)	46.67 (43.08)	36.67 (37.22)	26.67 (30.99)	63.75
T8: Washing + storing in tap water	96.67 (83.85)	86.67 (68.85)	73.33 (59.00)	63.33 (52.78)	53.33 (46.92)	40.00 (39.23)	33.33 35.01)	20.00 (26.57)	58.33
	T	**DOP**	**T x DOP**						
CD at 5%	2.76	2.76	7.82						
SEm±	0.99	0.99	2.79						

*T= Treatments, DOP=Duration of preservation in months; **Data in parenthesis is angular transformed value

those samples preserved in 1.0 percent sulfurous acid solution (Table 4). All treatments except 1.0 per cent of sulfurous acid solution and sterilized distilled water showed significant bleaching of preserved hard samples after 6 months while significant difference in visibility of actual disease symptoms was observed in all treatments for aforesaid duration.

Limited study has been done where specimens exhibit clear symptoms of disease and retain green colour of healthy tissues after preservation of diseased plant samples. In spite of it little literature is available which support our study. Kyriakopoulou (1982) described the method for the preparation of dry herbarium specimens using calcium chloride and its reliability to preserve natural green colour. A technique for the preservation of green colour was ascribed to Webb (1982) where tissues of plant the samples comprising coniferous needles, leaves of holly, mosses, lichens and ferns were dipped in a solution. It included water, at least one monohydric alcohol and one preservative either sulphurous acid or formalin, or ethylene glycol. One more compound either cupric sulphate or cupric chloride or cupric acetate etc. for to biologically fix and retain the green color of the leaves permanently. The similar study was conducted by Woods (1897) where he kept the in specimens 5 per cent boiled copper sulphate solution to get bluish green tint followed by removal of free copper not in combination with chlorophyll. Afterward samples were thoroughly washed and kept in glycerin-formalin solution or any of the common media for preservation. Brown *et al.* (1991) and Yamauchi and Watada (1991) worked on green colour preservation and capability of chlorophyll retention during their study on processing of parsley leaves. A technique was given by Guzman *et al.* (2002) to retain green colour in vegetable tissues by adding zinc and copper chlorides which decreased the breakdown of chlorophyll.

The technique in present study is comparatively easy and safe which may be beneficial to prepare phytopathological herbaria with an advantage of preserving the natural green color of plant tissues without losing actual appearance of particular symptom of disease.

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Research Article

A Multiple Regression Analysis of Dimensions of Job Satisfaction and Subjective Well being, Life Satisfaction and Emotional Affect of Adults

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ABSTRACT

The present study was undertaken in Jorhat town area, Assam. The study aimed to explore the impact of dimensions of job satisfaction on subjective well being and its components. The dimensions of job satisfaction considered under the study were Salary and facilities, supervision, promotion, work opportunities and human relations. Life satisfaction, positive affect and negative affect were the components of subjective well being. A total of 384 adults aged 18 years and above working in various government and private organizations were the study sample selected using techniques of Cochran's formula for infinite population. Tools used for the investigation were Asha job satisfaction scale, satisfaction with life scale, positive affect and negative affect scale–short form. Upon completion of data collection and analysis, the results indicated that job satisfaction and its dimensions explained 4.40 per cent of the variability of subjective well being in the government employees and 48.20 per cent of the variability of subjective well being in the private employees. Work opportunities, human relations and overall job satisfaction were found to be the best predictors of components of subjective well being in the government employees. Whereas, supervision, human relations and overall job satisfaction were the best predictors of components of subjective well being in the private employees.

Keywords: Job satisfaction, Subjective well being, Life satisfaction, Positive affect, Negative affect

INTRODUCTION

Subjective well being (SWB) is one of the major ways to assess the quality of life of societies, along with economic and social indicators. It measures the well being and life satisfaction of people directly with individual approaches. Diener (2000) defines subjective well being as "people's cognitive and affective evaluations of their lives". It is the value of self evaluation about how good one feels and how well one thinks his/her life is going on. The 'cognitive appraisal' describes how we consider our global life satisfaction and our satisfaction with specific domains such as family life, career, marital life etc. The 'affective appraisal' concerns our emotional experience i.e. high SWB is the experience of frequent and intense positive states (e.g. joy, hope, and pride), and the general absence of negative ones (e.g. anger, jealousy, and disappointment). Individuals who feel satisfied with their lives, and who frequently experience positive feelings such as joy, contentment, and hope, are more inclined to be enjoying a high quality of life. Measures of SWB can be used to inform policy decisions, educational curricula and social initiatives that contribute to a better quality of life for citizens across the world. As such, the area of SWB is of fundamental importance to human development. Higher SWB is known to lead to better health benefits and perhaps even increased longevity.

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Work is considered as a pivotal aspect of life. People who are satisfied with their jobs are the significant assets to an organization, whereas the dissatisfied employees may be the major liabilities. Locke (1976) defines job satisfaction as "a positive emotional state resulting from the appraisal of one's job or it's experiences". Many studies state that job satisfaction is directly linked to productivity as well as to personal well-being of the employees. Individuals may experience stress from their work when it makes high mental, physical, emotional, and other demands, while affording only few job resources such as support, autonomy, and feedback. This subsequently leads to poor SWB and health problems. Research has also found that stressful work characteristics are related to negative feelings, exhaustion and general dissatisfaction. A study by Tait *et al.* (1989) found a correlation of 0.44 between job satisfaction and life satisfaction. Another meta-analysis study done by Thoresen *et al.* (2003) found that job satisfaction was related to both positive affect and the absence of negative affect.

There are a number of studies exploring the relationship of global job satisfaction and one or more components of SWB. According to the principle of compatibility, the relationship between two variables will be strongest (or otherwise) when both are assessed at the same level of specificity, time and context (Fishbein and Ajzen, 1974). That means variables are better studied in a similar global level or component level. Therefore the current study had been undertaken to explore the impact of job satisfaction on subjective well being, taking into account component levels of both the study variables during analysis and interpretation.

MATERIALS AND METHODS

Sample: A total of 384 adults aged above 18 years and working in various government (N=192) and non government or private (N=192) organizations. in the Jorhat town area, Assam were selected for the study, using Cochran's formula for infinite population. The Public and Autonomous organisations selected for drawing respondents for the study are referred to as government organisations in this study, namely, schools, colleges, national and state level banks, district administrative offices and government research offices. The private organisations that are run by individuals and companies for profit and are not owned or operated by the government are referred to as the non-government organisations in this study. Private schools, private colleges, private banks, retail trades and private maintenance and repair trades are the non government organisations selected for drawing respondents for the study.

Tools: The Asha Job Satisfaction Scale was used to measure the dimensions of job satisfaction of the respondents; Satisfaction with Life Scale was used to determine the levels of life satisfaction; and Positive Affect and Negative Affect Scale–short form was used to find out the levels of positive affect and negative affect experienced by the respondents.

Ethical consideration: Respondents were assured that the data collected will be used as a part of a combined statistical report, therefore no individual data that links the respondents or the organizations' identity would be disclosed anywhere. Respondents were approached for data collection after informed consent from them and the administrative heads of the selected organizations. The study was undertaken with approval from competent committee of research advisory of Assam Agricultural University, Jorhat, Assam.

RESULTS AND DISCUSSION

Multiple linear regression was applied to see the impact of the five dimensions of job satisfaction contributing towards life satisfaction, positive affect, negative affect and subjective well being of government as well as private employees of Jorhat. The predictors in the regression models given below are Job satisfaction (JS) and its five dimensions namely, salary and facilities, supervision, Promotion, work opportunities, and Human relations. The dependent variables in the regression models are Subjective well being and its components viz. life satisfaction, positive affect and negative affect.

Table 1 and 2 presents the results of investigation of Job satisfaction and its five dimensions as potential predictors of subjective well being in government organizations. Table 2. with R value=0.694 shows a moderate level of prediction. The salient inferences that could be drawn from the above analysis are-

The predictor variables explain only 4.40 per cent of the variability of SWB of the government

Table 1: Results of multiple regression analysis investigating job satisfaction and its five dimensions as potential predictors of subjective well being in government organisations

Predictor variables	Unstandardized coefficient beta	Std. error	T	Sig.	R	R square
Salary and facilities	.018	.055	.322	.748		
Supervision	.087	.070	1.245	.215		
Promotion	.054	.062	.863	.389	.210	.044
Work-opportunities	.172	.077	2.222	.027		
Human relations	-.152	.152	-1.001	.318		
Job satisfaction	-.090	.118	-.760	.448		

Table 2: Results of multiple regression analysis investigating job satisfaction and its five dimensions as potential predictors of subjective well being in private organisations

Predictor variables	Unstandardized coefficient beta	Std. error	T	Sig.	R	R square
Salary and facilities	-.416	.071	-5.858	.000		
Supervision	-.322	.086	-3.752	.000		
Promotion	.302	.084	3.612	.000	.694	.482
Work-opportunities	-.241	.128	-1.885	.061		
Human relations	-.540	.082	-6.583	.000		
Job satisfaction	.697	.084	8.271	.000		

respondents. The rest 95.60 per cent of the variation is caused by factors other than the predictors included in this model. Whereas, in case of the private employees, the predictor variables explain 48.20 per cent of the variability of SWB in them. And the rest 51.80 per cent of the variation is caused by factors other than the predictors included in this model. Among all the potential predictors present in the regression model, satisfaction with Work-opportunities at job is the best predictor of SWB in the respondents with a beta weight of 0.172 (17.20%) in case of the government employees, at $p<0.05$ level of significance. This means that every 1 unit increase in satisfaction with 'Work-opportunities' leads to 0.172 unit increase in SWB, which infers that the respondents that were highly satisfied with work-opportunities at work had higher SWB. Job satisfaction is an important domain of life satisfaction that can help predict the subjective wellbeing count of people. Having opportunities at work to present one's creativity and innovation can give an individual to carry on a satisfied life with a purpose. Many government employees stated during the interviews that they felt very good about the fact that they were working in the field of their own subject of interest and passion. This might lead to higher SWB. Harter *et al.* (2003) reported in his study that employee perceptions of opportunities to learn and grow at work can lead to positive affective constructs such as well-being. Warr (1987) also opined that a combination of personal and environmental influences act to facilitate or constrain individual well-being. Opportunities to use one's skills can be important environmental influences leading to better well being.

In case of private employees, Job satisfaction as a whole is the best predictor of SWB with a beta weight of 0.697(69.70%), at $p<0.0001$ level of significance. This means that for every 1 unit increase in satisfaction with job as a whole leads to 0.697 unit increase in SWB. Job satisfaction contributing significantly towards SWB in case of private employees can be supported by the research studies showing positive link between positive organizational commitment and better well-being (Begley and Czajka, 1993; Romzek, 1989). Recent studies have found that people regard work as a calling, enjoyable, fulfilling, and socially useful aspect in life. People look in their work for meaning and personal development. A job gives an identity to the person,

Table 3: Results of multiple regression analysis investigating job satisfaction and its five dimensions as potential predictors of life satisfaction in government organisations

Predictor variables	Unstandardized coefficient beta	Std. error	T	Sig.	R	R square
Salary and facilities	.010	.095	.111	.912		
Supervision	.297	.121	2.458	.015		
Promotion	-.132	.108	-1.227	.221	.357	.127
Work-opportunities	.059	.134	.439	.661		
Human relations	-.654	.262	-2.502	.013		
Job satisfaction	.494	.204	2.425	.016		

Table 4: Results of multiple regression analysis investigating job satisfaction and its five dimensions as potential predictors of life satisfaction in private organisations

Predictor variables	Unstandardized coefficient beta	Std. error	T	Sig.	R	R square
Salary and facilities	.445	.184	2.424	.016		
Supervision	-1.663	.222	-7.480	.000		
Promotion	-.019	.216	-.088	.930	.693	.480
Work-opportunities	1.615	.330	4.892	.000		
Human relations	-.956	.212	-4.501	.000		
Job Satisfaction	.817	.218	3.746	.000		

income, avenues, opportunities for social interaction and support, time structure, engaging in challenges and newer possibilities (Henry, 2004; Jahoda 1982; Avolio and Sosik, 1999). This can explain the reason behind Job satisfaction and work opportunities being important predictors of SWB in the respondents of the study.

Table 3 and Table 4 with R value = 0.357 and 0.693 respectively, indicates a moderate level of prediction. The salient inferences that could be drawn from these tables are:

The predictor variables explain 12.70 per cent of the variability of life satisfaction (LS) of the government employees (since R square = 0.127). The rest 87.30 per cent of the variation is caused by factors other than the predictors included in this model. Whereas, the predictor variables explain 48 per cent of the variability of life satisfaction of the private employees. And the rest 52 per cent of the variation is caused by factors other than the predictors included in this model. Among all the potential predictors present in the regression model, satisfaction with Human relations at job is the best predictor of LS in the government employees with a beta weight of 0.654 (65.40%), in negative value, at $p<0.05$ level of significance. This means that every 1 unit increase in satisfaction with 'Human relations' leads to 0.654 unit decrease in LS. As reported in the interviews, many participants preferred a millennial lifestyle, where they have only a limited circle of social relations. They were certain that they were satisfied with the limited people they spend quality time with. This can also be the result of increased practice of social distancing during the pandemic. But as we all know, human beings are inherently social and friendships in terms of better intensity and quality are positively associated to life satisfaction (Amati *et al.,* 2018). Therefore though a person thinks that he is satisfied with the minimum social interactions he have, but in actual the limited social interactions might have negative impact on his/her emotional health, and thus lowering their life satisfaction. In such cases, human relations may predict lowered life satisfaction in the respondents.

Whereas in case of the private employees, satisfaction with Supervision at job is the best predictor of LS, with a beta weight of 1.663 (16.63%), but in negative value, at $p<0.0001$ level of significance. This

Table 5: Results of multiple regression analysis investigating job satisfaction and its five dimensions as potential predictors of experience of positive affect for government employees

Predictor variables	Unstandardized coefficient beta	Std. error	T	Sig.	R	R square
Salary and facilities	.113	.060	1.873	.063		
Supervision	.178	.077	2.306	.022		
Promotion	-.016	.069	-.234	.815	.247	.061
Work-opportunities	.154	.085	1.806	.073		
Human relations	-.054	.166	-.326	.745		
Job satisfaction	-.206	.130	-1.587	.114		

Table 6: Results of multiple regression analysis investigating job satisfaction and its five dimensions as potential predictors of experience of positive affect in private employees

Predictor variables	Unstandardized coefficient beta	Std. error	T	Sig.	R	R square
Salary and facilities	.082	.086	.957	.340		
Supervision	-.094	.104	-.901	.369		
Promotion	-.062	.101	-.611	.542	.486	.236
Work-opportunities	.245	.155	1.583	.115		
Human relations	.313	.100	3.142	.002		
Job satisfaction	.222	.102	2.174	.031		

means that for every 1 unit increase in satisfaction with Supervision leads to 1.663 decrease in LS of the respondents. A good superior is motivating, yet challenging because he/she has higher performance expectations and continues to identify areas for improvement in the employee for their optimum performance. In private organizations, employees need to be consistently attentive, competent and be skilful to achieve targets of profit. Many employees might not feel very pleasant about meeting deadlines, and thriving for better performance consistently, which may lead to general stress and therefore it might lower life satisfaction in the private employees.

Table 5 with R value = 0.247 and Table 6. with R value= 0.486 indicates a good level and moderate level of prediction investigating the dimensions of job satisfaction and total job satisfaction as potential predictors of experience of Positive Affect (PA). The salient inferences that could be drawn from these tables are–

The predictor variables explain only 6.10 per cent of the variability of experience of positive affect of the government employees (since R square = 0.061). And the rest 93.90 per cent of the variation is caused by factors other than the predictors included in this model. Whereas in case of private employees, the predictor variables explain 23.60 per cent of the variability of experience of PA and the rest 76.40 per cent of the variation is caused by factors other than the predictors included in this model.

Among all the potential predictors present in the regression model, total Job satisfaction is the best predictor of experience of PA in the government employees, with a beta weight of 0.206 (21%), but in negative value. This means that every 1 unit increase in Job satisfaction as a whole leads to 0.206 decrease in experience of PA. Therefore the respondents that were highly satisfied with their jobs as a whole had lower experience of positive affect in government employees. An employee content with his/her job generally experiences positive emotions, since job satisfaction is an affective reaction towards one's job. In case of the government employees, if they are too content or have been content for a longer time with what they do, it might also mean that they are in a comfort zone and there has been no new challenges faced or no new

things tried. Participants working in government organizations can be content with their jobs for many reasons such as status or good salary. But, being comfortable with a high level of job satisfaction might limit the release of dopamine from newer experiences such as trying new job roles that are challenging. Therefore total job satisfaction can be an important predictor of lowered positive affect in government employees.

Satisfaction with Human relations at job is the best predictor of PA in the private employees, with a beta weight of 0.313(31.30%), at $p<0.001$ level of significance. This means that for every 1 unit increase in satisfaction with Human relations at work leads to 0.313 increase in PA, which infers that the respondents that were highly satisfied with human relation at work had higher experience of PA. In private organizations, Human relations are very important for business development, customer satisfaction, collaboration and teamwork. When the employees have positive relationship with their customers, stakeholders, colleagues and supervisors, they can be more productive, operational and may experience more positive emotions. This way, higher satisfaction with Human relations may predict higher experience of positive affect in the private employees. This finding can be supported by studies of Argyle (2001) and Myers (2000) which corroborates that social relationships are known as one of the strongest predictors of happiness. An atmosphere of cooperation and concern for each other and a team feeling in the workplace results in high morale among the employees (Hingar *et al.,* 2012).

Table 7 and Table 8 R values = 0.233 and 0.628 respectively indicates good levels of prediction investigating the dimensions of job satisfaction and total job satisfaction as potential predictors of experience of Negative affect (NA). The predictor variables explain only 5.40 per cent of the variability of NA in the government employees with R square = 0.054. And the rest 94.60 per cent of the variation is caused by factors other than the predictors included in this model. Whereas, the predictor variables explain 39.40 per cent of the variability of NA of the private employees. And the rest 60.60 per cent of the variation is caused by factors other than the predictors included in the

Table 7: Results of multiple regression analysis investigating job satisfaction and its five dimensions as potential predictors of experience of negative affect in government organizations

Predictor variables	Unstandardized coefficient beta	Std. error	T	Sig.	R	R square
Salary and facilities	.093	.054	1.721	.087		
Supervision	-.001	.069	-.009	.993		
Promotion	-.072	.061	-1.169	.244	.233	.054
Work-opportunities	-.186	.076	-2.441	.016		
Human relations	.183	.149	1.226	.222		
Job satisfaction	-.042	.116	-.359	.720		

Table 8: Results of multiple regression analysis investigating job satisfaction and its five dimensions as potential predictors of experience of negative affect private employees

Predictor variables	Unstandardized coefficient beta	Std. error	T	Sig.	R	R square
Salary and facilities	-.289	.063	-4.565	.000		
Supervision	.005	.077	.069	.945		
Promotion	.308	.075	4.128	.000	.628	.394
Work-opportunities	-.423	.114	-3.717	.000		
Human relations	-.615	.073	-8.400	.000		
Job satisfaction	.071	.075	.942	.347		

regression model. The salient inferences from these tables are:

Among all the potential predictors present in the regression model, satisfaction with Work opportunities is the best predictor of negative affect experienced by the respondent government employees, with a beta weight of 0.186 (19%), but in negative value, at $p<0.05$ level of significance. This means that for every 1 unit increase in satisfaction with 'Work-opportunities' leads to 0.186 decrease in experience of NA, which infers that the respondents that were highly satisfied with work-opportunities had lower experience of negative affect. Satisfaction with work opportunities was found as the best predictor of experience of NA (in negative value) for the government employees in the present study. Employees who get opportunities to project their creative skills, innovativeness and accept challenging tasks have higher satisfaction with work opportunities (Hingar *et al.,* 2011). Creativity is known to reduce negative emotional responses (Chiu *et al.,* 2018), as it helps healthy expression of our emotions. This explains why work opportunities is an important predictor of lowered experience of negative affect in the respondents.

In case of the private employees satisfaction with Human relations at job is the best predictor of experience of Negative feelings with a beta weight of 0.615(61.50%), but in negative value, at $p<0.001$ level of significance. This means that for every 1 unit increase in satisfaction with "Human relations" leads to 0.615 decrease in NA, which infers that the respondents that were highly satisfied with Human relations at work had lower experience of negative affect. Good human relations at work can facilitate teamwork and thus better productivity. Team work can reduce the experience of negative emotions such as frustration, distress and irritations (Dubreuil *et al.,* 2020). In such cases, human relations at work can be an another important predictor of lowered Negative affect in the respondents, as it can effectively facilitate team work and productivity.

CONCLUSION

Job satisfaction was found to be contributing largely to the variability of subjective well being in the respondents, which means job satisfaction can predict the outcome of subjective well being of an individual. Work opportunities, human relations and overall job satisfaction were found to be the best predictors of subjective well being in the government employees. Whereas, supervision, human relations and overall job satisfaction were the best predictors of subjective well being in the private employees. However more rigorous investigations are required to elucidate how the relationship of job satisfaction and subjective well being can be intervened for better quality of life of oneself as well as people around us. Organisations should be aware and strategic in creating a work culture that fosters equal and better work opportunities, collaborative human relations, efficient supervision and overall job satisfaction among the workers. Satisfied employees can form a society of happy people.

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Research Article

Aspirations of Farm Women of Punjab

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ABSTRACT

The present study was conducted with the objective to identify the aspirations of farm women. A total of 500 farm women of Punjab state were selected as sample for the study. The study highlights that majority of the farm women aspired for possession of assets, children's education, children's occupation, foreign immigration of children, children's marriage and lavish life style. It was also observed that women do not aspire for socio-political status, agriculture and lavish marriage of their children. Overall (62.6%) of farm women had medium level of aspirations. The study reflects that farm women do not want to keep their wards in agriculture. They want them to be educated and settle in foreign countries. Their aspirations were comparatively high for their children's education as compared to other aspirations.

Keywords: Aspirations, Farm women, Children's education, Foreign immigration

INTRODUCTION

Aspirations mean fantasy of the individual's hope or ambition for achieving something in life. Aspirations of woman indicate what she wants to be in future life, irrespective of the limitations imposed by reality. It is concerned with the total self and one's conception of herself in the light of social norms. Her aspirations are integral part of woman's self picture not only as she is, but what she would like to be. Infact, aspiration is a strong hope, dream, or goal. Aspirations have two distinctive aspects. First, they are future oriented. They can only be satisfied at some future time. This distinguishes them from immediate gratifications. Secondly, aspirations are motivators. These are goals individuals are willing to invest time, effort or money to attain. This distinguishes them from idle daydream and wishes (Richard, 1989).

The idea of aspiration has a positive, upward connotation. We aspire to be or to become something that we perceive is better than what or where we currently are. One way to think about the meaning of aspiration is the idea of reaching for the stars. We may never quite make it, but the act of looking and moving upwards can enrich our daily lives. In the process of reaching for the stars, we make progress forward (Conradie and Robenys, 2013). There are many different types of aspirations, such as career, social, and personal. Similarly woman also aspires for different aspects of her life. Woman wants to receive good education, jobs, security, savings and happy life. Woman would like to become a lawyer, nurse, doctor, social worker, teacher and officer etc. Women also aspire for good clothes, fashion choices, going to cinemas and lavish life. She aspires for good education and better career for her children. Women aspire to improve her standard of living and live a quality of life. They also want to construct a better house, providing better education to their children, and improve their income by engaging in some of the activities/occupations to become an independent person (Chanoria *et al.,* 2019). Similarly rural women also aspires for achieving something better than they have. Now a day's rural women are more aspirational than ever before, their interest has leaned towards brands and high-quality products. They are also becoming socially networked, using mobile devices to connect with family and friends. They are more

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discerning, no longer willing to accept inferior products simply because such offerings cost less than higher-quality one (Chaturvedi and Sahai, 2019). Aspirations are not static and rigid. These change radically under strong conditions. Aspirations cannot be cultivated in a day. They develop slowly as their formation is the result of innumerable factors like socialization, peer groups, parents, social association, religion, culture etc. So aspirations act as a motivating force, which compel an individual to attain new goals in life. Keeping in view the present scenario, a study was undertaken to identify the aspirations of selected farm women.

MATERIALS AND METHODS

The study was conducted in five agro-climatic zones of Punjab. Ten districts were proportionately selected from all agro-climatic zones. From each selected district, two villages were purposively selected. Thus twenty villages were selected in all. From each selected village, 25 farm women were purposively selected. So in total 500 respondents were selected.

RESULTS AND DISCUSSION

Aspirations of farm women were studied in respect of ownership/possession of assets, children's education, children's occupation, socio-political aspirations, agricultural aspirations, foreign immigration, lavish marriage of children and lavish life style.

The data in Table 1 presents the aspirations of farm women with regard to ownership/possession of assets. It is evident from table that majority of the respondents i.e. 72.40 per cent expressed that land holding was most important aspiration followed by a large house (70.80%), marbled floor (63.20%), bedroom for each member (62.00%), bedrooms with attached bathrooms (57.20%), fully furnished kitchen (54.20%) and modern furniture (45.80%).

Findings further revealed that aspirations which are important for a large number of farm women were agricultural machinery (50.80%), more household assets (47.40%), AC in each room (45.80%), television/ LCD/LED in each room (45.80%), smart phones for

Table 1: Distribution of respondents according to aspirations with regard to ownership/possession of assets (n=500)

Items of aspirations	Most important		Important		Not important		Mean	Rank	F-value
	F	%	F	%	F	%			
Land holding	362	72.40	88	17.60	50	10.00	2.62	2	
Agricultural machinery	171	34.20	254	50.80	75	15.00	2.19	11	
Residential plots in village	56	11.20	137	27.40	307	61.40	1.49	17	
Residential plots in city	114	22.80	96	19.20	290	58.00	1.65	15	141.26**
Large house	354	70.80	134	26.80	12	2.40	2.68	1	(0.000)
Bedroom for each member	310	62.00	166	33.20	24	4.80	2.57	3	
Bedrooms with attached bathrooms	286	57.20	184	36.80	30	6.00	2.51	5	
Marbled floor	316	63.20	152	30.40	32	6.40	2.56	4	
Fully furnished kitchen	271	54.20	195	39.00	34	6.80	2.47	6	
Lawn in the house	156	31.20	204	40.80	140	28.00	2.03	12	
Luxury car	162	32.40	162	32.40	76	35.20	1.77	14	
Smart phones for each family member	206	41.20	211	42.20	83	16.60	2.24	9	
Laptop for each family member	85	17.00	137	27.40	278	55.60	1.61	16	
Television/LCD/LED in each room	142	28.40	229	45.80	129	25.80	1.93	13	
AC in each room	189	37.80	229	45.80	82	16.40	2.21	10	
Modern furniture	229	45.80	209	41.80	62	12.40	2.33	7.5	
Household assets	215	43.00	237	47.40	48	9.60	2.33	7.5	
Overall mean							2.19		

**Significant at 1% level (multiple response); Mean range (1-3)

each family member (42.20%) and lawn in the house (40.80%). It is also depicted from data that aspirations like residential plots in village (61.40%), residential plots in city (58.00%), laptop for each family member (55.60%) and luxury car (35.20%) were not important aspirations for large proportion of farm women. Comparison among these aspirations showed that aspirations for large house (X=2.68) was aspired highest followed by land holding (X=2.62), bedroom for each member (X=2.57), marbled floor (X=2.56), bedrooms with attached bathrooms (X=2.51), fully furnished kitchen (X=2.47). In that order possession of residential plots in village (X=1.49), laptop for each family member (X=1.61), residential plots in city (X=1.65) were least aspired by farm women. Overall mean score for aspiration for possession of assets (X=2.19) show that it was an important aspiration of farm women.

When one way ANOVA test was applied to compare different aspirations with regard to possession, it was found that there was significant difference (F value = 141.26**) among different items of aspirations at one per cent level of significance. It shows that farm women aspire for some aspirations significantly more than others.

Overall it can be concluded from the table that farm women had high aspirations for large house, land holding, bedroom for each members with attached bathrooms and marbled floor were high while she did not aspire for laptop for each family member, residential plots in city and residential plots in village. Similarly, in Bihar, Odisa and Tamil Nadu, Chaturvedi and Sahai (2019) found that rural women from these three states aspired for more assets and constructing a large and better house.

Results from Table 2 showed the aspirations of farm women with respect to their children's education. It was observed from the results that there were only 323 farm women who had school going children. Out of them large (66.56%) proportion of the respondents expressed that children education in high status school was most important to them followed by children coaching from private tuition center (53.25%). It can also be observed from the table that there were total 230 farm women whose children studying 10th class onwards. Out of them, for the majority of the respondents (66.97%) higher education for children from reputed colleges/universities was the most important followed by children education in foreign countries (57.39%) and professional degrees for children (52.60%) respectively. For each item, majority of the respondents perceived education is most important. Therefore, it can be concluded that respondents showed more concern about children's education.

The mean score for each item related to children's education was more than two which showed that farm women aspires high for children's education. Comparatively, aspirations for high status school (X= 2.54) was highest followed by children's higher education from reputed colleges/universities (X=2.47), children's education in foreign countries (X=2.41),

Table 2: Distribution of respondents according to aspirations with respect to children's education (n=500)

Items of aspirations	Most important		Important		Not important		Mean	Rank	F-value
	F	%	F	%	F	%			
Children's education in high status school (n=323)	215	66.56	67	21.55	41	13.18	2.54	1	
Children's coaching from private tuition center (n=323)	172	53.25	58	18.65	93	29.90	2.24	5	
Children's higher education from reputed Colleges/Universities (n=230)	154	66.97	31	13.47	45	19.56	2.47	2	7.06** (0.000)
Professional degrees for children (n=230)	121	52.60	61	26.53	48	20.87	2.31	4	
Children's education in foreign countries (n=230)	132	57.39	61	26.53	37	16.08	2.41	3	
Overall mean							2.39		

**Significant at 1% level (multiple response); Mean range (1-3)

professional degrees for children (X=2.31) and children's coaching from private tuition center (X=2.24). When one way ANOVA test was applied to compare different aspirations with respect to children's education it was found that there was significant difference (F value = 7.06**) among different aspirations at one per cent level of significance. It shows that farm women aspire for some aspirations significantly more than others.

Overall it can be concluded from the Table 3 that farm women aspires high for their children's schooling from high status schools followed by their higher education from reputed colleges. Similarly, in Bihar, Odisa and Tamil Nadu, Chaturvedi and Sahai (2019) found that rural women from three states aspired that their children receive higher education.

Table 3 depicts the aspirations of farm women with respect to occupation of children. It was found that out of 500 families, there were 433 families whose children went to school, college and in search of some occupation. Therefore aspirations with respect to children occupation were studied for them only. Majority of the respondents (70.66%) aspired that their children should settle in foreign countries. They further shared that their children may do any kind of odd jobs there like as truck driver, taxi driver, care taker, helper etc. The results were in line with scenario in rural Punjab where majority of the youth is settling abroad for better future (Bhabra, 2020). This was followed by 67.21 per cent respondents who wanted their children to become engineer, college lecturer (51.96%), school teacher (49.65%) and public officer (49.42%).

Results obtained from Table 3 showed that large proportion (40.42%) of the respondents expressed that police officer was important occupation for their children followed by successful businessman (39.96%). The results further showed that large number of farm women said that becoming lawyer (43.88%) or doctor (39.26%) was not important for their children. Findings further revealed that majority (65.81%) of the farm women expressed that they do not want their children to become agriculturist was not important for their children. The results were in accordance with those reported by Rai (2022) in Punjab, who found that farming and farm related enterprises are not the first choice of occupation of parents for their children. Nandi *et al.* (2022) in south India indicated that farm parents do not aspire to become their children as an agriculturist. It depicts that farming families are not satisfied with farming as an occupation. There is need to analyse the reasons for such dissatisfaction and chalk out strategies to support and stabilize the farming as an occupation.

Aspirations with respect to different occupation was compared and it was observed that occupations to settle in foreign countries (X=2.61) was highest

Table 3: Distribution of respondents according to aspirations with respect to occupation of children (n=433)

Items of aspirations	Most important		Important		Not important		Mean	Rank	F-value
	F	%	F	%	F	%			
Agriculturist	63	14.54	85	19.63	285	65.81	1.48	10	
Doctor	145	33.49	118	27.25	170	39.26	1.94	8	
Engineer	291	67.21	87	20.10	55	12.70	2.54	2	
Professor/College lecturer	225	51.96	128	29.56	80	18.48	2.33	3	
School teacher	215	49.65	129	29.79	89	20.56	2.29	5	80.65**
Lawyer	115	26.56	128	29.56	190	43.88	1.83	9	(0.000)
Public officer	214	49.42	145	33.48	74	17.09	2.32	4	
Police officer	166	38.34	175	40.42	92	21.24	2.17	6	
Successful businessman	150	34.64	173	39.96	110	25.40	2.09	7	
To settle in foreign country (as taxi driver/ truck driver/care taker etc.)	306	70.66	87	20.09	40	9.23	2.61	1	
Overall mean							2.16		

**Significant at 1% level (multiple response); Mean range (1-3)

followed by engineer (X=2.54), professor/college lecturer (X=2.33) and public officer (X=2.32). Findings from the above table also depicts that occupations like agriculturist (X=1.48), public officer (X=1.83) and doctor (X=1.94) were least aspired by farm women for her children. Overall aspiration with respect to children's education (X=2.16) show that it was an important aspiration of farm women. When a comparison was made by using one way ANOVA test for different aspirations with respect to children's education, it was found that there was significant difference (F value = 80.65**) among different items of aspirations at the one per cent level of significance. It shows that farm women aspire for some aspirations significantly more than others.

Overall it can be concluded from Table 3 that farm women aspired higher for their children should settle in foreign countries, to become engineer, professor/ college lecturer and public officer while she did not aspire much for their children became lawyer, doctor or agriculturist.

Data presented in Table 4 shows the aspirations of farm women with respect to socio- political status of family. A glance at the table clearly depicts that farm women do not aspire for socio-political of her family (X=1.18). For all socio-political items majority of the farm women (80-93.40%) said that these were not important to them. Data depicts that majority of respondents i.e. 93.40 per cent expressed that a chairman of block samiti, block samiti member (91.80%), zilaparishad member (91.60%), a member of cooperative society (86.80%), a pardhan of cooperative society (86.00%), a village panchayat member (85.60%), a sarpanch (85.00%), contacts with officers (84.20%) and contacts with police officers of their family member (82.40%) was not important to them. Political status and their family's contacts with political leaders were also not important aspirations for 80.20 per cent and 80.00 per cent respondents respectively.

Further an attempt was made to compare the aspirations for different socio-political items. The table shows that mean score for all the items ranged between 1.26 to 1.08 which clearly depicts that farm women do not aspire for any kind of socio–political status. Comparatively she aspires more for self political status (X=1.26) and family contacts with political leaders (X=1.25). When one way ANOVA test was applied to compare different aspirations with respect to socio-political status, it was found that there was significant difference (F value =9.09**) among the different items

Table 4: Distribution of respondents according to aspirations with respect to socio-political status of family (n=500)

Items of aspirations	Most important		Important		Not important		Mean	Rank	F-value
	F	%	F	%	F	%			
Self political status	32	6.40	67	13.40	401	80.20	1.26	1	
Contacts with political leaders	23	4.60	77	15.40	400	80.00	1.25	2	
Contacts with police officers	14	2.80	74	14.80	412	82.40	1.20	5	
Contacts with officers	11	2.20	68	13.60	421	84.20	1.18	6	
Family member to be:									
Village panchayat member	51	10.20	21	4.20	428	85.60	1.24	3	9.09**
Sarpanch	41	8.20	34	6.80	425	85.00	1.23	4	(0.038)
Block Samiti member	15	3.00	26	5.20	459	91.80	1.11	10	
Chairman of Block Samiti	6	1.20	27	5.40	467	93.40	1.08	12	
Zilaparishad member	6	1.20	36	7.20	458	91.60	1.09	11	
Member of Co-operative society	14	2.80	52	10.40	434	86.80	1.16	8	
Pardhan of Co-operative society	15	3.00	55	11.00	430	86.00	1.17	7	
Member of the Legislative Assembly	12	2.40	41	8.20	447	89.40	1.13	9	
Overall mean							1.18		

**Significant at 1% level (multiple response); Mean range (1-3)

of aspirations at one per cent level of significance. It shows that farm women aspire for some aspirations significantly more than others. Overall it can be concluded from this table that farm women do not aspire for socio-political status for her family.

Table 5 showcase the aspirations of farm women with respect to agriculture. For all agriculture items majority of the farm women (80.80-76.40%) said that these were not important aspiration to them. It is clear from the data that aspirations to become progressive farmer (80.80%), to become member of PAU kisan club (80.60%), to become pardhan of PAU kisan club member (78.40%), to have contacts with agricultural experts (77.40%) and to have contacts with big agripreneurs (76.40%) were not important for majority of them. Data also depicts that respondents had no concern about agriculture.

Further an attempt was made to compare the aspirations with respect to agriculture. Mean score for all the items ranged between 1.21 to 1.28 clearly shows that farm women do not aspire for any kind of agriculture aspiration. Comparatively she aspires more for family member to have contacts with agripreneurs (X=1.28) and family member to have contacts with agricultural experts (X=1.27). When a comparison was made by using one way ANOVA for different aspirations with respect to agriculture, it was formed that there was no significance difference among different items of aspirations.

Data shown in Table 6 presents the aspirations of farm women with respect to foreign immigration. It was observed from data that majority of respondents i.e. 61.20 per cent expressed that foreign immigration for their children was most important aspiration.

However, 44.60 per cent expressed that going abroad as tourist was not important aspirations for them followed by 33.2 per cent for whom it was important. Foreign immigration of the whole family not important for a large proportion of respondents (39.2%), closely followed by 37.8 per cent for whom

Table 5: Distribution of respondents according to aspirations with respect to agriculture (n=500)

Items of aspirations	Most important		Important		Not important		Mean	Rank	F-value
	F	%	F	%	F	%			
Family member to become progressive farmer	23	4.60	73	14.60	404	80.80	1.23	3.5	
Family member to become member of PAU Kisan Club	12	2.40	85	17.00	403	80.60	1.21	5	
Family member to become Pardhan of PAU Kisan Club	5	1.00	103	20.60	392	78.4	1.23	3.5	1.54NS (0.19)
Family member to have contacts with agricultural experts	22	4.40	91	18.20	387	77.40	1.27	2	
Family member to have contacts with agripreneurs	23	4.60	95	19.00	382	76.40	1.28	1	
Overall mean							1.31		

Non Significant at 1% level (multiple response); Mean range (1-3)

Table 6: Distribution of respondents according to aspirations with respect to foreign immigration (n=500)

Items of aspirations	Most important		Important		Not important		Mean	Rank	F-value
	F	%	F	%	F	%			
Foreign immigration for family	189	37.8	115	23.0	196	39.2	1.98	2	
Foreign immigration for children	306	61.2	98	19.6	96	19.2	2.42	1	52.03**
To go abroad as tourist	111	22.2	166	33.2	223	44.6	1.77	3	(0.000)
Overall mean							2.06		

**Significant at 1% level (multiple response); Mean range (1-3)

it was most important. When aspirations with respect to foreign immigration were compared, it was found that aspiration for foreign immigration for children (X=2.42) was highest, followed by foreign immigration for family (X=1.98). Aspiration to go abroad as tourist was found least among farm women. Overall mean (X=2.06) with respect to foreign immigration shows that it was important for them.

When one way ANOVA test was applied to compare different aspirations with respect to foreign immigration, it was found that there was significant difference (F value = 52.03**) among the different items of aspirations at one per cent level of significance. It shows that farm women aspire for some aspirations significantly more than others. Overall it can be concluded from this table that farm women wanted their children to settle down in abroad. Comparatively, she did not aspire much for foreign immigration of the whole family.

The Table 7 depicts the aspirations of farm women with respect to their children's marriage. Their aspirations with respect to children marriage were studied under three categories i.e. lavish celebrations, taking dowry and giving dowry.

Data regarding lavish celebration reveals that majority of respondents (93%) expressed that theme wedding of children, inviting large number of guest (76.4%), inviting famous singer at wedding (71.0%), spending lavishly and getting expensive dresses (59.6%) was not important for them. While, 38.2 per cent of respondents expressed that celebration in big or expensive resorts was important for them. Among all they aspired highest (X=1.92) for celebration in big resorts. Theme wedding of children (X=1.08) was least aspired by farm women. Overall mean score for lavish celebration (X=1.45) clearly depicts that farm women do not aspire for lavish celebration of their children's marriage.

As far as taking dowry is concerned, a glance at the data clearly depicts that farm women do not aspire to take dowry. It was found that majority of farm women (87.5%) expressed that to getting luxury car in

Table 7: Distribution of respondents according to aspirations with respect to children's marriage (n=500)

Items of aspirations	Most important		Important		Not important		Mean	Rank	F-value
	F	%	F	%	F	%			
Lavish celebration									
Celebration in big/expensive resorts	135	27.0	191	38.2	174	34.8	1.92	1	
To spend lavishly	30	6.0	154	30.8	316	63.2	1.42	3.5	
To invite famous singers at wedding	65	13.0	80	16.0	355	71.0	1.42	3.5	
Theme wedding for children	7	1.40	28	5.6	465	93.0	1.08	6	84.45**
Get expensive dresses	86	17.2	116	23.2	298	59.6	1.57	2	(0.000)
To invite large number of guests on children's marriage	20	4.0	98	19.6	382	76.4	1.27	5	
Taking dowry [Families having son (n=458)]									
To get dowry of all major household equipments	25	5.4	56	12.2	377	82.3	1.23	9	
To get luxury car in dowry	24	5.2	33	7.2	401	87.5	1.17	11	
To get lot of gold as dowry	39	8.5	63	13.7	356	77.7	1.19	10	
Giving dowry [Families having daughters (n=472)]									
To gift a lot of gold to daughter	158	33.5	82	17.4	232	49.2	1.84	3	
To gift major household equipments	112	23.7	188	39.8	172	36.4	1.87	2	
To gift luxury car to daughter	34	7.2	68	14.4	370	78.4	1.28	7	
Overall mean							1.43		

**Significant at 1% level (multiple response); Mean range (1-3)

dowry, getting dowry of all major household equipments (82.3%) and to get lot of gold as dowry (77.7%) was not important for them. Mean score for items ranged between 1.23-1.17, which clearly depicts that farm women do not aspire for taking dowry.

With respect to giving dowry, data show that majority of the respondents (78.4%) expressed that gifting luxury car to their daughters was not important to them. While, around forty per cent (39.8%) of the respondents expressed that to gift major household equipments was important for them. One third of the respondents (33.5%) expressed that to gift lot of gold to daughter was most important for them. Data show that farm families want to give gold and household equipments to their daughters but not cars. Mean score for giving dowry (X=1.66) depicts that women aspire for giving dowry to their daughter.

Further a comparison between three categories show that giving dowry to their daughters was important (X=1.66) to farm women followed by lavish celebration of children's marriage (X=1.45) and taking dowry (X=1.19) was not important for majority of farm women.

When one way ANOVA test was applied to compare the different aspirations with respect to children's marriage, it was found that there was significant difference (F value =84.45**) among different items of aspirations at 1per cent level of significance. It shows that farm women aspire for some aspirations significantly more than others.

Table 8 presents aspirations of farm women with respect to their lavish life style. It was evident from analysis that majority (64.00%) of respondents expressed going out for dinner as an important aspiration followed by 51.00 per cent who expressed visiting new restaurants/hotels was important to them. Aspirations for real gold/diamond jewellery (50.80%), branded clothing (50.00%), branded or expensive footwear (48.40%) and expensive or matching jewellery (47.80%) were also important for the respondents.

It can further be observed from the data that going for parties (59.0%), going for holidaying (54.0%) and having maids for all household chores (53.60%) were not important to them. Further when a comparison was made between different items of aspirations for lavish life style, it was found that farm women aspires for branded clothing (X=1.90) the most followed closely for branded or expensive footwear and having lot of gold and/diamond jewellery (X=1.89) each, expensive or matching jewellery (X=1.83). Other items like going for parties (X=1.43), going for holidaying (X=1.46) and visiting new restaurants/hotels were least aspired by farm women. Overall mean score (X=1.71) shows that farm women aspires for their lavish life style.

When one way ANOVA test was applied to compare different aspirations with regard to lavish life style, it was formed that there was significant difference (F value = 124.91**) among different items of aspirations at one per cent level of significance. It shows that farm women aspire for some aspirations

Table 8: Distribution of respondents according to aspirations with respect to lavish life style (n=500)

Items of aspirations	Most important		Important		Not important		Mean	Rank	F-value
	F	%	F	%	F	%			
Having branded clothing	102	20.40	250	50.00	148	29.60	1.90	1	
Having branded or expensive footwear	101	20.20	242	48.40	157	31.40	1.89	2.5	
Having expensive or matching jewellery.	89	17.80	239	47.80	172	34.40	1.83	4	
Having lot of real gold/diamond jewellery.	96	19.20	254	50.80	150	30.00	1.89	2.5	124.91**
Having maids for all household chores	75	15.00	157	31.40	268	53.60	1.61	6	(0.000)
Going for parties	9	1.80	196	39.20	295	59.00	1.43	9	
Going for holidaying	4	0.80	226	45.20	270	54.00	1.46	8	
Going out for dinner	45	9.00	320	64.00	135	27.00	1.82	5	
Visiting new restaurants/hotels	5	1.00	255	51.00	240	48.00	1.53	7	
Overall mean							1.71		

**Significant at 1% level (multiple response); Mean range (1-3)

significantly more than others. Overall it can be concluded from table 5.14 that farm women aspires more for branded clothing, branded footwear, gold/ diamond jewellery as comparative to going out for dinner, holidaying and parties.

Further an attempt was made to categorize the respondents into different levels of aspirations. Data presented in Table 9 reveals that large percentage (55.00%) of respondents had medium level of assets' aspirations followed by nearly one third of the respondents (32.0%) who had high level of assets' aspirations. Only 13.00 per cent of respondents were in low level of assets' aspirations.

The Table 9 further depicts a large proportion of farm women (47.89%) had high level of aspirations for their children's education followed by 42.18 per cent of respondents who had medium level of aspirations. Very few (9.93%) of the respondents had low aspirations with respect to children education.

Moving towards children's occupation, it is clear from the data that more than half of respondents i.e. 52.66 per cent were having high level of aspirations. More than one third (35.34%) of them were having low level of aspirations, while only 12.00 per cent of the total respondents were having medium level of aspirations with respect to children occupation.

With regard to socio-political status, the data clearly indicate that majority of the respondents (86.40%) had low level of socio- political aspirations. Around nine per cent respondents had medium level of socio-political aspirations while only 4.80 per cent of the total respondents were having high level of socio-political aspirations. This shows that respondents were less concerned with their socio-political status.

Regarding aspirations for agriculture, data from the above table showed that majority of the respondents (80.40%) had low level of agricultural aspirations. Very less proportion i.e. 14.60 and 5.00 per cent of respondents had medium and high level of agricultural aspirations respectively.

Further the Table 9 depicts the aspirations with respect to foreign immigration. It was found that 40.40 per cent respondents had high level of aspirations with respect to foreign immigration. More than one third of farm women (35.60%) had low level of aspirations,

Table 9: Distribution of farm women according to level for different types of aspirations (n=500)

Type of aspirations	Frequency	Percentage	Mean	Rank
Assets				
Low (19-29.66)	65	13.00	2.19	2
Medium (29.67-40.32)	275	55.00		
High (40.32-50.98)	160	32.00		
Children education (n= 403)				
Low (1-5.67)	40	9.93	2.38	1
Medium (5.68 – 10.35)	170	42.18		
High (10.36-15.01)	193	47.89		
Children occupation (n=433)				
Low (6-14)	153	35.34	2.17	3
Medium (15-22)	52	12.00		
High (23-30)	228	52.66		
Socio-political status				
Low (12-20)	432	86.40	1.18	8
Medium (21-28)	44	8.80		
High (29-36)	24	4.80		
Agricultural aspirations				
Low (5-8.33)	402	80.40	1.24	7
Medium (8.34-11.66)	73	14.60		
High (11.67-15)	25	5.00		
Foreign immigration				
Low (7-11)	174	35.60	2.06	4
Medium (12-15)	120	24.00		
High (16-19)	206	40.40		
Lavish marriage of children				
Low (7-13.33)	318	63.60	1.45	6
Medium (13.34-19.66)	136	27.20		
High (19.67-25.99)	46	9.20		
Lavish life style				
Low (9-15)	186	37.20	1.71	5
Medium (16-21)	271	54.20		
High (22-27)	43	8.60		
Overall Aspirations				
Low (71-99)	86	17.2	1.79	
Medium (100-127)	313	62.6		
High (128-155)	101	20.2		

Mean range (1-3)

while less than one fourth (24.00%) of the respondents had medium aspirations about foreign immigration. Moving towards lavish marriage of children, the data indicate that majority (63.60%) of the respondents had low level of aspirations with respect to lavish marriage of children. This was followed by 27.20 per cent of respondents who had medium level of aspirations. Only 9.20 per cent of the total respondents had high aspirations with respect to lavish marriage of children.

Lastly the table depicts levels of aspirations for lavish life style. The findings revealed that 54.20 per cent of the respondents had medium level of aspirations followed by 37.20 per cent respondents had low level of aspirations with respect to lavish life style. Very few (8.60%) of the respondents had high level of aspirations with respect to lavish life style. Further the respondents were categorized into different levels for overall aspirations. It can be observed from the table that majority (62.6%) of the respondents had medium level of aspirations. Only one fifth (20.2%) of the respondents had high level of aspirations, while less than one fifth (17.2%) of the respondents had low level of aspirations.

CONCLUSION

The present investigation highlights that farm women aspired highest for the education of her children from high status schools followed by possession of assets. The results further revealed that farm women aspired higher for their children's settlement in foreign countries, then making them engineers, professors/college lecturers and public officers. Farm women did not aspire for making her children agriculturist. It was also found that farm women aspire more for foreign immigration of their children. It clearly depicts the scenario of rural Punjab where a large no. of families are sending their children to foreign countries for their bright future. The study clearly depicts that farm women do not aspire for socio-political status of their family. Lavish celebration of children's marriage and taking dowry was not important for majority of farm women. Whereas, giving dowry to their daughter was important to them. This may be because they feel to give share of girls in property in property in the form of dowry. The study highlights that rural women aspires the most for the bright future of her children by providing them good education, getting them settled in foreign countries and get good salary. They do not aspire to be in agriculture or keep their words in agriculture. This may be due to dissatisfaction in farming, inherent risk, low profitability and low social status. The study also highlights the need to analyse reasons for withdrawal from agriculture and at the same time offers food for thought to chalk out strategies for attaching its youth towards agriculture.

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Research Article

Social Media Visibility of Krishi Vigyan Kendra's of India

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ABSTRACT

This study conducted during March-August, 2021, aimed to analyze the social media usage patterns of scientists in Krishi Vigyan Kendra (KVK), a recognized extension service and education system in India. A structured questionnaire was used to collect data from 150 KVK scientists in 145 KVKs across 24 states and union territories. The results showed that the majority of KVKs had independent websites (85.33%) and Facebook pages (72.00%), while less than two-thirds had YouTube channels (60.00%) and Twitter handles (59.33%). Almost all KVKs (97.33%) were part of WhatsApp groups for farmers/stakeholders, but only a small percentage had Instagram accounts (15.33%). The study also revealed that the frequency of updating varied across platforms, with some KVKs facing challenges due to insufficient funds and lack of internet facilities.

Keywords: Krishi Vigyan Kendra, KVK professionals, Social media, Social media participation, Website

INTRODUCTION

The usage of social media has skyrocketed during the past decade, all across the world. Social media is a key tool for distributing technical information to local, regional, and international audiences. Social media is being utilised more and more to spread knowledge and raise awareness. To interact with different audiences, platforms including Facebook, Twitter, YouTube, and blogs have been employed (Lakshmi, 2018; Shanmuka, 2022). This may be ascribed to the universal platform that social media offers for individuals to share their thoughts and produce their own material, whether it be words, photographs, sound clips, or videos. The potential low-cost instruments of social media can expand the reach and coverage of agricultural extension (Thakur, 2017). It may also be related to the accessibility of these platforms, which are free to use. A techno-social system for participatory culture that fosters participation, openness, connectivity, discourse, and community might be described as social media. Other factors contributing to the expansion of social media reach include the convergence of technologies and the development of portable, multipurpose technology. Social media are modern digital communication channels made up of numerous evolving technologies for conversation and information exchange among individuals. Social media can be defined as web based tools of electronic communication that allow users to interact, create, share, retrieve and exchange information and ideas in any form (text, pictures, video, etc.) that can be discussed upon, archived and used by anyone in virtual communities and networks (Suchiradipta and Saravanan, 2016). Among these digital tools are Twitter, Instagram, Facebook, WhatsApp, YouTube and others. As a techno-social system for participatory culture with traits like participation, openness, connectivity, discussion, and community, social media may be described (Fuchs, 2021). Social media sites were popular not only because they allowed people to interact with friends and family, but also because it was

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soon discovered how powerful communication could be and how it could be used in the workplace. Social media allows for the generation of content more quickly than traditional mass media (Fuess, 2011). According to Sokoya *et al.* (2012), agricultural professionals, researchers, and other stakeholders are increasingly using social media. Social media has made it possible for information to be sent and received quickly. It is now a reliable method of assuring sustained success and viability for the agricultural extension sector. The experts at India's Krishi Vigyan Kendras take the initiative to reach out to local farmers with the newest technology that would benefit them. They may exchange knowledge and participate in conversations and debates about agriculture thanks to social media. They benefit as well by staying informed and aware of current events in the agriculture industry. Krishi Vigyan Kendra, acts as "the lighthouse for farmers in India," and demonstrates the utilization of science and technological input in agricultural research and education in the fields of farmers in rural regions (Singh, 2023) and it provides need based vocational training to farmers, rural youth, women and extension agents (Singh, 2022). One of the leading institutions devoted to the advancement of rural agricultural research is KVK's under ICAR, SAU, and NGO. KVK has been established by ICAR as an institutional innovation across the nation for the application of agro-science and technology, with the assistance of a multidisciplinary team, including the prominent scientists and subject matter experts in the agricultural sector (Dashora, 2022). Accessing the farm related information among the farmers through digital medium increasingly becoming popular and majority of farmers were holding the medium level of information seeking behavior through mobile by using such virtual platforms. Mobile is quite amiable device to harness such sources which limit the time and spatial constraints and provide quality information (Shukla *et al.,* 2022). Therefore, it is important to understand how extensively KVK scientists use social media to gather and disseminate agricultural information to the farming community.

MATERIALS AND METHODS

An ex-post facto study was conducted to examine the social media visibility of KVKs in India during 2021. A Sample size of 150 scientists belonging to 145 different KVKs throughout India was randomly selected for the study. Socio-personal variables viz., age, sex, caste, education, experience, background, position in KVK like- Head/PC, SMS; socio-economic variables namely job satisfaction; and communicational characteristics such as Information Seeking Behavior of KVK professionals were identified as independent variables for the study. Collected data were analyzed with the help of percentage, frequency, mean and standard deviation.

The data was collected by using structured questionnaire shared as Google forms to know the how many KVKs are having their social media channels under the jurisdiction of State Agricultural Universities, ICAR and NGOs. Based on the preliminary survey, 6 social media platforms were selected for the study. Extent of utilization of social media is operationalized as the frequency of use of selected social media by the KVK scientists, for seeking and dissemination of agricultural information, besides using social media for sharing success stories, communicating with other Organisations, seeking suggestions as well as for entertainment purpose.

RESULT AND DISCUSSION

It is indicated in Table 1 reveals that majority of the KVK professionals (67%) belonged to middle age group followed by young age group (20%) and old age group (13%), as age is negatively related with the position of the KVK professionals. These findings were in agreement with finding of Kumar and Kaur (2016); Rai *et al.* (2018); Singh *et al.* (2018); Singh *et al.* (2019) and Singh (2021).

Majorities (87%) of respondents were male and only 13 per cent were female. It may be because of in KVK involves more field visits, supervision and travelling. Similar results reported by Hanamanth (2021); Singh (2016); Singh *et al.* (2018); Singh *et al.* (2019) and Singh (2021). Nearly three-forth (71%) respondents came from rural background and greater than one-fourth (29%) had urban background. Similar results were found by Jat (2010); Singh *et al.* (2018); Singh *et al.* (2019) and Singh (2021). More than three-fourth (79%) respondents possessed doctorate and less than one-fourth (21%) were post-graduate. Similar results find by Patel and Chauhan (2011); Singh *et al.* (2018); Singh *et al.* (2019) and Singh (2021). Majority of (64.00%) respondents had medium years'

Table 1: Profile of the respondents

Profile	Category	Percentage
Age	Young	20.00
	Medium	67.33
	Old	12.67
Sex	Male	87.33
	Female	12.67
Background	Rural	71.33
	Urban	28.67
Education	Post-graduate	21.33
	Doctorate	78.67
	Post-doctorate	0
Experience	Low	20.67
	Medium	64.00
	High	15.33
Position in KVK	Head/PC	26.67
	SMS	73.33
Job-satisfaction	Low	25.33
	Medium	57.34
	High	17.33
Information seeking behavior	Low	19.33
	Medium	69.34
	High	11.30

experience followed by 21 per cent and 15 per cent respondents had low and high experience respectively. Similar results find by Prosper and Gowda (2013); Singh *et al.* (2018); Singh *et al.* (2019) and Singh (2021). Approximately, then three-fourth (73%) respondents were SMS and more than one-fourth (27%) were head. Similar results found by Raghava and Rao (2014); Singh (2021). Majority of (58%) respondents were having medium range of job satisfaction followed by 25 and 17 per cent were having low and high job satisfaction respectively. This might be attributed to a positive organizational atmosphere and dedication. The KVK professionals feel fulfilled since they are able to contribute to the well-being of millions of farmers. As a result, we can observe that majority of KVK professionals are satisfied with their jobs. Similar results find by Mohan (2000); Singh (2016); Singh *et al.* (2018); Singh *et al.* (2019); Singh (2021) and Sarnaik (2022). Slightly more than three-fourth of (70%) respondents were having medium information seeking behavior followed by 19 per cent and 11 per cent were under low and high information seeking behavior, respectively. Information seeking behaviour is an essential component in designing and developing of need-based product or program for stakeholders or farmers. Similar results were reported by Raghava and Rao (2014); Singh (2021).

KVK through these social media channel shares the important information. The results in Table 2 reveal that a majority of KVK scientists were using a variety of social media such as, independent website, Facebook page, WhatsApp, YouTube, Instagram and Twitter, for seeking and dissemination of agricultural information, sharing success stories, communicating with other organisations, seeking suggestions as well as for entertainment purpose. The results revealed that majority of (85.33%) KVKs had own independent, slightly less than three-fourth of (72.00%) KVKs had their own Facebook page, less than two-third of (60.00%) KVKs were not having their YouTube channel, nearly cent per cent of (97.33%) respondents were having their WhatsApp groups of farmers/

Table 2: Social media channel possession stats by KVKs

Social media	Extent of Social media visibility of KVK			
	Existence of social media platforms		No	
	Yes			
	Number	Percentage	Number	Percentage
Face book	108	72.00	42	28.00
WhatsApp groups of farmers	146	97.33	4	2.67
You Tube	60	40.00	90	60.00
Instagram	23	15.33	127	84.67
Twitter	89	59.33	61	40.67
Website	128	85.33	22	14.67

Table 3: Distribution of KVKs according to their Frequency of updating Social media Channel

Social media	Extent of updating									
	Daily		Weekly		Monthly		Yearly		Not update	
	No.	%	No.	%	No.	%	No.	%	No.	%
Face book	25	23.14	50	46.29	20	18.51	2	1.85	11	10.18
WhatsApp groups of Farmers	80	54.79	35	23.97	24	16.43	7	4.79	0	0.00
You Tube	0	0	19	31.67	30	50.00	8	13.33	3	5.00
Instagram	5	21.73	3	13.04	2	8.69	4	17.39	9	39.13
Twitter	13	14.60	34	38.20	33	37.07	4	4.49	5	5.61
Website	18	14.06	35	27.35	40	31.25	30	23.43	5	3.90

stakeholders, more than half of (59.33%) KVK professionals have their Twitter handle, majority of (84.67%) KVK professionals were not having Instagram account of their KVK. The studies done by James *et al.* (2020); Singh (2021) were found in line with present study.

Table 3 represented that nearly half of (46.29%) KVKs were updating their Facebook page weekly, followed by daily (23.14%) monthly (18.51%) and yearly (1.85%). Slightly more than half of (54.79%) respondents found updating their WhatsApp group on daily basis, followed by 23.97 per cent weekly, 16.43 per cent monthly and 4.79 per cent yearly update their farmers WhatsApp group. This can be justified that the majority of KVKs felt WhatsApp more user friendly and convenient. Half (50.00%) of KVKs were updating their YouTube channel monthly, however, approximately 32.00 per cent were updating weekly and 13.33 per cent were updating yearly. Most of (38.20%) KVKs Professionals updated their twitter handle weekly, 37.07 per cent did monthly, 14.60 per cent daily and 4.49 per cent were updating on yearly basis. Slightly less than one - fourth of (21.73%) KVKs were updating daily, 17.39 per cent yearly, 13.04 per cent weekly and 8.69 %were updating their Instagram account monthly. KVKs were also handling the independent websites for providing the agricultural related information to the farmers. The findings of present study reveal that slightly less than one-third (31.25%) of respondents were keeping updated their websites with latest and relevant agricultural information on monthly basis, which is followed by 27.35 per cent weekly, 23.43 per cent yearly and 14.06 per cent daily basis updated. The findings were found in line with Singh (2021).

CONCLUSION

Providing agricultural information to farmers through ICT is one of the activities of KVK. The popularity of social media platform can be effectively harnessed by KVKs in agriculture in terms of making the contacts with farmers and providing the relevant information to them. Visibility of different social media platform varied among different KVKs. Out of six distinct and identified social media platform there were three platforms namely WhatsApp, websites and Facebook very profoundly used by most of the KVKs. Visibility of KVKs on social media cannot confined with merely appearance of KVK on social media, it is determined by frequency of updating relevant information for targeted beneficiary. WhatsApp and Facebook were most frequently and constantly updated by the KVKs.

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Research Article

Constraint Analysis for Women in Dairy Entrepreneurship

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ABSTRACT

A study was conducted in two cluster villages of Nischintakoili block of Cuttack district to analyze the Constraints in dairy farming. It is an overview of the role and challenges faced by the women engaged in dairy farming in Odisha, India. Women in Odisha play a pivotal yet often undervalued role in the dairy farming sector, contributing significantly to household livelihoods and the broader agricultural economy. The results revealed that, their participation is hindered by various constraints, including limited access to resources such as land, finance, and technology, as well as cultural barriers and unequal work burdens. Despite these challenges, initiatives aimed at empowering women in dairy farming through education, training, access to resources, and supportive policies have shown promising results. Efforts focused on financial inclusion and the establishments of women-centric cooperatives have empowered women, enabling them to make independent decisions and access markets directly. Sustained efforts to support and empower women in dairy farming are crucial for inclusive agricultural growth and gender equality in Odisha, ultimately leading to broader socio-economic progress.

Keywords: Dairy farming, Farmwomen, Perceived constraints

INTRODUCTION

In dairy farming women play a pivotal role yet often undervalued role, particularly in regions like Odisha, Bihar and Uttar Pradesh. The majority of dairy farmers' workforces are farm women (Lahoti *et al.,* 2012). Women actively participate in many facets of dairy farming, although facing numerous challenges but they greatly contribute for enhancing the standard of living including nutritional aspects derived from dairy of their families as well as the economy. Women in Odisha engage in a variety of tasks related to dairy farming, such as caring, milking, health monitoring of animals, processing, selling dairy products etc. In rural areas, a large number of women run small-scale dairy farms, frequently juggling this work with other household responsibilities. Their contributions are vital in sustaining household nutrition and generating income for the family. Barely 5 per cent of Indian farm households had access to information about animal husbandry, according to Kumari *et al.* (2015). This resulted from the area's inappropriate livestock extension system. Within the livestock industry, women account for over three-quarters of the labour demand. It has been egregiously underestimated and devalued how important women are to agriculture and related fields (Sharma *et al.,* 2018).

However, in contrary to technology infested, demand driven market mainly run by men with hired labour, women encounter multifaceted challenges that impede their progress in the dairy farming sector. Restricted access to resources, such as financial resources, technological advances and land, continues to be a major obstacle. Women frequently lack the legal authority to hold land, which limits their capacity to grow or make investments in their dairy businesses. Their inability to obtain finance and financial limitations make it much more difficult for them to invest in newer technology, better infrastructure, or superior breeds. Furthermore, women's roles within the home are frequently restricted by societal conventions and traditional gender roles, which also restrict their access to training opportunities and participation in decision-

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making processes. India has a vast abundance of livestock, yet despite being world largest producer of milk and with 24% of world milk production coming from India during 2021-2022, its per-capita productivity is among the lowest in the world further the per capita consumption (427 g/day) considering the population is questionable (Economic Survey, 2021-22). This is because the farmers here do not use enhanced dairy management techniques to the necessary extent (Patil *et al.,* 2009). Additionally, cultural conventions may limit their mobility, making it impossible for them to independently look for market possibilities or attend programmes.

Despite these challenges, initiatives aimed at empowering women in dairy farming have shown promising results. Government programs and NGOs have introduced schemes focusing on women's education, providing training in modern dairy farming techniques, and promoting women's participation in cooperatives and self-help groups. These efforts aim to enhance women's knowledge, build their confidence, and foster their leadership skills within the dairy farming domain. Entrepreneurship can be beneficial for women in rural areas as it enables them to add to the family income while taking care of their own home and livestock oriented task (Qureshi *et al.,* 2016). The only way to address the issues of unemployment, effective use of both human and non-human resources, and raising the standard of living for the vast majority of the impoverished is through small-scale entrepreneurship (Singh, 2009).

Furthermore, various interventions, including access to microfinance and the establishment of women-centric cooperatives, have helped alleviate financial constraints. These initiatives empower women to make independent decisions, access markets directly, and negotiate better prices for their dairy products. Women's involvement in dairy farming not only contributes to economic development but also fosters social empowerment. When women are involved in income-generating activities such as dairy farming, they gain recognition for their contributions within their families and communities. This newfound recognition can lead to increased decision-making authority and a shift in gender dynamics within households.

MATERIALS AND METHODS

The study was undertaken in two cluster villages of Nischintakoili block of Cuttack district. A total of forty women farmers involved in dairy farming in SHG mode were selected amongst 100 farm women who were having at least 2 milch animals, interested in receiving training and showing keen interest for women empowerment. The constraints related to various input resources, technologies, financial, infrastructure, preparation of value-added dairy products and marketing of milk and milk products were analyzed following a well-structured questionnaire and group discussion. The analysis was done following three point rating scale i.e., high (3), medium (2) and low (1) and weighted mean score along with ranking was calculated. The major focus was on gender angle which was analyzed based upon gender participation and decision making in dairy farming activities. To minimize the errors, the quantitative data were collected in local units but later on they were converted into standard units. The data was appropriately analyzed using different statistical techniques.

RESULTS AND DISCUSSION

The data on resource constraints revealed that unavailability of nutri-rich fodder (WMS of 2.7) resulting low yield and composition of milk and also influences the preparation good quality value added milk products (Table 1). People are acquainted with feeding of paddy straw available in bundle and dry grasses having very low nutritional value which is the major reason for low milk production in terms of quality and quantity. Seventy five percent of the respondents also agreed to retain of small quantity of milk for household consumption which is also perceived as a constraint for value addition. However, 85 per cent respondents were found to be maintaining hygiene and sanitary measures in cleaning of cows, shed and using cleaned utensils for milk collection and processing and did not consider low quality of milk due to poor management practices. About 50 per cent of the respondents revealed that good quality fodder especially hybrid napier, Yashwant and IGFRI-6 provided by ICAR-CIWA are preferred by animals. The above findings are in line with the results of Gautam *et al.* (2021) who described respondents considered high cost of animal feeds as one of the most serious constraints.

Table 1: Resource constraints in dairy entrepreneurship as perceived by the farm women (N=40)

S.No.	Constraints	High	Medium	Low	Weighted score	WMS	Ranking
1.	Limited dairy animals	2(5.0)	36(90.0)	2(5.0)	80	2.0	III
2.	Lower production of milk	1(2.5)	22(55.0)	17(42.5)	64	1.6	V
3.	Small quantity for household consumption	30(75.0)	6(15.0)	4(10.0)	106	2.6	II
4.	Lack of quality feed for higher milk yield	16 (40.0)	2(5.0)	22(55.0)	74	1.8	IV
5.	Unavailability of nutri- rich fodder	32(80.0)	6(15.0)	2(5.0)	110	2.7	I
6.	Low quality of milk due to poor management practices	2(5.0)	4(10.0)	34(85.0)	48	1.2	VI

(The numbers in the parentheses indicate percentage)

It was observed that about 70 per cent of farm women involved in Dairy-farming mostly sell milk neglecting family consumption and preparation of home based value added products (Table 2). Lack of equipment for value addition of milk was found to be the major constraints (WMS 2.9) followed by storage facilities of milk following scientific and hygienic methods. However, the farm women are not aware on different methods of milk processing (WMS 1.4). Gender sensitization activities were carried out in the operational villages providing agri-nutri education on simple, practically feasible and economically viable method of milk processing through presentations and discussion, scientist-farmers interface, demonstration of different technologies. These findings are in conformity with the finding of Kant *et.al.* (2015); Mohapatra *et al.* (2012).

A perusal of findings presented in Table 3 revealed that marketing of milk was not found to be a major constraints rather there is heavy demand of milk products preparation equipment like paneer pressing machine. Awareness among the dairy farm women was developed on enhancing income generation

Table 2: Technological constraints in dairy entrepreneurship as perceived by the farm women (N=40)

S.No.	Constraints	High	Medium	Low	Weighted score	WMS	Ranking
1.	Lack of knowledge on balanced feed	34(85.0)	2(5.0)	4(10.0)	110	2.7	III
2.	Lack of hygienic and scientific milk storage	3(7.5)	28(70.0)	9(22.5)	74	1.8	V
3.	Lack of storage facilities	36(90.0)	2(5.0)	2(5.0)	114	2.8	II
4.	Lack of women friendly technologies	5(12.5)	29(72.5)	6(15.0)	79	1.9	IV
5.	Lack of equipment for value addition	35(87.5)	5(12.5)	0(0.0)	115	2.9	I
6.	Lack of knowledge on value addition of milk	1(2.5)	16(40.0)	23(57.5)	58	1.4	VI

(The numbers in the parentheses indicate percentage)

Table 3: Financial constraints in dairy entrepreneurship as perceived by the farm women (N=40)

S.No.	Constraints	High	Medium	Low	Weighted score	WMS	Ranking
1.	Lack of access to financial institutions	3(7.5)	4(10.0)	33(82.5)	50	1.2	V
2.	Lack of knowledge of govt. schemes	3(7.5)	6(15.0)	31(77.5)	52	1.3	IV
3.	Not registered as dairy farmers	0(0.0)	40(100.0)	0(0.0)	80	2.0	II
4.	Not registered as FPOs	40(100.0)	0(0.0)	0(0.0)	120	3.0	I
5.	Lack of access and control over finances	5(12.5)	15(37.5)	20(50.0)	65	1.6	III
6.	Lack of marketing	1(2.5)	4(10.0)	35(87.5)	46	1.1	VI

(The numbers in the parentheses indicate percentage)

through selling value added dairy products. About 77.5% of farm women involved in dairy farming were aware about various govt. schemes and 82.5% showed access to banks for finance. However, registration as dairy farmer and association in registered SHGs/FPOs was the major limitation for availing finance from banks (WMS of 3.0) as 100% of the respondents agreed to it as a major constraint. This finding is in conformity with the findings of Sethi (2010) and Sharma (2018).

The data in Figure 1 and 2 depicts that participation and decision making in selling and purchasing of live animals, feed, livestock products and maintenance of records was controlled by men except preparation and processing of milk products which was a women dominated activity in the study area.

It is important to focus on dairy enterprises as the dairy cooperatives existing in the study area has better scope playing a vital role in the development of the dairy sector with value addition to make it more attractive and profitable through commercialization.

CONCLUSION

The participation of women in dairy farming, particularly in regions like Odisha, is both significant and multifaceted. Despite facing various challenges, women play a crucial role in sustaining household

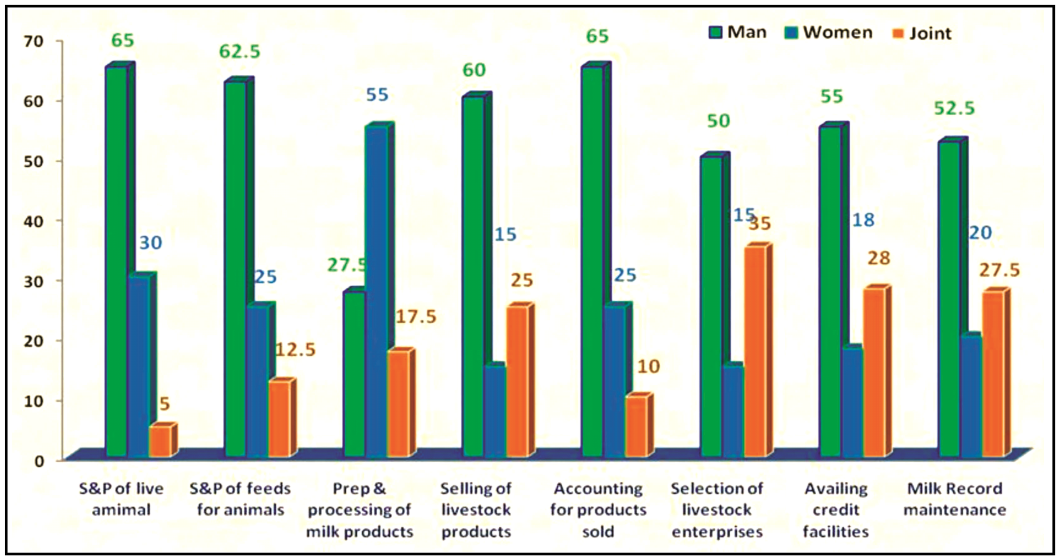

Figure 1: Gender participation in dairy farming activities

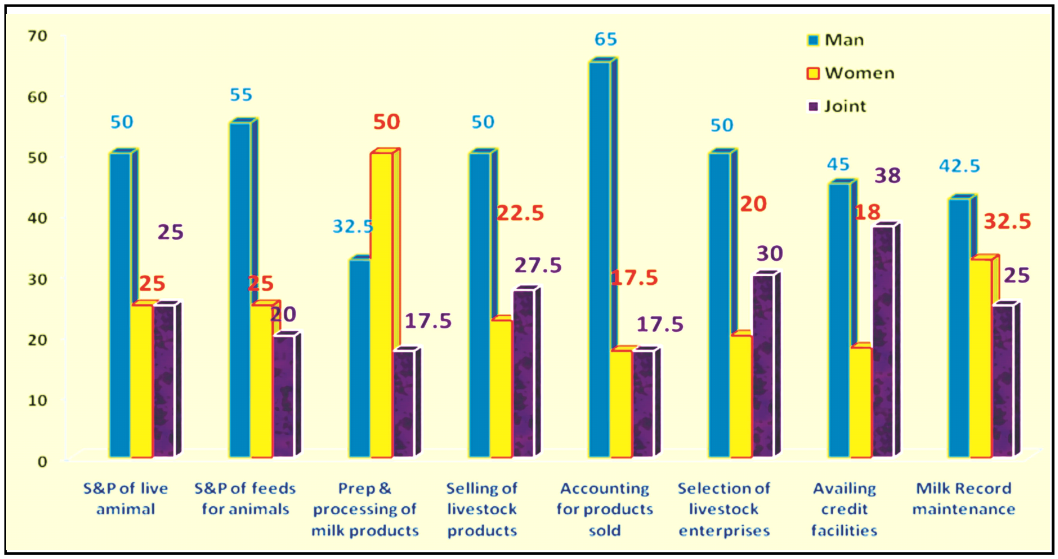

Figure 2: Gender decision making in dairy farming activities

livelihoods, contributing to the agricultural sector, and fostering economic growth. The constraints faced by women in this field, such as limited access to resources, cultural barriers, unequal work burden, and restricted market access, hinder their full potential in dairy farming. Addressing these challenges requires comprehensive interventions that empower women through education, training, access to resources, and supportive policies. Efforts aimed at empowering women in dairy farming have shown promise, leading to increased knowledge, confidence, and leadership skills among women engaged in this sector. Initiatives focusing on financial inclusion, such as microfinance and women-centric cooperatives, have been instrumental in enhancing women's decision-making abilities and market participation. It's crucial to recognize that women's involvement in dairy farming not only contributes to economic prosperity but also fosters social empowerment. As women gain recognition for their contributions, there's a positive shift in gender dynamics within households and communities. This recognition leads to increased agency, decision-making power, and improved socio-economic status for women.

Moving forward, sustaining and expanding efforts to support women in dairy farming are imperative for inclusive growth and gender equality. Enabling women to overcome constraints and fully participate in the dairy farming sector will not only enhance their individual well-being but also contribute significantly to broader agricultural development and societal progress. Empowered women in dairy farming can serve as catalysts for positive change, promoting economic resilience and social advancement within their communities.

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Research Article

Profile Characteristics of Agri-Startups in Andhra Pradesh State

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ABSTRACT

Despite being referred to as India's backbone, the agriculture industry continues to fall behind. It accounts for 16.5 per cent of Agri-to-GDP ratio relative to global 6.40 per cent and employs nearly 47.50 per cent of the workforce. The sector has been stymied by difficulties ranging from low yield to old operational processes that restrict farmers' economic wellbeing. Several Agri-Startups have popped up around the country to address these issues. The present study was conducted to document the profile status of Agri-Startups. The sample of study comprised of randomly drawn 44 Agri-Startup entrepreneurs across Andhra Pradesh State following multistage stratified sampling method. The study indicated that majority of the Startups (54.55%) belonged to 'Agri-Tech' sector and were present in 'validation stage' of growth (36.36%) and around 41 per cent of them were providing products/services in the areas of 'precision agriculture'. Nearly 45 per cent of the Agri-Startups were acquainted with incubator programs and more than 50 per cent of the Startup entrepreneurs had attended only one training program related to their Startup. Additionally, more than 90 per cent of the respondents had 'bootstrapping fund' as the major source of funding. The findings of the study provide managerial implications for policy makers as they would lend support to utilize the database available on profile characters of Agri-Startups and entrepreneurs notably in the area of strategic entrepreneurship.

Keywords: Agri-Startups, Entrepreneurs, Agri-tech, Entrepreneurship, Startups, Stakeholders

INTRODUCTION

India's expanding Startup ecosystem has been actively involved in disrupting the agriculture sector. Among them, Agri-Startups are offering pertinent and original solutions to a variety of problems faced along the whole agricultural value chain. These Agri-Startups have filled the gap between farmers, input dealers, wholesalers, retailers, and consumers by establishing connections amongst them all and offering reliable marketing connections and timely, high-quality products. Additionally, they are leaving a ripple effect on the socio-economic makeup of the Indian population in where they are functioning as well as opening new employment opportunities. Agri-Startups, which account for 4.2 per cent of all Startups in India (Government of India, 2020), are still in their infancy, addressing many growing concerns in the agribusiness sector (FICCI and PwC, 2018). As a result, particular policy instruments like R&D grants and tax breaks, business accelerators and incubators, proof-of-concept money and access to capital are necessary to support high-growth Startups (OECD, 2010). Andhra Pradesh State has a well-organized Startup ecosystem with an emphasis on institutional support and incubation. The State Government's Startup policy was introduced in 2014 by the Information Technology, Electronics and Communications (ITE & C) Department. Agri-Tech firms in Andhra Pradesh make up to 15.72 per cent of all Startups in this industry (GOI, 2022). Well-skilled and trained entrepreneurs have a plethora of chances and several alternatives for success. And for this, it is critical to raise awareness about understanding entrepreneurship as a subject and pursuing it as a profession. The socio-economic qualities of

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entrepreneurs influence their boom in launching new Startups. It has been found that there are no systematic studies conducted on Agri-Startups and Agri-Startup entrepreneurs of Indian context. As a result, the present exploratory study was conducted among Agri-Startups in Andhra Pradesh State. The exploration and understanding of the respondent's profile characteristics is critical for gaining a deeper understanding of the entrepreneurs, socio-economic and psychological characters; and the key to being a successful Agri-Startup is to perform functions and provide services that are needed and desired by its members. Hence the present paper explores and describes various profile characteristics of Agri-startups & Startup entrepreneurs.

MATERIALS AND METHODS

The present study was conducted in Andhra Pradesh State, one of the emerging Startup ecosystems in our Country. The study was conducted by deploying survey research design and the respondents were selected by using multistage stratified random sampling method, from the present 'stage' of Startup operations (44) and 'sector' (44) to which the product or service offered by the Agri-Startup belonged. Thus, a total of 44 Agri-Startups were finally approached for the primary data collection by using pre-tested and semi-structured interview schedule. Furthermore, the secondary data was collected from Startup India web portal, Startup publications and other online data bases. In the present study, profile characteristics were operationalized as a set of characteristics or qualities that define personal attributes of Startup entrepreneurs. The entrepreneurs were further grouped into three categories (low, medium and high) for Startup work experience, trainings, employees and total capital investment based on cumulative frequency method. The socio-economic traits of the Startup entrepreneurs were finalised based on the review of literature and suitability to Agripreneurship. Agri-Startup ecosystem network was measured based on frequency of their interaction on a five-point continuum i.e., always, often, sometimes, rare, never with the scores of 5, 4, 3, 2, & 1, respectively.

RESULTS AND DISCUSSION

The general profile characteristics of Agri-Startups were collected in terms of Agri-Startup sector, stages of development, year of establishment, location, ownership status, annual turnover, customer segmentation, product portfolio, service portfolio, nature of incubation support received. The results are presented in the Table 1. In sector wise distribution of Agri-Startups, majority of them were from 'agri-tech' (54.55%) followed by 'organic', 'food processing' and 'dairy' sector. It could be attributed to the fact that most of the Startup entrepreneurs perceive 'agri-tech sector' as more attractive in providing immediate solutions through IT/IoT based technological interventions and however the much focus needs to be given to promote other sectors of Agri-Startups like 'food processing and dairy Sector'. In the case of 'Stages of Agri-Startups', a significant per cent (36.36%) belonged to 'validation stage' as they were building 'minimum viable product' with increased user growth and revenue. A considerable per cent of the Startups belonged to 'early-traction stage' (29.55%), operating in emerging areas like provision of inputs, digital agriculture services and market linkage models. While, a notable per cent (22.73%) of the Startups were in 'ideation stage', having single head management or vague team with no right balance of skills and funds. Further, a sizable per cent (11.36%) of the Agri-Startups were in 'scaling stage' expanding in terms of customer base and revenue with growing market share. A perusal of figures in table 1indicated that more than a three-quarter (77.27%) of the Startups were established during '2017 to 2020' which implies the inception of 'Startup India' (2016) initiative of Government of India that has rolled out several programmes aimed at assisting entrepreneurs. This finding could be linked to the claim of Ohlan and Raj (2020) that the bulk of Agri-Startups were founded in 2017 and after. Table 1 is apparent that a significant per cent (45.46%) of Agri-Startups were located in 'semi-urban' areas followed by 'urban areas' and 'rural areas'. The obtained results were attributed to the fact that majority of respondents had established their infrastructure facilities in 'semi-urban' areas comparatively due to low cost of establishment of infrastructure facilities and other operational benefits than in 'urban' areas. The data on ownership status indicated that over half of the respondents belonged to a 'private entity' (47.73%), followed by 'general partnership,' and 'sole proprietorship' firms. This implies that respondents owned their businesses privately, which might be attributable to the low cost of setup, minimal liability, and easy fund raising.

Table 1: General profile of Agri-Startups (N=44)

S.No	Variables	Categories	Frequency	Percentage
1.	Sector	Agri-Tech	24	54.55
		Dairy	3	6.82
		Organic	9	20.45
		Food Processing	8	18.18
2.	Stage of development	Ideation	10	22.73
		Validation	16	36.36
		Early-Traction	13	29.55
		Scaling	5	11.36
3.	Year of establishment	2011-2012	1	2.27
		2012-2017	9	20.45
		2017-2020	34	77.27
4.	Location	Rural	10	22.72
		Semi-Urban	20	45.46
		Urban	14	31.82
5.	Ownership status	Sole proprietorship	8	18.18
		General partnership	15	34.09
		Corporations	0	0.00
		Private entity	21	47.73
6.	Annual turnover as on 2020	Low (Up to 237)	38	86.36
	(lakhs rupees)	Medium (238 to 544)	4	9.09
		High (Above 544)	2	4.55
	Customer segmentation	Consumers	25	56.82
		Farmers	24	54.55
		Wholesalers	14	31.82
8.	Product portfolio	Precision agriculture	18	40.91
		Agri Machinery & Equipment	13	29.55
		Agricultural Inputs	12	27.27
		Manufacturing of processed food products	11	25.00
		Organic agriculture and value-added packaged powders and products	8	18.18
		Urban farming	6	13.64
		Mobile Applications & services	4	9.09
		Organic milk	2	4.55
		Pharmaceutical	1	2.27
9.	Services portfolio	Advisory services	25	56.82
		Real time information systems	16	36.36
		E-commerce platform	15	34.09
		Digitalized services	12	27.27
		Training and capacity building services	10	22.73
		Export services	7	15.91

Table 1 contd...

S.No	Variables	Categories	Frequency	Percentage
10.	Incubator support	Agri-Startup acquaintance with incubator	20	45.45
11.	Stage of Startups acquaintance with incubator	Ideation	9	20.45
		Validation	8	18.18
		Early Traction	3	6.82
		Scaling	0	0.00
12.	Nature of incubation support received	Training	15	34.09
		Mentorship and advisory services	12	27.27
		Networking	11	25.00
		Technology commercialization	11	25.00
		Access to capital sources	9	20.45
		Marketing and accounting	5	11.36

Annual turnover refers to yearly sales or yearly receipts of a firm and is very important for keeping the financial wellness of a Startup. Results on annual turnover indicated that a large majority (86.36%) possess 'low annual turnover' (below 237 lakhs rupees/annum). The low annual turnover of the Startups indicates low costs and higher returns. The results are in line with findings of Ravi (2007) who reported that majority of the respondent's belonged to low-income category. The results on customer segment revealed that 56.82 per cent of Agri-Startups had 'local consumers' as end customers whereas, 54.55 per cent and 31.82 per cent of Agri-Startups had major customer segment as 'farmers' and 'wholesalers'. This could be due to the reason that most of the new goods and services offered by Agri-tech Startups were tailored specifically for farmers to boost farm productivity and address farm-level concerns. Around 41 per cent of Agri-Startups were providing products in the areas of 'precision agriculture', followed by 'machinery and equipments', 'manufacturing of processed food products'. Precision agriculture is appealing to Startups because it allows for more effective use of inputs for increased crop output and quality while minimising environmental impact. The study on services portfolio revealed that, around 57 per cent of Agri-Startups were providing 'advisory services', followed by 'real time information systems', 'e-commerce platform' and 'digitalized services'. Nearly 45.45 per cent of the Startups were acquainted with 'incubator programs' which provide required resources along with financial and technical assistance. Further, a significant per cent of the Startups in 'ideation stage' (20.45%) have been receiving 'incubation support' followed by 'validation stage' (18.18%) and 'early-traction stage' (6.82%). Among the support services extended by incubators, majority offered 'training support' (34.09%) followed by 'mentorship and advisory services' (27.27%), 'networking and technology commercialization support' (25.00%), 'access to capital sources' (20.45%) and 'marketing and accounting strategies' (11.36%).

The profile characteristics of Agri-Startup entrepreneurs were studied with respect of their age, gender, occupation, education, family profile, professional experience, trainings received and financial sources for their respective Startups and the results are furnished in the Table 2. A significant majority of the aspiring Agri-Startup entrepreneurs belonged to 'young and medium age group', 56.82 and 38.63 per cent, respectively. It is important to emphasise that young people are more likely to consider Agri-Startup as an entrepreneurial activity. The above findings were in line with findings of findings of Rituraj *et al.* (2015) who observed that majority of agripreneurs belonged to young age group followed by middle and old age groups. Only (6.82%) of the respondents were female which was a very meagre share even after the nationwide encouragement of women entrepreneurship in the country. This finding could be linked to the claim of Jumamil *et al.* (2017) that males have more entrepreneurial intentions than female.

Agri-Startup was found to be the 'main occupation' of 84.09 per cent of the entrepreneurs, followed by 'subsidiary occupation' (15.91%). The

Table 2: Socio-personal profile of Agri-Startup entrepreneurs (N=44)

S.No	Variables	Categories	Frequency	Percentage
1.	Age	Young (Up to 35 years)	25	56.82
		Middle (35-50)	17	38.63
		Old (Above 50)	2	4.55
2.	Gender	Male	41	93.18
		Female	3	6.82
3.	Startup occupation	Primary	37	84.09
		Subsidiary	7	15.91
4.	Education	Higher Secondary Schooling	3	6.82
		Graduate	16	36.36
		Post Graduate	25	56.82
5.	Family size	Small (Up to 4)	27	61.36
		Medium (5 to 6)	15	34.09
		Large (Above 6)	2	4.55
6.	Family type	Nuclear	29	65.91
		Joint	12	27.27
		Extended	3	6.82
7.	Caste	General Class	24	54.54
		Other Backward Class	17	38.64
		Scheduled Caste	3	6.82
		Scheduled Tribe	0	0.00
8.	Domicile	Urban	24	54.55
		Semi-Urban	11	25.00
		Rural	9	20.45
9.	Startup work experience (years)	Low(Up to 1)	25	56.82
		Medium (1-2)	14	31.82
		High (Above 2)	5	11.36
10.	Trainings received (Number)	Low (Up to 1)	24	54.55
		Medium (1-2)	9	20.45
		High (Above 2)	11	25.00
11.	Employees (Number)	Low (Up to 3)	20	45.45
		Medium (3-5)	13	29.55
		High (Above 5)	11	25.00
12.	Type of employment generated	Skilled	11	25.00
		Technical	16	36.37
		Administrative	9	20.45
		Unskilled	8	18.18
13.	Institutional sources of finance	Incubators	15	34.09
		Commercial Banks	14	31.82
		Private Banks	11	25.00
		Government grants and support	11	25.00
		Venture Capitalists	2	4.55
		Accelerators	1	2.27

Table 2 contd...

S.No	Variables	Categories	Frequency	Percentage
14.	Non-institutional sources of finance	Bootstrapping	42	95.45
		Family & Friends	36	81.82
		Private money lenders	0	0.00
		Angel Investors	4	9.09
15.	Stage of funding	Pre-Seed Funding	1	2.27
		Seed Funding	17	38.64
		Series A Funding	7	15.91
		Series B Funding	11	25.00
		Series C Funding	6	13.64
		Series D Funding	2	4.55
		Initial Public Offering: Stock Market Launch	0	0.00
16.	Total capital investment	Low (Up to 192)	41	93.18
	(lakhs rupees)	Medium (193 to 233)	1	2.27
		High (Above 234)	2	4.55

educational background of Startup entrepreneurs revealed that more than half (56.82%) of the entrepreneurs were having 'post-graduation education' indicating that post-graduates often acquire specialization in pursuing Agripreneurship. This finding could be linked to the claim of Reis (2017), where majority of the respondents were post-graduated. Table 2 is apparent that majority (61.36%) of the Startup entrepreneurs had 'small' size family followed by 'medium' and 'large' families. This finding could be linked to the claim of Jumamil *et al.* (2017) that respondents from smaller households had more entrepreneurial intentions than from medium or large households. Regarding family type it was found that a significant proportion (65.91%) of the respondents belonged to 'nuclear families' followed by 'joint family' and 'extended family'. Sirisha *et al.* (2021) have reported that entrepreneurs of nuclear families have experienced relatively superior levels of social, economic, and overall empowerment. More than half of the respondents belonged to 'general class' (54.54%) followed by 'other backward classes', 'schedule caste' and none of them were from 'schedule tribe'. Majority (54.55%) of the Agri-Startup entrepreneurs belonged to 'urban areas' followed by 'semi-urban' areas and 'rural areas'. These results once again confirm the findings of Freire-Gibb *et al.* (2014) that creative people who live in urban area are more likely to establish their own ventures.

It could be clearly seen from Table 2 that more than half (56.82%) of the respondents were having 'less than one year' of experience about Agri-Startups. Another 31.82 per cent were having 'medium' (between 1-2 years) experience and 11.36 per cent were having 'high' (above 2 years) experience categories. According to the findings, it is indicated that Startups that are still in the early stages of development will have low professional experience. These results are in contradiction to the ones reported by Mubeena *et al.* (2020) that, majority (35.41%) of the agripreneurs had medium entrepreneurial experience. Table 2 also reveals that among the respondents, 54.55 per cent had 'low level of trainings'. Around 25 per cent and 20 per cent were categorized as having 'high' to 'medium' level of trainings. Further, the study confirms the fact that majority of the Startups did not receive incubation support, which would otherwise offer management training services. Deepthi (2016) also reported similar results on level of respondent's participation in trainings related to Agri-Startups. From Table 2, it indicated that 'low to medium level' of employees were on the expected line as majority of the budding Startups employ limited workforce.

The type of employment generated by the majority (36.37%) was 'technical manpower' followed by, 'skilled', 'administrative' and 'unskilled' as technical manpower is essentially required for smooth and

successful functioning of Startups. The financial sources of the Startup entrepreneurs were analysed and the results are presented in Table 2 that incubators (34.09%) are the major institutional sources of finance followed by 'commercial banks', 'private banks' and 'government grants and support' (25.00%). However, venture capitalists and accelerators supported very few Startups which accounts for 4.55 and 2.27 per cent, respectively. With respect to 'non-institutional sources' Startups relied on 'bootstrapping fund' (95.45%) followed by 'family & friends' and 'angel investors'. These results once again reaffirm that Startup founders mostly prefer to expand up their businesses via non-institutional sources, such as bootstrapping funds, rather than institutional sources. In their 2003 study, Astebro and Bernhardt examined the negative association between new enterprises and bank loans and the positive relationship between venture survivals with non-banking financing. This finding could be linked to the claim of Abdullah *et al*., (2014); Manisha *et al*., (2022) who concluded that majority of agripreneurs relied on their own funds.

It is evident from Table 2 that majority of Agri-Startups (38.64%) belonged to "seed stage" due to their lower initial cost followed by the 'series B', 'series A', 'series C' and 'series D', but none of the Startups were able to advance to "final IPO stage" to raise additional capital from the general public. A huge majority of the respondents (93.18%) had low total capital investment owing to their early stage of growth. The above findings confirm that Startups operating at seed stage had low capital investment which supports the fact that limited capital (Horvath, 2018) is required to start an early-stage Startup. It is worth noting that despite the fact that training was the primary support service provided by incubators, nearly three-fifths of the entrepreneurs received less than one training owing to lack of access to the trainings.

CONCLUSION

As indicated by the findings of the study, majority of the selected Agri-Startups belonged to 'ideation to validation stages' which clearly indicates that most of the Agri-Startups were established recently between the years '2017 to 2020' and were operating at early stages of growth having no prior experience. Further-more, majority of the Agri-Startup entrepreneurs had not acquainted with any of the any incubator programs. The study revealed that entrepreneurs had not received formal training in their Startup domains which indicates a wider gap between the Startup entrepreneurs and training providers. Additionally, the findings indicate that major sources of financing were bootstrapping/ own savings followed by 'family & friends' which clearly indicates inadequate institutional financial support to the Agri-Startups in its early stages of development. Creating a local presence along the Agri-Startup clusters to facilitate ecosystem integration and access to government, industry, research and development organizations, training providers, CSR funds should be mobilised to support and develop a robust Agri-Startup ecosystem in our country.

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Research Article

A Study on Access and Purpose of Internet Utilisation in Agriculture Postgraduate Students

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ABSTRACT

Technological advances are fast transforming our modes of communication, as well as the art of teaching and expanding styles of learning. During the last decade, the exponential increase in Internet usage has impacted the lives of millions of individuals all over the world. The youthful generation gets exposed to the Internet at a young age, and this will lead to a tremendous growth in Internet usage in the near future. The Internet has now become an increasingly crucial aspect of the educational process for both students and teachers. This study was carried out with the help of an online questionnaire sent to agricultural postgraduate students in Uttar Pradesh through google form mode to obtain student opinions on the frequency of Internet use, purpose for utilising the Internet services and their technological skills. A total of 283 responses of students were collected. Frequency distributions, mean, percentage and Mean percent score were calculated to analyse the data.

Keywords: Access, Agriculture, Internet, Postgraduate, Purpose, Student, Utilisation

INTRODUCTION

During the second half of the twentieth century, information and communication technologies used to obtain knowledge that had a tremendous impact on human growth. As a result, the twenty-first century has been labelled as the "knowledge period," or "knowledge revolution." The internet has become a beacon of transformation since it provides limitless knowledge to everyone. India has embraced Digitised Educational Resources by the year 2007, with support from government and external funding agencies (James and Bossu, 2014). People's education is being influenced by the internet, which provides alternate, creative learning approaches (I°man and Dabaj, 2004).

The global educational system was highly impacted by the COVID-19 pandemic. It has prompted educational institutions to shut, affecting more than 90 per cent of the world's student population. Considering that face-to-face learning was no longer acceptable throughout this unusual period of the Covid-19 pandemic, learners were obliged to participate in e-learning during this era of Covid-19 Lockdown. To maintain teaching and learning processes in educational institutions, our educational system has ended up switching to online learning, which is an imperfect but speedy approach to the crisis.

The internet is gradually has been used as a repository of educational materials. Students will start participating actively, course discussions will comprise more depth, students will become even more self - reliant, students will start utilizing new student-based educational support, student skill sets will boost and connectivity between students and teachers will also become steady and pliable. The educated, particularly those at the university level, who have the capacity to affect societal transformation, are interested in accessing, utilising, and imparting knowledge via the

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internet as well as other communication technologies. It could be claimed that university students who are implementing this transformation have a responsibility to be prepared with competent cognitive, emotional, and psychomotor proficiency throughout their studies. Acquiring knowledge and transforming it into technology to improve people's quality of life, as well as students' potential to access and implement this knowledge deliberately while disseminating it at a high level, is a prerequisite of the information age.

MATERIALS AND METHODS

The present research was done on the students who were pursuing their post-graduation degree in agriculture from six well established universities of Uttar Pradesh i.e. Acharya Narendra Dev University of Agriculture and Technology, Kumarganj, Ayodhya, Banda University of Agriculture and Technology, Banda, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Institute of Agricultural Sciences, B.H.U. Varanasi, Sam Higginbottom University of Agriculture, Technology and Sciences, Naini, Prayagraj and Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut. Ten per cent of the whole population of the students from each university were selected which comprises of total of 283 respondents. Frequency distributions, mean, percentage, mean percent score was calculated to analyse the data.

RESULTS AND DISCUSSION

According to Table 1, Majority of the students (98.23%) were accessing to internet via an Internet-enabled smartphone, followed by 75.61 per cent of the students were accessing to internet via tablet/computer/laptop, 70.32 per cent of the students had access to internet at their educational institution, 32.15 per cent of the students used commercial facility (e.g. cyber cafe) for accessing the internet, 28.26 per cent of the students had access to internet at home using a broadband connection and 14.13 per cent of the students had access to internet at home using a dial-up connection.

According to Table 2, most of the students (93.64%) used internet services more than once a day, 3.88 per cent of the students utilised the internet at

Table 1: Distribution of respondents on the basis of access to internet services (n=283)

Particulars	f	%
Via an Internet-enabled smartphone	278	98.23
Via tablet/computer/laptop	214	75.61
At home using a broadband connection	80	28.26
At home using a dial-up connection	40	14.13
At educational institution	199	70.32
Via a commercial facility (e.g. cyber cafe)	91	32.15

Table 2: Distribution of respondents on the basis of hours spent on the internet per day by respondents (n=283)

Particulars	f	%
Up to 3 hours	106	37.46
4 - 7 hours	129	45.58
7 hours and above	48	16.96

Table 3: Distribution of respondents on the basis of how often they use internet services (n=283)

Particulars	f	%
More than once a day	265	93.64
Once a day	11	3.88
Once in a week	7	2.48

Table 4: Distribution of respondents on the basis of educational purpose of utilisation of internet services

Particulars	f (%)			MPS	Rank
	Always	Sometimes	Rarely		
Attending online classes	146(51.59)	105(37.10)	32(11.31)	80.09	IV
Collection of general information	200(70.67)	71(25.09)	12(4.24)	88.81	I
Searching for academic information	181(63.96)	89(31.45)	13(4.59)	86.45	II
Searching for project work	144(50.88)	115(40.64)	24(8.48)	80.80	III
Searching for scholarship	94(33.22)	109(38.52)	80(28.27)	68.31	VII
Online examination	119(42.05)	112(39.58)	52(18.37)	74.55	VI
Online results	141(49.82)	111(39.22)	31(10.95)	79.62	V

least once a day and 2.48 per cent of the students used internet services at least once a week.

According to Table 3, 45.58 per cent of the students were spending 4-7 hours on the internet per day, 37.46 per cent of the students were using internet up to 3 hours per day, 16.96 per cent of the students spent more than 7 hours on the internet per day.

Table 4 reveals that in terms of the Educational Purpose of Utilization of Internet Services, Collection of general information was ranked 1st with MPS 88.81, followed by Searching for academic information ranked 2nd with MPS 86.45, Searching for project work with MPS 80.80 got 3rd rank, followed by Attending online classes getting 4th rank with MPS 80.09, Online results ranked 5th with MPS 79.62, followed by Online examination ranking as 6th with MPS 74.55, and least usage was done by the students with the purpose of searching for scholarship with MPS 68.31. Table 5 reveals that in terms of the Entertainment Purpose of Utilization of Internet Services for Entertainment, Access to social networking sites was ranked 1st with MPS 81.03, followed by Chatting ranked 2nd with MPS 78.44, downloading music with MPS 63.25 got 3rd rank and followed by playing games getting 4th rank with MPS 47.70.

Table 6 reveals that in terms of the Miscellaneous Purpose of Utilization of Internet Services, banking transaction was ranked 1st with MPS 81.03, followed by e-ticketing ranked 2nd with MPS 78.44 and searching for medical/health tips with MPS 63.25 got 3rd rank.

The findings in Table 7 suggested that 68.90 per cent students attended any workshop for e-learning skills, 54.77 per cent students have studied any free certificate course on any MOOC platform, 61.48 per cent students have done registration or enrolment on digitised educational sources like CeRA, Krishikosh, MOOCs etc. and 44.88 per cent students got enrolled in any paid courses on any digitised educational sources.

Table 5: Distribution of respondents on the basis of miscellaneous purpose of utilisation of internet services

Particulars	f (%)			MPS	Rank
	Always	Sometimes	Rarely		
e-ticketing	123(43.46)	107(37.81)	53(18.73)	74.91	II
Banking transaction	187(66.08)	79(27.92)	17(6.01)	86.69	I
Medical/health tips	59(20.85)	122(43.11)	102(36.04)	61.60	III

Table 6: Distribution of respondents on the basis of entertainment purpose of utilisation of internet services

Particulars	f (%)			MPS	Rank
	Always	Sometimes	Rarely		
Access to social networking sites	138(48.76)	129(45.58)	16(5.65)	81.03	I
Download music	69(24.38)	116(40.99)	98(34.63)	63.25	III
Chatting	137(48.41)	109(38.52)	37(13.07)	78.44	II
Games	34(12.01)	54(19.08)	195(68.90)	47.70	IV

Table 7: Distribution of respondents on the basis of their Technological Skills

Particulars	Yes	No
	f (%)	f (%)
Have you attended any workshop for e-learning skills?	195(68.90)	88(31.10)
Have you studied any free certificate course on any MOOC platform?	155(54.77)	128(45.23)
Have you done registration or enrolment on digitised educational sources like CeRA, Krishikosh, MOOCs etc?	174(61.48)	109(38.52)
Have you get enrolled in any paid courses on any digitised educational sources?	127(44.88)	156(55.12)

CONCLUSION

The usage of the Internet has increased dramatically in recent years and pandemic acted as fuel to this burning fire. Students utilise the Internet in massive quantities all throughout the world. It's crucial to look into their online activities because not only they're thought as opinion makers and leaders in technological goods, but they are the future of our society as well. The findings of this study revealed that most of the students i.e. 98.23 per cent were accessing to internet via an Internet-enabled smartphone, 93.64 per cent students were using internet services more than once a day and 45.58 per cent of the students were spending 4-7 hours on the internet per day. In case of the educational purpose of utilization of internet services, collection of general information was ranked 1st with MPS 88.81, in case of the entertainment purpose, access to social networking sites got 1st rank with MPS 81.03 and banking transaction was ranked 1st with MPS 81.03 in case of the miscellaneous purpose of utilization of internet services. 68.90 per cent students attended any workshop for e-learning skills, 61.48 per cent students have done registration or enrolment on digitised educational sources but only 54.77 per cent students have studied any free certificate course on any MOOC platform and 44.88 per cent students got enrolled in any paid courses. It can be concluded that most of the students utilise their time on internet for gathering relevant and information and students have been using internet in ways that will improve their academic knowledge and achievements.

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Research Article

Status of Adoption of Improved Technologies in Farming Sector in Nagaland, India

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ABSTRACT

The study examined the level of knowledge of growers on improved technology and the status of adoption of technologies in agriculture. Also, it has identified the constraints in the adoption of improved technologies in the farming sector and mitigation measures to overcome the problems. Nagaland was purposively selected, and 6 villages from 3 blocks under Dimapur district were purposively selected. Altogether, 100 farmers were chosen as respondents and an interview schedule was constructed for data collection. Respondents were continuing the cultivation of 8 major crops. The overall knowledge level of the respondents on improved farming technologies was inadequate to moderate and the adoption level was of medium level. Study identified ten constraints with mitigation measures from respondents. Which are in descending order: attack of insects and diseases on crops, marketing, weed management, transportation, inputs availability, extension contact, harvesting, planting materials, land preparation and irrigation facilities for farming. The policy process may sincerely take cognizance of all the findings of the study. Also, up-scaling the knowledge level of the farmers on improved farming technologies, adoption of improved farming technologies and mitigation of identified constraints may be prioritised in all the existing and forthcoming initiatives for improvement of agriculture and farming communities.

Keywords: Adoption, Agriculture, Constraints, Knowledge, Nagaland, Technology

INTRODUCTION

India is an agricultural dependent country and the fact that the majority of the populations are vegetarians, solely depends on the agricultural products for their survival. Being an agricultural based nation, country's economy is principally influenced by annual crop yields of agricultural practices. In India, farmers cultivate major food crops such as rice, wheat, cereals, pulses, different vegetables (onion, potato, sugarcane, oil seeds, mango, orange, red chilli) and also various commercial crops such as coconut, coffee, tea, cotton, rubber and jute. Agriculture contributes approximately 18% to the total GDP of the country and provides employment to over 60 to 70 per cent of the population in India (Upendra *et al.*, 2020).

Technology can be used in all aspects of agriculture, such as the application of herbicides, pesticides, fertilizers and seeds. Over the years, technology has proven very useful in the agricultural field. The introduction of new technologies and scientific methods has made a monumental impact on the farming sector in recent decades. Its welcomed induction has not only made farming more sustainable and profitable, it has also dramatically reduced the manual workload placed on many farmers. For years, in the industrialized world, scientific and technological advancements have benefited farmers by driving agriculture production. However, in the developing countries (including India) of the world, smallholder farmers constitute above 80 per cent of the farming community. The majority of these farmers are containing with lack to access of many modern tools needed to be successful, such as crop management products, modern irrigation practices, fertilizers, postharvest loss solutions, improved seeds, mobile

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technology, as well as access to information and extension services (Rehman *et al.*, 2016).

In Indian farming scenario, adoption of technologies is varied and diversified, according to the socio-economic conditions of the farmers and the agro-ecological situation. Nagaland is located in the North-east India and blessed with favourable climate for cultivating a wide range of crops. Agriculture plays a pre-dominant role in the economy of Nagaland. About 50 per cent of the total areas have economic cultivable land and the mainstay of the people of the State is land based, i.e. Agro-horticultural activities (Deka and Thirugnanavel, 2020). Major crops growing in the state, namely, rice, millet, maize and pulses. Important horticultural crops in the state are coffee, cardamom, tea, orange, kiwi, pineapple and king chilli (among the hottest chillies in the world) and different vegetable crops namely melon, cucumber, spinach, onion, carrot, tomatoes, brinjal, chillies, leek etc. Traditional means of agricultural practise and knowledge are integral, even with the introduction of new ideas and innovations (Solo and Kikhi, 2021). This paper is an attempt to explore the knowledge level of respondents on improved technologies and adoption of improved technologies in Nagaland's farming sector. Further, constraints involved in agriculture of Nagaland with mitigation measures were also emphasised in the study.

MATERIALS AND METHODS

The present study was conducted in the state of Nagaland. Dimapur district was purposively selected for the study as farming is practised in major portion of the district and it contributes major portion of agricultural production. Three blocks i.e., Medziphema, Chumoukedima and Dhansiripar were purposively selected for the present study and two villages from each selected block namely, Medziphema, Molvom, Tenyiphe I and Tenyiphe II, Seluophe and Bade, totalling up to six villages were purposively selected. Further, 17 respondents each from Medziphema village and Molvom, 17 respondents each from Tenyiphe I and Tenyiphe II and 16 respondents each from Seluophe and Bade village were selected which summed up to a total of 100 respondents were included for the study.

An interview schedule was prepared for collection of data from the respondents. The present data were based on both primary data as well as secondary sources. The primary data were collected by personal interviews with the help of an interview schedule from the respondents. The secondary data were collected from pertinent documents, publications, journals, internet and the concerned department. The collected data were processed, classified, tabulated and systematically analysed with proper and appropriate tools for drawing conclusions.

To assess the overall knowledge level of the respondents, a list was prepared with questions on the different practices and management of various crops. It covers 10 aspects *i.e.*, acquiring seeds from authentic sources, time of sowing/planting, field preparation, recommended spacing, manures and their recommended dose, fertilizers and their recommended dose, irrigation operation, harvesting time, pest control and disease management for crops production and management. Further, their knowledge level was assessed with a degree of extend of knowledge following 'fully aware', partially aware' and 'not aware'. Similarly, all the aspects had included to explore the knowledge level also included to assess the status of adoption in agriculture. Similarly, adoption level was assessed with extend of adoption, following 'fully adopted', partially adopted' and 'not adopted'. Based on the knowledge and adoption level, respondents are categorised under low (<mean - SD), medium (mean - SD to mean + SD) and high (>mean + SD) in respect of each crop. Further, respondents were asked to identify the important constraints in the farming sector with reference to modernization and also asked to propose suggestive measures for mitigating the respective constraint.

RESULTS AND DISCUSSION

The outcomes of the research are presented and discussed in the present section. Outline of the section is as follows. Firstly, we present and discuss about the existing cultivation pattern in the study area. The next section covers the knowledge and adoption status of respondents on improved cultivation practices. Constraints in cultivation and suggestive measures for mitigation are covered in last section of this chapter.

Most of the low and middle income countries' people primarily depend on agriculture (Ghosh *et. at.,* 2023). In the study area, respondents are continuing the cultivation of 8 crops. Around 37.00 per cent of

Table 1: Distribution of respondents based on different crops cultivated (N=100)

Crops	Frequency (%)*
Paddy	34 (43.00)
Maize	28 (28.00)
Cabbage	37 (37.00)
Colocasia	35 (35.00)
King chilli	10 (10.00)
Ginger	18 (18.00)
Pineapple	17 (17.00)
Banana	13 (13.00)

*Multiple responses were obtained

the respondents were involved in cabbage cultivation, 35.00 per cent in colocasia, 34.00 per cent in paddy cultivation, Another, 28.00 per cent are growing maize, 18.00 per cent are growing ginger, 17.00 per cent are growing pineapple, 13.00 per cent are continuing with banana cultivation and 10.00 per cent are continuing king chilli cultivation.

Less knowledge requirement for cultivation of a crop is an parameter to assess sustainability of it (Patra and Benjongtoshi, 2023). Up-scaling of the knowledge level of growers on improved technologies in rice cultivation was emphasised by Lalthamawii *et al.* (2022); Gogoi *et al.* (2022). Table 2 revealed that 61.76 per cent of the paddy growers had a medium knowledge level, while 23.52 per cent had low knowledge level and the remaining 14.70 per cent had high knowledge level on paddy cultivation. Majority of the maize growers (85.71%) had a medium knowledge level, followed by high knowledge level with 10.71 per cent and a low knowledge level with the remaining 3.57 per cent, respectively. It was emerged that 80.00 per

Table 2: Distribution of respondents based on their overall knowledge level about the improved practice on crop cultivation (N=120)

Crops	Knowledge level of respondents			
	Category	Frequency (%)	Mean	SD
Paddy (n=34)	Low (<9.32)	8 (23.52)	11.64	2.32
	Medium (9.32-13.96)	21 (61.76)		
	High (>13.96)	5 (14.70)		
Maize (n=28)	Low (<9.33)	1 (3.57)	11.10	1.77
	Medium (9.33-12.87)	24 (85.71)		
	High (>12.87)	3 (10.71)		
Cabbage (n=37)	Low (<9.37)	4 (10.81)	10.75	1.38
	Medium (9.37-12.13)	30 (81.08)		
	High (>12.13)	3 (8.10)		
Colocasia(n=35)	Low (<7.55)	4 (11.42)	9.31	1.76
	Medium (7.55-11.07)	28 (80.00)		
	High (>11.07)	3 (8.57)		
King chilli (n=10)	Low (<9.19)	1 (10)	10.8	1.61
	Medium (9.19-12.41)	6 (60)		
	High (>12.41)	3 (30)		
Ginger (n=18)	Low (<9.13)	4 (22.22)	11.05	1.92
	Medium (9.13-12.97)	12 (66.66)		
	High (>12.97)	2 (11.11)		
Pineapple (n=17)	Low (<9.68)	3 (17.64)	11.00	1.32
	Medium (9.68-12.32)	9 (52.94)		
	High (>12.32)	5 (29.41)		
Banana (n=13)	Low (<11.03)	3 (23.07)	12.84	1.81
	Medium (11.03-14.65)	8 (61.53)		
	High (>14.65)	2 (15.38)		

cent of the colocasia cultivators had a medium level of knowledge, followed by 11.42 per cent had a low level of knowledge and 8.57 per cent had a high level of knowledge on improved cultivation practices of colocasia.

In respect of the knowledge level of respondents on vegetable cultivation, the majority of the cabbage growers (81.08%) had medium level of knowledge, followed by low knowledge level with 10.81 per cent and high knowledge level with remaining 8.10 percent. A majority (60.00%) of the king chilli growers had medium knowledge level, while 30.00 per cent had a high level of knowledge, followed by 10.00 per cent had a low knowledge level on improved cultivation practices of king chilli. In respect of ginger growers, 66.66 per cent had a medium knowledge level, while 22.22 per cent had a low level of knowledge and 11.11 per cent had a high level of knowledge on improved cultivation practices.

Further, in respect to respondents' knowledge level on fruit cultivation, 52.94 per cent of the pineapple growers a had a medium knowledge level, 29.41 per cent had high level of knowledge, followed by 17.64 per cent had a low knowledge level on improved cultivation practices of pineapple. Whereas, 61.53 per cent of the banana growers had a medium knowledge level, while 23.07 per cent had a low level of knowledge and 15.38 per cent had a high knowledge level, respectively on improved cultivation practices of banana. Further, it can be concluded from the study that majority of the farmers are categorized under the medium knowledge level and this finding has agreement with the finding of (Patra and Kense, 2020; Grewal *et al.,* 2023).

Table 3 shows the distribution of respondents based on their overall adoption level of improved practices on crop cultivation. In this respect, respondents' size (n= presented as parenthesis against

Table 3: distribution of respondents based on their overall adoption of improved practices on selected crops

Crops	Adoption level of respondents			
	Category	**Frequency (%)**	**Mean**	**SD**
Paddy (n=34)	Low (<7.19)	6 (17.64)	9.44	2.25
	Medium (7.19-11.69)	23 (67.64)		
	High (>11.69)	5 (14.70)		
Maize (n=28)	Low (<7.56)	4 (14.28)	10.03	2.47
	Medium (7.56-12.5)	19 (67.86)		
	High (>12.5)	5 (17.85)		
Cabbage (n=37)	Low (<8.59)	3 (8.11)	10.00	1.41
	Medium (8.59-11.41)	30 (81.08)		
	High (>11.41)	4 (10.81)		
Colocasia(n=35)	Low (<6.51)	4 (11.43)	7.25	0.74
	Medium (6.51-7.99)	29 (82.86)		
	High (>7.99)	2 (5.71)		
King chilli (n=10)	Low (<8.06)	4 (40.00)	9	0.94
	Medium (8.06-9.94)	6 (60.00)		
	High (>9.94)	0 (0.00)		
Ginger (n=18)	Low (<7.43)	3 (16.66)	8	1.57
	Medium (7.43-10.57)	12 (66.66)		
	High (>10.57)	3 (16.66)		
Pineapple (n=17)	Low (<7.21)	5 (29.41)	10.23	0.79
	Medium (7.21-8.79)	7 (41.17)		
	High (>8.79)	5 (29.41)		
Banana (n=13)	Low (<7.49)	2 (15.38)	4.88	2.74
	Medium (7.49-12.97)	8 (61.53)		
	High (>12.97)	3 (23.07)		

each crop) was varied in nature from one crop to another and analysis was done accordingly.

It is urgent to increase productivity and reduce the area under rice cultivation to mitigate climate change due to the emission of greenhouse gases from rice cultivation (Patra and Babu, 2017; Patra *et al.,* 2024). Therefore, the adoption of all the possible improved technologies in rice cultivation is needed. But study indicated that the majority (67.64%) of the rice growers had a medium adoption level; this is in line with the findings of Lcho *et al.* (2021), while 17.64 per cent had a low adoption level and the remaining 14.70 per cent had a high adoption level on improved rice cultivation. A majority (67.86%) of the maize growers had a medium adoption of improved maize cultivation, followed by high adoption level with 17.85 per cent and a low adoption level with remaining 14.28 per cent. It was emerged that 82.86 per cent of the respondents had a low level of adoption and 5.71 per cent had a high level of adoption on improved cultivation practices of colocasia.

In respect of the adoption level of respondents on vegetable cultivation, a majority (81.08%) of cabbage growers had a medium level of adoption of improved cultivation practices, followed by high adoption level of 10.81 per cent and a low adoption level with the remaining 8.11 per cent. Around 60.00 per cent of the king chilli growers had a medium adoption level while 40.00 per cent had a low level of adoption on improved cultivation practices of king chilli. In respect of ginger growers, 66.66 per cent had a medium adoption level, while 16.66 per cent each had a low level of adoption and a high level of adoption on improved cultivation practices of ginger, respectively.

Further, in respect of the adoption level of respondents on fruit cultivation, 41.17 per cent of the pineapple growers had a medium adoption level and 29.41 per cent each had a high adoption and low adoption of improved cultivation practices of pineapple. It is important to mention that pineapple cultivation is an important livelihood alternative in the region (Gamlin and Patra, 2020). Whereas, 61.53 per cent of the banana growers had a medium adoption level, 23.07 per cent had a high adoption and the remaining 15.38 per cent had a low adoption level on improved cultivation practices of banana. These findings were in line with the findings of Prodhan *et al.* (2017). From the study it can be concluded that majority of the respondents are categorised under medium adoption level and this finding has disagreement with the finding of Kumari *et al.* (2022).

Table 4 shows the information related to major constraints involved in the farming sector and the measures suggested by them to overcome these constraints. The constraints were ranked according to the number of respondents who highlighted the particular issue as a constraint. Pest and disease management was the biggest problem faced by the respondents in the study area and this was ranked as Ist constraint and all (100.00%) the respondents faced this constraint. Farmers lacked knowledge on pest and disease management. They were also faced with financial problems for purchasing pesticides and chemicals as these were expensive.

Marketing of farm produce is a widely recognized problem (Patra *et al.,* 2019 and Gogoi *et al.,* 2023) It was found that 89.00 per cent of the respondents had faced problem in terms of marketing and was ranked as IInd constraint. There were problems in getting a proper market linkage and also lacked a proper market place for both the sellers and buyers. Further, farmers faced problems due to price fluctuation of their produce and earned meagre income by selling their produce at a lower rate. It was evident that 77.00 per cent of the respondents had faced constraints in terms of weed management and ranked as IIIrd. The problem was accelerated due to the high cost of labour and excessive weed due to heavy and well distributed rainfall.

Transportation was the IVth constraint. Around 70.00 per cent of the respondents had faced problem in this aspect. It was reported that a lack of transport facility prevailed, especially at interior rural areas. Respondents also faced problems due to the bad road condition and poor road connectivity from the field to the main road restricting their interest in supplying their produce to bigger market areas instead of selling only in and around their village premises and neighbouring villages.

Further, it was revealed that 69.00 per cent of the respondents had faced problems in terms of input

Table 4: Prioritization of constraints in agriculture as identified by farmers and suggestive measures by them to overcome the respective constraints

S.No.	Per cent of respondents	Rank	Constraints	Nature of problems	Suggestions given by the farmers
1.	100.00	I	Attack of Insects and diseases	• Lack of knowledge on management and control • Financial constraints to buy pesticides and chemicals	• More training on pest and diseases management • Govt should provide subsidy
2.	89.00	II	Marketing	• Poor market linkage • No proper market place • Price fluctuations	• Establish market linkage by agents • Fixed selling price of crop • Provision by the govt.
3.	77.00	III	Weeds management	• Demand and high cost of labour due to excess weed • Lack of knowledge of proper methods of weed management	• Practice crop rotation • Manual hand weeding
4.	70.00	IV	Transportation	• Lack of transportation facilities • Poor road condition • Poor road network from farm to main road	• Own private vehicle • Construction of better road by the govt • Agri-link road
5.	69.00	V	Input availability	• High cost of inputs • Inputs unavailability	• Inputs provided at subsidy rates • Farm inputs made available around village area
6.	67.00	VI	Extension contact	• Poor access to extension services • Inefficient extension service delivery	• Establish proper link between the farmers and the agents
7.	64.00	VII	Harvest/post harvest management	• Post harvest loss	• Provide storage facility by govt
8.	48.00	VIII	Planting materials	• Lack of information on the source of improved varieties of planting materials	• Provide information of improved seeds source by extension agents
9.	46.00	IX	Land preparation	• High cost, scarcity of labour • Ploughing difficulty due to hilly landscape	• Band and work together in alternate fields • Follow up terrace cultivation
10.	35.00	X	Irrigation	• No proper irrigation facilities	• Establishment of irrigation channel

availability and was ranked as Vth constraint. Various inputs including machinery, improved seeds, manures, fertilizers and farm chemicals were expensive for the farmers and non-availability of the inputs to acquire by farmers.

Inadequate extension support is a tremendous problem in Indian agriculture (Patra and Chophi, 2022; Patra and Babu, 2023; Satapathy *et al.,* 2023) and rigorous extension support is needed to improve the knowledge and awareness level of farmers (Patra and Babu, 2020; Chatterjee and Mondal, 2022); Extension contact was found as VIth constraint and reported by 67.00 per cent of the respondents. Respondents expressed poor accessibility to extension services and inefficient extension service. Concerning extension service to farmers, Information and Communication Technology (ICT) has immense role (Burman et al., 2023). Post harvest loss was recognized by the growers (Koza *et al.,* 202). Post harvest management was ranked as the VIIth constraint and 64.00 per cent of the respondents had faced problems of post harvest losses and they also faced problems to sell their produce on time.

Further, lack of information about the source of improved varieties of planting materials was ranked as VIIIth constraint and faced by 48 per cent of the respondents. The respondents lacked awareness of the authentic source for acquiring of improved planting material. It was revealed that 46 per cent of the respondents had faced constraints in terms of land preparation, and this was the IXth constraint. The farmers expressed high costs and scarcity of labour during field preparation and also expressed difficulty in ploughing due to the hilly terrain. It was found that 35.00 per cent of the respondents had faced problems with irrigation, which was the Xth constraint. A majority of the farmers were dependent on rainwater for cultivation. However, farmers had expressed problems with non-existence of irrigation channels in their fields.

The respondents proposed some of the important suggestive measures to overcome all the constraints were more training on pest and disease management, Government should provide subsidies on high-cost inputs, establishment of market linkage by government agencies, fixed selling price/minimum support price of crops, promote the practice of crop rotation, establishment of multipurpose storage facilities to avoid post-harvest loss and establishment of irrigation channels for irrigated cultivation. Concerning suggestive measures to mitigate the constraints, farmers training was recommended by agricultural officers as the most important extension initiative to address the farming problems (Patra and Mondal, 2007; Patra, 2004).

CONCLUSION

Findings revealed that the majority of the respondents had a medium level of knowledge on the various improved practices of crops cultivation. The status of the adoption of technologies by the farmers still needs to reach a satisfactory level and be amped up. This paper also identified the constraints at the farmers' level and encouraged them to propose mitigation measures to respective constraints. Accordingly, ten significant constraints in the farming sector of Nagaland, along with mitigation measures to respective constraints, were documented. In order to improve the farmers' knowledge and adoption level, it is recommended to introduce active and continuous extension activities for information dissemination and technology adoption at the farmers' level. Policy process may consider all the findings of the study and initiate to achieve all-round development of the farming sector on a priority basis by inclusion of outcomes of the present study in the existing and forthcoming farming sector development initiatives.

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Research Article

Exploring the Relationship Between Socio-economic Variables and Adoption of Guava Cultivation Practices Under National Horticulture Mission in Haryana

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ABSTRACT

Guava is a very popular fruit. It is available throughout the year. Being very hardy, it gives an assured crop even with very little care. The NHM programme has resulted in a few notable improvements in India, including the first time since independence that the GDP from the horticulture industry has surpassed the GDP from the agriculture sector. The present data were solicited from randomly selected 120 guava growers in Sirsa, Fatehabad, and Hisar districts of Haryana state during 2022-23. Forty respondents were selected randomly from each district. It was found that two-fifths of the respondents (42.50%) were from the age group of 36–50 years, and one-third of the farmers (30.00%) were educated up to secondary and senior secondary school. Nearly two-thirds of the respondents (62.50%) hailed from the nuclear family, with a majority of 62.50 per cent having a family size of up to 4 members. Regarding land holding, 33.33 per cent of the respondents had 5–10 acres, 39.17 per cent of the farmers had annual income above Rs. 300,000, Half of the farmers (50.00%) were exposed to a medium level of mass media exposure, and 46.67 per cent of the farmers belonged to a high level of socio-economic status. Nearly three-fourths of the respondents (73.34%) had a medium level of adoption of guava cultivation under NHM, while 20.00 per cent had a high and 6.66 per cent had a low level of adoption. A significant association was found between education, size of land holding, annual income, extension contacts, and socio-economic status and levels of adoption of guava cultivation practices among respondents at a 0.5% level of significance.

Keywords: Guava, Adoption, National horticulture mission, Association

INTRODUCTION

In the agricultural industry, horticulture plays a significant role. The rapidly expanding demand for horticulture commodities and goods, particularly the expanding markets for processed fruits and vegetables and floriculture, are indications of the phenomena that is anticipated to further accelerate horticulture expansion in the nation. Horticulture is therefore expected to grow in prominence and play a bigger part in the agricultural industry and eventually the overall economy of the country (Singh *et al.,* 2008). Additionally, the diversification of land use for orchard cultivation for commercial fruit production has contributed to economic success, which has led to noticeable changes in agricultural incomes, lifestyles, and consumption patterns of our people (Singh *et al.,* 2008). Horticulture crops have the distinct advantage of producing more yield per unit of land area when compared to other crops, leading to the creation of jobs and increased income in rural regions (Upadhyay *et al.*, 2018). Horticulture in India makes up roughly 33 per cent of agriculture's Gross Value Added (GVA), which is a very substantial contribution to the country's economy. India, at present produces more horticultural

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products than it is food grains, with 320.48 million tonnes of horticulture products produced on just 25.66 million ha, compared to 127.6 million ha for food grains. Productivity of horticulture crops is much higher compared to productivity of food grains (12.49 tones/ha against 2.23 tones/ha.). India has become the world's top producer of a number of fruits, including mango, banana, guava, papaya, sapota, pomegranate, lime, and many others. It is also the world's second-largest producer of fruits and vegetables. Production and productivity of horticultural crops have increased as a result of the National Horticulture Mission's launch. Productivity of horticulture crops has increased by about 38.5% between 2004-05 and 2021-22 (Ministry of Agriculture & Farmers Welfare, 2022). The challenge for further boosting the production and productivity of horticulture crops is the increase in demand for horticultural produce due to greater health awareness, rising income, export needs, and increasing population (Anonymous, 2022). Since a very long time ago, guava had been grown throughout the country. Every state had been actively working to cultivate guava in the regions most suited for its propagation since it was an agricultural crop with a high potential for maintaining health. The guava is a significant fruit crop grown in tropical and subtropical areas of the world. It is accessible all year round, but not in the summer. Guava is a very lucrative crop that can be cultivated with little care and attention because it is fairly hardy. Due to its great nutritional value and numerous health advantages, guava is frequently referred to as a "Super Fruit" (Singh *et al.,* 2017). Guava production in India is projected to have reached 5.59 million metric tonnes in the fiscal year 2023. From the previous fiscal year, this represented a modest increase. About 359 thousand hectares of guava were grown in the nation in 2023 (Minhas, 2023). According to the latest research, the total guava production across India was 4.92 million metric tons in the year 2022 and the cultivated area for amrood fruit was nearly 315 thousand hectares in the country in 2022.India exports Guava fruit to over 30 countries across the globe. During the year 2020-2021, Uttar Pradesh remained the top state producing the highest quantity of guava. It contributes nearly 21 per cent of total guava production in India. After that, we have Madhya Pradesh, Bihar, Andhra Pradesh, Haryana, Punjab, and West Bengal (Anonymous, 2023).The state government's initiative to encourage farmers to produce horticulture crops instead of traditional ones has resulted in an area under horticulture crops in Haryana reaching roughly 6.40 per cent of the total cropped area of the state (Sally, 2011).Haryana is most important guava producing state comprising of 15863 hectare area under the crop and production 189714 MT during 2022-23 (Horticultural department government of Haryana, 2023).

The production of fruits and vegetables now accounts for 30 per cent of the country's agricultural GDP and has emerged as an important catalyst for economic growth in many areas. With the increase in adoption of improved production technology and increased use of purchased inputs, the attitude of farmers in Haryana state has changed. The farmers are not only interested in increasing crop yield per unit of area but also in the income obtained as an ultimate end product. Guava fruit is commercially grown throughout the country. Although there are a number of aspects influencing productivity and production, but the most important factor is sound knowledge of improved technology and full use of the recommended practices for successful results. Adopting better production technology brings with it a many kinds of issues (Sumit, 2012).

MATERIALS AND METHODS

The present study was undertaken in Haryana State during 2022-23. Three districts of Haryana State; Fatehabad, Hisar and Sirsa were selected randomly to conduct the study. In Sirsa district Sirsa and Nathusari Chopta blocks were selected randomly. From Fatehabad district Fatehabad, Bhattu Kalan and Bhuna blocks were selected randomly and in Hisar district Hisar-II block was selected randomly. Hence, 40 respondents were selected from each district and a whole 120 respondents were selected from the 3 districts. The data was collected with interview procedure by contacting each farmer on his farm for collecting information relevant to the research objectives. The data were analysed by using MS Excel, OP STAT and Statistical Package for Social Sciences (SPSS) for computing frequency, percentage, WMS, rank and Chi-square (χ^2) to draw meaningful inferences.

RESULTS AND DISCUSSION

It is evident from the data given in Table 1 that two-fifths of the respondents (42.50%) were from the age

Table 1: Contextual matrix of the respondents

Independent Variables	Hisar (N=40)	Fatehabad (N=40)	Sirsa (N=40)	Total (N=120)
Age				
up to 35 years	5(12.50)	11(27.50)	16(40.00)	32(26.70)
36-50 years	27(67.50)	13(32.50)	11(27.50)	51(42.50)
above 50 years	8(20.00)	16(40.00)	13(32.50)	37(30.80)
Education				
Illiterate	3(7.50)	3(7.50)	6(15.00)	12(10.00)
Primary school	1(2.50)	7(17.50)	7(17.50)	15(12.50)
Middle school	15(37.50)	12(30.00)	7(17.50)	34(28.33)
Secondary& senior secondary school	15(37.50)	13(32.50)	8(20.00)	36(30.00)
Graduate and above	6(15.00)	5(12.50)	12(30.00)	23(19.17)
Caste				
General category	16(40.00)	21(52.50)	33(82.50)	70(58.33)
Backward class	22(55.00)	8(20.00)	4(10.00)	34(28.33)
Scheduled caste	2(5.00)	11(27.50)	3(7.50)	16(13.34)
Family type				
Nuclear	19(47.50)	27(67.50)	29(72.50)	75(62.50)
Joint	21(52.50)	13(32.50)	11(27.50)	45(37.50)
Family size				
Small (up to 4 members)	18(45.00)	27(67.50)	30(75.00)	75(62.50)
Medium (5-8 members)	14(35.00)	6(15.00)	10(25.00)	30(25.00)
Large (above 8 members)	8(20.00)	7(17.50)	-	15(12.50)
Size of land holding				
Up to 1 acre	1(2.50)	6(15.00)	-	7(5.84)
Between 1-2.5 acres	6(15.00)	5(12.50)	5(12.50)	16(13.33)
Between 2.5-5 acres	10(25.00)	10(25.00)	7(17.50)	27(22.50)
5-10acres	17(42.50)	15(37.50)	8(20.00)	40(33.33)
10 and above	6(15.00)	4(10.00)	20(50.00)	30(25.00)
Annual income (Rs.)				
Up to 1,50,000	7(17.50)	8(20.00)	17(42.50)	32(26.66)
Between 1,50,001 - 3,00,000	18(45.00)	13(32.50)	10(25.00)	41(34.17)
Above 3,00,000	15(37.50)	19(47.50)	13(32.50)	47(39.17)
Subsidiary occupation				
Nil	20(50.00)	19(47.50)	19(47.50)	58(48.33)
Labour	1(2.50)	4(10.00)	7(17.50)	12(10.00)
Dairy	12(30.00)	11(27.50)	7(17.50)	30(25.00)
Business	3(7.50)	4(10.00)	2(5.00)	9(7.50)
Service	4(10.00)	2(5.00)	5(12.50)	11(9.17)
Social participation				
Not member of any organization	23(57.50)	16(40.00)	26(65.00)	65(54.17)
Member of one organization	11(27.50)	13(32.50)	11(27.50)	35(29.17)
Member of more than one organization	6(15.00)	11(27.50)	3(7.50)	20(16.66)

Table 1 contd...

Independent Variables	Hisar (N=40)	Fatehabad (N=40)	Sirsa (N=40)	Total (N=120)
Mass media exposure				
Low (5-8)	4(10.00)	14(35.00)	17(42.50)	35(29.16)
Medium (9-12)	26(65.00)	17(42.50)	17(42.50)	60(50.00)
High (13-15)	10(25.00)	9(22.50)	6(15.00)	25(20.84)
Extension contacts				
Low (5-11)	5(12.50)	8(20.00)	15(37.50)	28(23.33)
Medium (12-18)	22(55.00)	14(35.00)	16(40.00)	52(43.34)
High (19-25)	13(32.50)	18(45.00)	9(22.50)	40(33.33)
Socio-economic status				
Low (4-7)	5(12.50)	7(17.50)	6(15.00)	18(15.00)
Medium (8-11)	16(40.00)	16(40.00)	14(35.00)	46(38.33)
High (12-16)	19(47.50)	17(42.50)	20(50.00)	56(46.67)

Figure in the parenthesis denote percentage

group of 36–50 years, one-third of the respondents (30.00%) were educated up to secondary and senior secondary school, followed by middle school (28.33%), graduate and above (19.17%). Analysis revealed that the majority of farmers (58.33%) were from the general category, nearly two-thirds of the respondents (62.50%) hailed from the nuclear family, with a majority of 62.50 per cent having a family size of up to 4 members. Regarding land holding, 33.33 percent of the respondents had 5–10 acres, followed by 25.00 per cent of the respondents who had above 10 acres of land. Regarding annual income, 39.17 percent of the farmers were earning above Rs. 300,000. About half of the respondents (48.33%) were not engaged in a subsidiary occupation. More than half of the farmers (54.17%) were not participating in any type of social organization. It was revealed that half of the farmers (50.00%) were exposed to a medium level of mass media exposure, whereas less than one-third (29.16%) were exposed to a low level of mass media exposure. Regarding socio-economic status, 46.67 per cent of the farmers belonged to a high level of socio-economic status and 15.00 per cent among them were from a low level of socio-economic status.

Adoption refers to regular use of recommended package of practices for last three years for guava production. Table 2 depicts that more than three-fifth (63.33%) of the respondents adopted improved variety of guava i.e., Hisar Safeda followed by Hisar Surekha variety (60.84%). Regarding pit digging statement more than half (58.34%) of the respondents adopted pit size (1m x 1 m x 1 m) and nearly half (49.16%) of the respondents did not follow the period of pit digging (May-June). It was found that half of the respondents (50.00%) adopted soil and 45.00 per cent adopted FYM as pit filling material. More than half of the respondents (54.16%) did not opt the spacing of 6m x 6m and February-March duration was followed by 59.16 per cent for the time of sowing. When it comes to use of fertilizers, 56.66 per cent used FYM followed by chemical fertilizers (Sodium nitrate/Ammonium sulphate/Urea/Super Phosphate (SSP)/Murate of potash) i.e., 51.66 per cent. First week of February was most favoured time for manuring by the respondents (53.34%) whereas 51.66 per cent were not in favour of duration of time of manuring viz. first week of July. More than half (52.50%) of the respondents did not adopted flood as method of irrigation. Pruning time of guava cultivation was seen just after harvesting (April) by nearly half of the respondents (47.50%). More than half of the respondents (55.83%) adopted vegetables as intercropping with guava during initial 3-4 years. More than half of the respondents (53.34%) found that mealy bug was discovered to have a pest infestation in the guava production, followed by nematodes (52.50%). More than half of the respondents (51.66%) harvested guava when fruit was yellow in colour. For packaging, 55.00 per cent of the respondents use CFB, whereas 47.50 per cent of the respondents did not follow the

Table 2: Guava cultivation package of practices adopted by the respondents

Statements	Yes (1)	No (0)
Improved variety		
Hisar Safeda	76(63.33)	44(36.67)
Allahabad Safeda	63(52.50)	57(47.50)
Hisar Surekha	73(60.84)	47(39.16)
Lucknow-49	69(57.50)	51(42.50)
Pit digging		
Period (May-June)	61(50.84)	59(49.16)
Size (1m x 1m x 1m)	70(58.34)	50(41.66)
Filling material		
Soil	60(50.00)	60(50.00)
FYM	54(45.00)	66(55.00)
Insecticide	56(46.66)	64(53.34)
Spacing		
6mx6m	55(45.84)	65(54.16)
Time of sowing		
February-March	71(59.16)	49(40.84)
August-September	60(50.00)	60(50.00)
Use of fertilizers after planting		
Chemical fertilizers (Sodium nitrate/Ammonium sulphate/ Urea/Super Phosphate (SSP)/ Murate of potash)	62(51.66)	58(48.34)
Vermi-compost	57(47.50)	63(52.50)
Green Manure	59(49.16)	61(50.84)
FYM	68(56.66)	52(43.34)
Time of manuring		
First week of February	64(53.34)	56(46.66)
First week of July	58(48.34)	62(51.66)
Methods of irrigation		
Flood	57(47.50)	63(52.50)
Drip-irrigation	60(50.00)	60(50.00)
Pruning time		
Just after harvesting (April)	57(47.50)	63(52.50)
In spring season	50(41.66)	70(58.34)
Intercropping during initial 3-4 years		
Vegetables (okra, carrot, radish, brinjal etc.)	67(55.83)	53(44.17)
Fruits	32(26.67)	88(73.33)
Legumes (gram, beans etc.)	09(7.50)	111(92.50)
Pest control		
Fruit fly	62(51.66)	58(48.34)
Guava shoot borer	55(45.83)	65(54.17)
Mealy bug	64(53.34)	56(46.67)
Nematode	63(52.50)	57(47.50)
Stage of harvesting		
When fruit is yellow in colour	62(51.66)	58(48.34)
Changes colour from dark green to greenish yellow	61(50.83)	59(49.17)
Post harvest activity		
Cleaning, grading, and packing	63(52.50)	57(47.50)
For packing use CFB (corrugated fiber board)	66(55.00)	54(45.00)
Transportation		
Of Self	59(49.16)	61(50.84)
Of Dealer	59(49.16)	61(50.84)
Market channels		
Wholesale	63(52.50)	57(47.50)
Local Mandi	67(55.84)	53(44.16)
Village directly	62(51.66)	58(48.34)

Figure in the parenthesis denote percentage

cleaning, grading, and packaging procedures. Further it was found that nearly half of the respondents (49.16%) transported their produce (guava) themselves, while 55.84 per cent of the respondents sent their produce to a local mandi. The findings were supported with the results of studies conducted by Sunil Kumar (2004); Dhole *et al.* (2009) and Sumit (2012).

In all 38 practices, the responses included in the questionnaire were obtained on two point continuum i.e., Yes and No with the assigned scores of 1 and 0 respectively. On the basis of score range, three adoption categories were formulated as mentioned below: Low 35-46 Medium 47-57 High 58-70. As shown in Table 3, nearly three-fourth of the respondents (73.34%) had a medium level of adoption of guava cultivation under NHM, while 20.00 percent had high and 6.66 per cent had low level of adoption. The result were supported by Sumit (2012) and found that just half of the respondents i.e. 50.00 per cent were found to be having the adoption rate of medium level. Almost one-third

Table 3: Adoption level of guava cultivation package of practices under NHM

Level of Adoption	Frequency	Percentage
Low (35-46)	8	6.66
Medium (47-57)	88	73.34
High (58-70)	24	20.00

of the respondents i.e. 32.50 per cent were having a high adoption level while only 17.50 per cent had adopted the various practices of guava production at low level. The similar finding by Kamaljit (2012) reported that majority of farmers (75%) belonged to medium level of adoption whereas, 15 percent in high adoption category and 10 percent belonged to low level of adoption of package of practices of guava.

Table 4 shows that age, caste, family type, family size, subsidiary occupation, social participation, mass media exposure were found non-significant with level of adoption of guava cultivation practices under NHM. Education was found significant with level of adoption at a chi square value of 20.75. An overwhelming majority of the respondents (88.23%) who had education up to middle school had medium level of adoption of guava cultivation under NHM. Size of land holding was found significant with level of adoption at a chi square value of 17.85. An overwhelming majority of respondents (96.30%) who had land between 2.5-5 acres had medium level of adoption of guava cultivation under NHM. Annual income was found significant with level of adoption at a chi square value of 9.75. More than four-fifth of the respondents (81.25%) who had annual income up to 1.5 lacs had medium level of adoption of guava cultivation under NHM. Extension contacts was found significant with level of adoption at a chi square value of 11.32. More than four-fifth of the respondents (89.13%) who had medium level of extension contacts had medium level of adoption of guava cultivation under NHM. Socio-economic status was found significant with level of adoption at a chi square value of 16.32. An overwhelming majority of the respondents (89.13%) who had medium socio-economic status had medium level of adoption of guava cultivation under NHM. These findings are similar to those of Pawar (2016) and found that education, annual income, land holding, source of information, area under guava cultivation, area under high density plantation of guava cultivation innovativeness and social participation had positive and significant relationship with adoption of high density plantation technology of guava crop.

Table 4: Association between socio-economic variables and adoption level of guava cultivation package of practices

Socio-economic variables	Statistical tool (χ^2)
Age	2.46
Education	20.75*
Caste	3.46
Family type	0.22
Family size	1.57
Landholding	17.85*
Annual income	9.75*
Subsidiary occupation	4.90
Social participation	0.54
Mass media exposure	9.30
Extension contacts	11.32*
Socio economic status	16.32*

*Significant at 0.05% level of significance
**Highly significant at 0.01% level of significance

CONCLUSION

The present study was conducted in Hisar, Sirsa and Fatehabad districts of Haryana state. It was concluded that two-fifths of the respondents (42.50%) were from the age group of 36-50 years. One-third of the respondents (30.00%) were educated up to secondary and senior secondary school level, majority of the respondents were from general category. It was revealed that half of the farmers (50.00%) were exposed to a medium level of mass media exposure. Regarding socio-economic status, 46.67 per cent of the farmers belonged to a high level of socio-economic status. The study highlighted that nearly three-fourth of the respondents (73.34%) had a medium while, 20.00 per cent had high level of adoption of guava cultivation package of practices under NHM. A significant association was found between education, size of land holding, annual income, extension contacts and socio-economic status and levels of adoption of guava cultivation practices among respondents.

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Research Article

Gender Differences in Academic Adjustment and Interpersonal Support Among University Students

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ABSTRACT

The study was conducted in three universities of GNDU, Amritsar; PAU, Ludhiana and PUP, Patiala of Punjab, India to investigate the gender differences and relationship between academic adjustment and interpersonal support among university students of Punjab. The sample consisted of 480 university students randomly selected from three chosen purposively government universities. An equal number of students are distributed across both genders. The academic adjustment of the university students was measured using the Academic Adjustment Scale and Interpersonal Support Evaluation scale to measure the peer support available to university students. Data were analyzed using a t-test and Karl-Pearson's coefficient of correlation. The results also showed that female students displayed significantly better academic adjustment and interpersonal support as compared to male students.

Keywords: Academic adjustment, Interpersonal support, University students

INTRODUCTION

Female university students often have better academic adjustment compared to their male counterparts. Academic adjustment refers to how well students adapt to the demands and expectations of the university environment, including academic performance, social integration and psychological well-being. Here are some factors that contribute to the better academic adjustment of female university students like higher educational attainment, motivation, study habits and stronger social support networks.

Adjustment plays a major role in academic success. Adler and Stewart (2008) proposed a study to assess the relationship between adjustment to university and academic success. The findings revealed that poor college adjustment is positively related to low academic performance, poor grades and failure in life. Academic achievement has long been recognized as one of the major goals of education all around the world. Academic accomplishment is commonly measured through examination or continuous assessment (Singh, 2011). Academic adjustment refers to a student's ability for meeting educational responsibilities, including their drive to fulfill their academic efforts and satisfaction with academic environment through interpersonal support.

Interpersonal support among university students can encompass various forms, including appraisal support, belonging support and tangible support. These forms of support play significant roles in students' well-being, academic success, and overall adjustment. There are three types of supports like appraisal, belonging and tangible support. Appraisal support involves receiving feedback, encouragement, and constructive criticism from others. It helps students gain insights into their abilities, strengths, and areas for improvement. Belonging support enhances students' well-being, reduces feelings of isolation, and promotes a positive learning environment that encourages collaboration and mutual support. Tangible support involves practical assistance, resources, and material aid

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provided to students. It addresses their concrete needs and helps alleviate stressors that may hinder academic success. Tangible support ensures that students have the necessary resources and infrastructure to thrive academically, reduces barriers to success, and promotes equal opportunities for all. Interpersonal support in the forms of appraisal, belonging and tangible support is crucial for promoting students' well-being, academic engagement, and overall adjustment in the university setting. By fostering a supportive environment that addresses these different aspects of support, universities can enhance students' experiences and facilitate their success.

According to Dayioglu and Türüt-Asik (2007); Downing *et al.* (2008); Sheard (2009); Castagnetti and Rosti (2009) that female students could perform better in academic spheres in new environments than counterparts. However, some differences found between this study and other studies were that this study mainly examined the interaction between universities and individuals, with the emphasis on the individual student's subjective perception of the university environment, including the clearance of degree, programme and registration requirements, and professors performance on teaching. On the other hand, Dayioglu and Türüt-Asik's (2007) reported that assistance for female students with respect to achieving higher CGPA for the female student population. Downing *et al.* (2008) concluded that on how females could do better as they focus their attention and avoid distractions by using schedules to manage their responsibilities effectively and developing study aids to assist their learning.

Castagnetti and Rosti (2009) studied that females exerted more effort than males, thereby achieving better academically. In universities, some subjects are fundamental in studying other courses. Students lacking fundamental knowledge and skills, especially in mathematics and writing, could hardly find it easy to handle their academic matters and achieve good grades when making the transition to the new learning environment.

According to Fauziah *et al.* (2002) in a local public university, the adjustment problems faced by new students include academic problems, health problems, financial crises as well as social and personal problems. For example, some of the academic problems faced by students were: unable to register for courses, difficult to understand textbooks written in English, and unable to attend lecture as early as eight in the morning. Financial problems included receiving funds late from the provider or the received amount of fund was not enough to cover the expenses during the course of study.

Safree *et al.* (2011) reported that the social support attained by 120 undergraduate students in a public university in Malaysia revealed a significant and positive relationship to their academic achievement, indicating that the higher the social support, the higher the academic achievement of the students.

This finding provides evidence that students who perceived that social support was available in campus were likely to be able to cope effectively with their academic, social, and personal-emotional problems. They were also predicted to show a higher degree of commitment to educational-institutional goals and higher degree of attachment to the institutions they were attached to. Moreover, the present study indicated a significant relationship between social support and academic achievement and this finding has further supported the importance of social support in undergraduates' academic performance. Therefore interpersonal support is an important predictor in determining both the adjustment and academic achievement among new undergraduates. Hence, it is important for those who are involved in tertiary education such as lecturers, academic advisors and university administrators to provide support services to assist new undergraduates who experience adjustment problems and to prepare them to proceed to the following semester with less problems (Abdullah *et al.,* 2014).

MATERIALS AND METHODS

Study location: The study was conducted during 2019 in the three purposively selected government universities of Punjab state i.e. Guru Nanak Dev University, Amritsar (GNDU); Punjab Agricultural University, Ludhiana (PAU) and Punjabi University, Patiala (PUP), Punjab, India. An equal number of students distributed across both the gender (n_1=80 females & n_2=80 males) who were randomly selected from each university. Thus the total sample comprised of 480 respondents.

Research tools

The following tools were used for collecting the information from the respondents:

Academic adjustment scale: Academic adjustment of the university students was assessed by administering the Academic Adjustment Scale developed by Baker and Sirk (1989). The scale consisted of 25 statements on a four-point likert scale. The minimum score on the scale was 25 and the maximum score was 100. In general procedure of scoring, high score indicated greater academic adjustment and low score indicated less academic adjustment among university students. The reliability of coefficient was 0.91 and validity was 0.92.

Interpersonal support evaluation scale: Interpersonal Support Evaluation Scale developed by Cohen *et al.* (1985) and used to measure the peer support available to university students. Higher scores on each of the dimensions (Appraisal, Belonging, and Tangible) indicated stronger perceived availability of social support in each context. The scale consisted of 12 statements, out of which 6 statements were positive and 6 statements were negative on a four-point likert scale with a reliability and validity coefficient of ($\geq$70). The interpersonal support was assessed across the following three levels: low, medium and high.

Statistical analysis of data: The following statistical frequency, percentage, mean, standard deviation and Karl-Pearson's coefficient of correlation.

RESULTS AND DISCUSION

The data presented in the Table 1 exhibits gender-wise distribution of the students as per their academic adjustment in the selected universities. The data revealed that the students from GNDU, more than half of the female students (61.25%) perceived to have a high level of academic adjustment followed by medium (37.50%) and low (1.25%) level. A similar trend was observed among male students, 57.50 per cent of the students had a high level, 42.50 per cent of the students perceived a medium and no students had a low level of academic adjustment.

Similarly, the students from PAU, more than half of the female students (67.50%) had a high level and 35 per cent of the students perceived to be at medium level of academic adjustment. The similar trend was observed among male students as well, where 65 per cent of the students had a high level and the rest 35 per cent of students perceived a medium level of academic adjustment.

Further, amongst students from PUP, 72.50 per cent of the female students had a high level and 33.75 per cent of students perceived to have a medium level of academic adjustment. In the same way among male students, 66.25 per cent of the students had a high level and the rest 27.50 per cent of students perceived a medium level of academic adjustment.

Hence, the results reflect that female students outnumbered their male students at high level of perceived academic adjustment. Female students may have access to stronger interpersonal support networks, both within and outside the university. These networks can provide them with guidance, emotional support, and resources, which can contribute to their academic adjustment. This finding is also similar to the study reported by Kyalo and Chumba (2011) who reported that sixty two per cent of female and forty nine per cent of male students had a high level of academic

Table 1: Gender-wise distribution of the students as per their academic adjustment in the selected universities (n=480)

Levels	Guru Nanak Dev University, Amritsar (n_1=160)		Punjab Agricultural University, Ludhiana (n_2=160)		Punjabi University, Patiala (n_3=160)	
	Females (n_{1f}=80) *f*(%)	Males (n_{1m}=80) *f*(%)	Females (n_{2f}=80) *f*(%)	Males (n_{2m}=80) *F*(%)	Females (n_{3f}=80) *f*(%)	Males (n_{3m}=80) *f*(%)
Low	1(1.25)	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Medium	30(37.50)	34(42.50)	26(32.50)	28(35.00)	27(33.75)	22(27.50)
High	49(61.25)	46(57.50)	54(67.50)	52(65.00)	58(72.50)	53(66.25)

Figures in parentheses indicate percentage

adjustment. Similarly, another study reported by Srivastava (2018) who also found that female students outnumbered their male students in academic adjustment as female students have better learning strategies from early age, are more consistent and persistent in their pursuit of academic goals. Another findings also reported that females exerted more effort than males, thereby achieving better academically Castagnetti and Rosti (2009).

The representation of data in the Table 2 portrays gender difference in the mean scores of the students in their academic adjustment in the selected universities. The analysis of the data reflected that students from GNDU, PAU and PUP, statistically non-significant gender differences were observed in academic adjustment but the trend of mean scores predicted that female students from GNDU (mean=2.97), PAU (mean=3.08) and PUP (mean=3.05) had better mean scores in academic adjustment as compared to male students. Thus, female students are mentally prepared for adjustment to reach their goal. Moreover, female students may exhibit higher levels of motivation and engagement in their studies, which can positively impact their academic adjustment. They may be more inclined to participate actively in class, seek additional support, and take advantage of academic resources. Female students may have perceived better interpersonal support, which can provide emotional support, guidance and encouragement. These support can positively influence their adjustment and overall academic performance. Similar study reported by Alipio (2020) who also found that female students had better academic adjustment as compared to male students because they have capability to make all sorts of adjustment and is very flexible. Another findings of the study revealed that female students made the transition to university and adjusted better than males in academic performance. The findings show that females could handle their studies much better than males when they make the transition to university and are faced with sudden changes in their learning mode and learning environment (Yau *et al.,* 2014).

The demonstration of data in the Table 3 depicts the correlation analysis between three dimensions of interpersonal support and academic adjustment with respect to gender. The examination of data stated that among female students, significant positive correlation were observed between belonging support (r= 0.20; $p<0.01$), tangible support (r= 0.14; $p<0.05$) and overall (0.19; $p<0.01$) interpersonal support with academic adjustment. Hence, it could be inferred that female students who perceived higher level of college

Table 2: Gender-wise mean score (± SD) distribution of the students as per their academic adjustment in the selected universities (n=480)

	Guru Nanak Dev University, Amritsar (n_1=160)			**Punjab Agricultural University, Ludhiana(n_2=160)**			**Punjabi University Patiala (n_3=160)**		
	Females (n_{1f}=80)	**Males (n_{1m}=80)**	**t-value**	**Females (n_{2f}=80)**	**Males (n_{2m}=80)**	**t-value**	**Females (n_{3f}=80)**	**Males (n_{3m}=80)**	**t-value**
	Mean ±SD	**Mean ±SD**		**Mean ±SD**	**Mean ±SD**		**Mean ±SD**	**Mean ±SD**	
Academic Adjustment	2.97±0.39	2.95±0.41	0.40^{NS}	3.08±0.33	3.02±0.27	1.32^{NS}	3.05±0.25	2.99±0.29	1.42^{NS}

Non-significant

Table 3: Correlation between different dimensions of interpersonal support and academic adjustment among university students as per their gender (n=480)

	Females (n_1=240)				**Males (n_2 = 240)**			
	Dimensions of Interpersonal Support				**Dimensions of Interpersonal Support**			
	Appraisal Support (r)	**Belonging Support (r)**	**Tangible Support (r)**	**Overall Interpersonal Support(r)**	**Appraisal Support (r)**	**Belonging Support (r)**	**Tangible Support (r)**	**Overall Interpersonal Support(r)**
Academic Adjustment	0.12	0.20**	0.14*	0.19**	0.04	0.05	0.11	0.05

*Significant at 5% level, **Significant at 1% level; r= Correlation coefficient

belongingness and instrumental support, they were more likely to adjust better in academic field. This finding is in line with the results of Lonczak *et al.* (2002) who reported that a strong sense of belonging support was directly proportional to academic adjustment. Students especially among girls it was depicted that those who feel connected with their college environment were less likely to exhibit emotional distress or less likely to show withdrawal symptoms.

However, appraisal support a dimension of interpersonal support had non-significant relationship with academic adjustment. Further analysis of data in case of male students reflected that all the dimensions (appraisal, belonging and tangible support) of interpersonal support were noted to be non-significant correlated with academic adjustment.

CONCLUSION

Female students were more academically adjusted and perceived better interpersonal support related to belonging, and tangible support as compared to their male counterparts. Also, the results indicate that female students having higher level of perceived interpersonal support tend to have better academic adjustment in educational institutions. Female students who enter university with strong academic skills and a solid foundation in their chosen field of study are more likely to have a smoother transition and perform well academically. Female students actively seek out and utilize interpersonal support systems such as appraisal, belonging and academic support through professors, mentors, and tutoring services tend to have better academic adjustment. Therefore, interpersonal support plays a significant role in individuals' well-being, including their academic adjustment.

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Research Article

Livelihood Security of Small and Marginal Farm Families, Adopted Conventional and Integrated Farming System: A Comparative Analysis

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ABSTRACT

Livelihood security is defined as adequate stock and flow of food and cash with an individual or a family to meet its basic needs. Secure ownership of, or access to, resources and income-generating activities, including reserves and assets to mitigate risks, relieve shocks, and prepare for contingencies. Small and marginal farm families dominate on agrarian based economy like India, their small operational base makes it unfeasible to enhance the incomes of these households only by raising the existing crop yields and furthermore it is difficult for the farmers to acquire adequate resources to sustain themselves and their livelihoods. Integrated farming system approach, is a valuable approach to addressing the problems of sustainable economic growth for farming communities. Thus present study entitled "Livelihood Security of Small and Marginal Farm Families Adopted Conventional and Integrated farming system: A Comparative Analysis" was conducted and a total of four livelihood security parameters were selected. Findings of the study depicts that the livelihoods of IFS farm families were more secure in comparison to CFS farm families. The results of the study also indicates that livelihood securities of both CFS and IFS farm families had positive and significant correlation with education, monthly family income, land holding, farming experience, livestock possession, possession of agricultural implements and possession of household assets, social participation, extension participation, mass media exposure, training exposure and exposure to e- services.

Keywords: Agriculture, Behavior, Conventional, Farmers, Information, Integrated

INTRODUCTION

Indian agriculture holds the responsibility to provide food and nutritional security to its swarming millions. The rapid growth in population and unexpected colonization lead to rapid fragmentation of land holdings and shrinkage in fertile cultivated land. In India, more than 70.00 per cent of the total population of the nation actually live in villages and largely depend on agriculture and related enterprises. Small and marginal farmers comprise more than 84.00 per cent of the 115 million operational holdings which are cultivating merely 29.00 per cent of the arable land (Singh *et al.,* 2011). The livelihoods of the small and marginal farm families are the most important concern. The current farming situation in India, calls for an integrated approach to address the promising issues. The integrated farming system approach is viewed as the most influential tool for improving the profitability of farming systems, for small and marginal farm families. In fact, our previous experience has clearly revealed that the income from cropping alone is not really sufficient to sustain the needs of small and marginal farm families. Integrated farming system is only possible approach to increase the income of the farmers and to full fill the need of food for increasing population. In IFS systems all agricultural and allied

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enterprises including fishery, bee keeping, animal husbandry, goat rearing, cropping systems, vegetable, fruits and others are setup into a single unit of land and hence better management and recycling of resource or input occurs. Ultimately contributes in increasing the farmer's income Choudhary (2019). With increased consumerism in rural areas, farm families' requirement for cash have also increased to improve their standard of living which is especially true in case of small and marginal farm families. Hence, farmer's income and food security would need to be expanded and enhanced. The word 'livelihood' conceptually indicates the activities, entitlements, means and assets by which people make a living. Assets are defined as natural or biological (i.e. water, land, resources, flora and fauna), social (i.e. social networks, family and community), human (i.e. health, nutrition, education and labour) physical (i.e. markets, schools, roads, clinics and bridges) and economic (i.e. savings, jobs and credit facilities). The sustainability of livelihoods becomes a function of how small and marginal farm families make use of asset portfolios on both a short and long-term basis. When farm families are able to cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future through adaptive and coping strategies while not debilitating the natural resource base than we can say that their livelihoods are sustainable (Jirli *et al.,* 2008).

MATERIALS AND METHODS

Out of two agro-climatic zones (Eastern and Western) of Haryana one agro-climatic zone namely Western Zone of Haryana was selected randomly. Hisar district from Western agro-climatic zone of Haryana was selected randomly. The list of villages procured from KVK after discussion with KVK scientists and Deputy Director of Agriculture of the farm families, practicing conventional and integrated farming system. A total sample of 100 farm families i.e. 50 small and marginal farm families practicing conventional and 50 practicing integrated farming from Hisar district were selected randomly. Data were collected with the help of pre structured interview schedule by the investigator from selected head of the households. The livelihood security has multidimensional aspects. It includes economic security, nutritional security, health security, food security, educational security, habitat security, infrastructure security, community participation, environmental security, etc. Therefore, it was important to select dimensions, which were representative indicators of all these sectors of human-life. The availability of authenticated literature and through discussion with experts of state agriculture department and Krishi vigyan kendras in relevant field, out of seven livelihood security parameters four were selected by using three point continuum scale that is most relevant, relevant and not so relevant by assigning 3, 2 and 1 respectively.

RESULTS AND DISCUSSION

Household food security is an important measure of well being and it ensures access to sufficient food for all people at all times to live an active, healthy and productive life. The components for measuring food security included in present investigation were: sources of food for sample farm families, number of meals the household normally has per day, frequency of fruit and vegetables intake, amount and quality of food eaten by household and household diet diversity.

Results pertaining to food sources of CFS farm families presented in Table 1 indicate that a considerable majority (66.00%) of households got their food from their own farm followed by own farm+ market (30.00%) and rest of the houses i.e. 4.00 per cent got food by sharing of food products. Similarly data regarding IFS farm families presented in the Table 1 depicts that majority of the households (74.00%) got their food from their own farm followed by own farm+ market (22.00%) and only 4.00 per cent got food by sharing of food products + Own farm production.

Data regarding number of meals consumed by the CFS families per day inferred that more than half (62.00%) of farm families had three meals in a day followed by two meals that is breakfast and dinner (34.00%) and breakfast and dinner adopted by only 4.00 per cent. While data regarding number of meals consumed in the IFS families presented in the Table 1 shows that majority of the farm families (78.00%) had three meals in a day followed by two meals a day (20.00%) that is breakfast and dinner and only 2.00 per cent had breakfast and lunch.

With respect to vegetable consumption by the CFS farm families it is clear from the Table 1 that a considerable majority (66.00%) of the households were

Table 1: Perceived food security of CFS and IFS farm families (n=100)

Component	Haryana	
	CFS (n=50) F (%)	IFS (n=50) F (%)
Sources of food (for consumption purpose)		
Own farm production	33(66.00)	37(74.00)
Own farm production + market	15(30.00)	11(22.00)
Sharing of food products+ own farm production	2(4.00)	2(4.00)
Number of meals per day		
Breakfast-lunch-dinner	31(62.00)	39(78.00)
Breakfast and dinner	17(34.00)	10(20.00)
Breakfast and lunch	2(4.00)	1(2.00)
Frequency of vegetables intake		
Daily	33(66.00)	36(72.00)
Twice or thrice in a week	14(28.00)	13(26.00)
Once in a week	3(6.00)	1(2.00)
Frequency of fruits intake		
Daily	-	3(6.00)
Twice or thrice in a week	7(14.00)	15(30.00)
Once in a week	38(76.00)	30(60.00)
Once in a month	5(10.00)	2(4.00)
Adequacy of food		
Enough food to eat	35(70.00)	44(88.00)
Availability of food throughout the year	35(70.00)	43(86.00)
The quality of food available is good	23(46.00)	36(72.00)
Nutritious food affordable with family income	21(42.00)	39(78.00)
Sufficient stock of food for future	34(68.00)	44(88.00)
Household diet diversity (Food groups eaten during last 24 hours)		
Cereals and value added products of cereals	50(100.00)	50(100.00)
Vegetables and value added products of vegetables	33(66.00)	41(82.00)
Fruits and value added products of fruits	10(20.00)	17(34.00)
Pulses and value added products of pulses	41(82.00)	46(92.00)
Milk, milk products and value added products	48(96.00)	50(100.00)
Egg /meat /fish and products	3(6.00)	5(10.00)

*Multiple responses are possible; Figures in parenthesis indicate percentage

consuming vegetables daily followed by twice or thrice in a week (28.00%) and only 6.00 per cent households were consuming vegetables once in a week. Whereas the consumption of vegetables by IFS households presented in the table-1 indicate that 72.00 per cent of the households were consuming vegetables daily followed by twice or thrice in a week (28.00%) and only 2.00 per cent once in a week respectively.

Results regarding frequency of fruits intake presented in Table 1 show that a little more than three forth (76.00%) of the CFS farm families were consuming fruits once in a week followed by twice or thrice in a week (14.00%) and 10.00 per cent of the families were consuming fruits once in a month. Whereas data regarding consumption of fruits by IFS families depict that 60.00 per cent of the households

were consuming fruits twice or thrice in a week followed by once in a week (30.00%) respectively, however only 6.00 per cent households were consuming fruits daily and 4.00 per cent once in a month respectively.

Multiple responses were recorded about food adequacy of CFS and IFS farm families and from the Table 1 it can be discovered that 70.00 per cent of households involved in CFS had enough food to eat, whereas 88.00 per cent farm families from IFS had also enough food to eat. It can also be seen from the Table 1 that 70.00 per cent of the CFS farm families had availability of food throughout the year followed by sufficient stock of food for future (68.00%), the quality of food available is good (46.00%) and 42.00 per cent households responded that nutritious food affordable with family income. With respect to food availability of IFS farm families it is clear from the table-1 that 88.00 per cent of the households responded that they had sufficient stock of food for future followed by availability of food throughout the year (86.00%), nutritious food affordable with family income (78.00%) and 72.00 per cent households perceived that the quality of food available is good. Household diet diversity among respondents.

Dietary diversity is defined as the number of different food groups and value added products consumed over a given reference period. It was calculated with the help of 24 hours recall method. Response were reported on eight food groups i.e. any cereals, any root vegetables, any vegetables, any fruits, egg/meat fish and products, food made from pulses, beans and peas, milk and milk products. However, for consumption purpose similar groups were combined together to form one group. Finally six food groups were included in the present study. Table 1 displays the frequency of farm families consuming food groups and value added products per day (diet diversity) over a period of 24 hour (whole day). Data presented in the Table 1 depict that cereals, milk & milk products were the most common food groups consumed by cent per cent and 96.00 per cent of the CFS farm families in the study area respectively. Protein rich foods such as pulses, beans, peas, lentils, nuts were found to be consumed by the 82.00 per cent of the CFS farm families followed by any vegetables (66.00%), fruits (20.00%) and only 6.00 per cent consuming meat egg/fish/ and products respectively. As far as the diet diversity of IFS farm families was concerned it can be visualized from the Table 1 that cent per cent of the households (100.00%) were consuming cereals and milk and milk products followed by pulses (92.00%), vegetables (82.00%), fruits (34.00%) and egg/meat/ fish and products only 10.00 per cent respectively. The findings are supported by Santhakumari *et al.* (2010) who studied that integrating interventions like livestock rearing, product diversification, nutrition gardening and other allied income generating activities had positive impact on food and nutritional security of small and marginal farm families. In case of nutritional security, the percentage of farmers in the completely secure category was only 8 per cent before the project, which showed a remarkable increase to 72 per cent after the project efforts. Swarnam *et al.* (2016) who also indicated that through the inclusion of various components with IFS model on 0.75 ha land significantly contributed in food diversity and met the dietary requirements of a family of 5 members. Further Rani (2013) also reported that food security, consumption and access stability were found excellent in villages of Haryana. Rajni (2016) who also supported that IFS enhances profitability, productivity and nutritional security of the farm families. IFS can be seen as a good resource management strategy to attain economic and sustained agricultural production to meet miscellaneous requirements of farm families and to assure food and nutritional securities and increment in farm income.

Economic security is to generate sufficient income to satisfy the basic needs and to maintain or increase the goods which is necessary for the stability of the family economy. This includes different components like- employment generation, savings, agriculture and allied insurances, households' debt condition and their level of satisfaction with their current financial condition.

A glance at the Table 2 shows that more than half (54.00%) of the CFS farm families responded that current farming system provide employment throughout the year and 44.00 per cent responded that current farming system generate income throughout the year and only one respondent (2.00%) was forced to migrate for job. On the other hand 92.00 per cent farm families involved in IFS revealed that current

Table 2: Perceived economic security of CFS and IFS farm families (n=100)

Component	Haryana	
	CFS (n=50) F (%)	IFS (n=50) F (%)
Employment generation		
Current farming system provide employment to family	27(54.00)	46(92.00)
Current farming system generate employment	22(44.00)	45(90.00)
Forced to migrate for employment	1(2.00)	-
Savings in terms of		
Money/ Subsidy	31(62.00)	41(82.00)
Food grains	10(20.00)	8(16.00)
Investments	9(18.00)	15(30.00)
Agriculture and allied insurance		
Kisan credit card	37(74.00)	41(82.00)
Soil health card	29(58.00)	33(66.00)
Pradhan Mantri Fasal Beema Yojna	49(98.00)	50(100.00)
Pradhan Mantri Krishi Sinchai Yojna	34(68.00)	30(60.00)
Haryana Bhavantar Bharpai Yojna	15(30.00)	29(58.00)
Pradhan Mantri Kisan Samman Nidhi	49(98.00)	50(100.00)
Household debt		
No	15(30.00)	27(54.00)
Yes, a little	29(58.00)	19(38.00)
Moderate amount	6(12.00)	4(8.00)
Satisfied with current financial condition		
Satisfied	12(24.00)	27(54.00)
Somewhat satisfied	23(46.00)	18(36.00)
Dissatisfied	15(30.00)	5(10.00)

*Multiple responses are possible; Figures in parenthesis indicate percentage

farming system provide employment throughout the year and a considerable majority (90.00%) of the households responded that current farming system generate income throughout the year.

It is apparent from the Table 2 that 62.00 per cent CFS farm families had savings in terms of money/ subsidy followed by in terms of food grains (20.00%) and in terms of investments 18.00 per cent respectively. However in case of IFS farm families 82.00% of the respondents had saving in terms of money/followed by investments (30.00%) and 16.00% respondents had savings as food grains by the farm families.

It can be seen from the Table 2 that maximum number of respondents from the CFS farm families (98.00%) had insurance under Pradhan Mantri Fasal Beema Yojna and Pradhan Mantri Kisan Samman Nidhi. It was followed by Kisan credit card (74.00%), Pradhan Mantri Krishi Sinchai Yojna (68.00%), Soil health card (58.00%) and Haryana Bhavantar Bharpai Yojna 30.00 per cent respectively. Whereas data regarding agriculture and allied insurance of IFS farm families (Table 2) depict that cent per cent of the respondents (100.00%) had insurance under Pradhan Mantri Fasal Beema Yojna and Pradhan Mantri Kisan Samman Nidhi followed by Kisan credit card (82.00%), Soil health card (66.00%), Pradhan Mantri Krishi Sinchai Yojna (60.00%) and Haryana Bhavantar Bharpai Yojna 58.00 per cent respectively by the farm families.

Data in the Table 2 portrays that more than half (58.00%) of the CFS farm families were under little

amount of debt followed by no debt (30.00%) and moderate amount of debt (12.00%) respectively. On the other hand with respect to IFS farm families it was noted that more than half of the respondents (54.00%) had no debt followed by little amount of debt (38.00%) and moderate amount of debt (8.00 per cent respectively. The findings are supported by Singh *et al.* (2017) who studied the usage pattern of the additional income from poultry farming to improve socioeconomic standards of marginal farmers and they found that farmers gave priority to essential facilities like electricity (23.48%), bathroom (23.40%), latrine (15.65%) and 12.66% of farmers converted their Kaccha houses to Pakka houses and some farmers also bought luxury things like mobile (26.96%) and washing machine 0.87 per cent. The findings are supported by Maurya and Kamalvanshi (2017) indicated that the higher value of the indicator implies households are better off and more safe and sound in terms of their livelihood. Habitat security and economic security status are in highly vulnerable situation for rainfed farmers compare to irrigated farmers.

Satisfaction with current financial condition: Data regarding their satisfaction with current economic condition was recorded on three point continuum and it was found that 46.00 per cent of the farm families involved in CFS were somewhat satisfied with their current financial condition followed by dissatisfied (30.00%) and satisfied (24.00%) respectively. On the other hand 54.00 per cent farm families practicing IFS were satisfied with their current financial condition followed by somewhat satisfied (36.00%) and only 10.00 per cent of IFS farm families were dissatisfied with their current financial condition.

Agriculture security is availability and access to the resources for agriculture production optimization i.e. adequacy of agriculture production of farm is sufficient for small and marginal farmer to sustain their living. The components of agriculture security included the adequacy of agriculture production, cropping system, adoption of sustainable farming practices and labour availability.

Data in Table 3 portrays that cent per cent (100.00%) of the CFS farm families had adequate food grains followed by pulses (76.00%), milk (72.00%), vegetables (66.00%), fodder for animals (46.00%) and fruits 10.00 respectively. Whereas in case of IFS cent per cent farm families (100.00%) had adequate food grains followed by milk (94.00%) and pulses (90.00%) respectively. As far as the adequacy of vegetables and fodder of IFS farm families was concerned it is manifested from the Table 3 that equal number of the households (82.00%) had adequate vegetables and fodder. More than half of the IFS farm families (54.00) had adequate fruits for consumption by the farm families.

Data regarding the adoption of sustainable farming practices by the CFS farm families presented in the Table 3 portrays that a considerable majority (68.00%) of CFS farm families were adopted inter cropping system for sustainability and a little more than three fourths (76.00%) per cent of the farm families were growing leguminous crop at least once a year followed by using organic manure and bio-pesticides in their farms (66.00%), timely and regularly vaccination to animals (64.00%). Equal number (62.00%) of the respondents were giving balanced diet to the animals/ birds and feeding concentrates on the basis of milk production followed by application of recommended fertilizers (58.00%), adoption of *in-situ* conservation technologies (38.00%) and adoption of soil and water conservation practices (36.00%) respectively. Similar findings are also reported by Gautam *et al.* (2007) that pulses and oilseeds if incorporated in cropping system, generates more income from the farm land. It was noticed that the raised income resulted into higher purchasing power of the small and marginal farmers. They can spend their earnings to purchase the essentials of their living. Farmers can afford good education and health for their family members.

As far as the adoption of sustainable farming practices by the IFS farm families concerned it is observed from the Table 3 that equal number (90.00%) of the farm families were adopted inter cropping system for sustainability and growing leguminous crop at least once a year followed by timely and regularly vaccination to animals (90.00%), use of organic manure and bio-pesticides (88.00%), adoption of soil and water conservation practices (86.00%), balanced diet to the animals/birds (84.00%), adoption of *in-situ* conservation technologies (78.00%),application of recommended fertilizers (72.00%) and feeding concentrates on the basis of milk production (46.00%) respectively. The findings are in line with the Deka and

Table 3: Perceived agriculture security of CFS and IFS farm families (n=100)

Component	Haryana	
	CFS (n=50) F (%)	**IFS (n=50) F (%)**
Adequacy of agricultural production		
Food grains	50(100.00)	50(100.00)
Pulses	38(76.00)	45(90.00)
Vegetables	33(66.00)	41(82.00)
Fruits	5(10.00)	27(54.00)
Milk	36(72.00)	47(94.00)
Fodder	23(46.00)	41(82.00)
Adoption of sustainable farming practices		
Adoption of inter cropping system for sustainability	34 (68.00)	45(90.00)
Use of organic manure and bio-pesticides	33(66.00)	44(88.00)
Adoption of soil and water conservation practices	18(36.00)	43(86.00)
Growing leguminous crop at least once a year	38(76.00)	45(90.00)
Application of recommended fertilizers	29(58.00)	36(72.00)
Balanced diet to the animals/birds	31(62.00)	42(84.00)
Timely and regularly vaccination to animals	32(64.00)	45(90.00)
Feeding concentrates on the basis of milk production	31(62.00)	23(46.00)
Adoption of *in-situ* conservation technologies	19(38.00)	39(78.00)
Labour availability		
Adequate	33(66.00)	36(72.00)
Partially adequate	10(20.00)	12(24.00)
Shortage of labour due to MGNREGA	7(14.00)	2(4.00)

*Multiple responses are possible; Figures in parenthesis indicate percentage

Goswami (2021) who emphasized those small-scale tea growers converting to sustainable production systems, including organics. Using primary data of small-scale tea growers in Assam India, a collective case study approach and mixed methods were used to evaluate the economic sustainability of organic tea cultivation on a small scale. Annual income from a hectare of organic tea cultivation was valued at rupee 85,975, surpassing that of conventional (rupee 75,880) under one assumption; that organic growers could match the average conventional yield of 15,000 kg. The researcher was found, organic cultivation to be an economically viable long-term option for small-scale tea growers over a period of 10 years; provided the yield stabilized post-organic conversion. Additional income could be derived through optimal resource use, best farm management practices, and an organic premium on green leaves.

With respect to labour availability of CFS farm families data presented in the Table 3 show that 66.00 per cent farm families had adequate labour availability followed by partially adequate (20.00%) and 14.00 per cent farm families were facing the problem of shortage of labour due to MGNREGA. Whereas farm families involved in IFS revealed they had adequate labour (72.00%) followed by partially adequate (24.00%) and only 2.00 per cent were perceived shortage of labour due to MGNREGA. The findings are in tune with Sajjad and Nasreen (2016) who examined agricultural sustainability among farm families in Vaishali district of Bihar state, India. Findings of the study indicated that agricultural sustainability among the sampled farm families decreased as the size of land holdings decreased and it was also noticed that nearly one third of the total sampled farm families had low agricultural sustainability the regression analysis showed that

economic efficiency and social equity influenced the agricultural sustainability. The findings are also supported by Swarnam *et al.* (2016) who studied the diversifying agricultural biodiversity through integrated faming system approach for the improvement of food and nutritional security of small and marginal farm families. Findings of the study indicated that through the inclusion of various components with diversified varieties of crops into the IFS model on 0.75 ha land significantly contributed in food diversity and met the dietary requirements of a family of 5 members. It was found that economic and physical diversity and value diversity index increased to 0.811 and 0.794 respectively as against zero in rice monoculture cropped areas. The results of the study also revealed that besides, enhancement of biodiversity, the IFS approach was also able to improve farm production, profitability and improved food and nutritional security of small and marginal farm families.

Health is an important factor which influences the livelihood of farm families. The components included to measure health security were, accessibility of health services, capacity to afford treatment, health insurance, getting medical facilities and means of transport in case of emergency, occurrence of acute diseases, prevalence of chronic diseases and addiction to alcohol /tobacco.

Data furnished in Table 4 indicate that a little more than half (52.00%) of the CFS farm families had accessibility of government and private hospitals within 2-4 kilometer followed by 4-6 kilometer (24.00%), 0-2 kilometer (16.00%), 6-8 kilometer (6.00%) and beyond 8 kilometer (2.00%) respectively. Data regarding the accessibility of government and private hospitals by the IFS farm families revealed that more than half of the respondents (56.00%) had access to government and private hospitals within 2-4 kilometer followed by 0-2 kilometer (24.00%), 4-6 kilometer (26.00%), and 6-8 kilometer 4.00 per cent respectively.

Regarding the ability to afford professional treatment for serious illness by CFS farm families, it was found that a good percentage of farm families (58.00%) reported that they could afford treatment by borrowing the money followed by affordability with much difficulty (24.00%) and responded that they could afford treatment 18.00 per cent respectively. In contrary to CFS farm families 60.00 per cent of the IFS farm families reported that they could afford treatment followed by ability to afford treatment by borrowing money (36.00%) and affordability with much difficulty (10.00%) respectively.

It is clear from the Table 4 that 44.00 per cent CFS farm families had health insurance under Ayushman Bharat Yojana followed by insurance policy (34.00%) and Pradhan Mantri Suraksha Bima Yojana 22.00 per cent respectively. However with respect to the health insurance of IFS farm families it can be noted from the Table 4 that a considerable majority of the respondents (58.00%) had health insurance under Ayushman Bharat Yojana followed by Pradhan Mantri Suraksha Bima Yojana (22.00%) and insurance policy 20.00 per cent respectively.

The observation of the Table 4 reveals that more than half (52.00%) of CFS farm families were sometimes getting medical facilities and means of transport in case of emergency followed by always (44.00%) and only 4.00 per cent respondents perceived that they were not getting medical facilities and means of transport in case of emergency. On the other hand in case of IFS farm families 52.00 per cent were always getting medical facilities and means of transport in case of emergency followed by sometimes (46.00%) and never 2.00 per cent respectively.

The results pertaining to occurrence of disease presented in Table 4 show that 52.00 per cent of CFS farm families reported the occurrence of diseases like cough, cold, fever, covid-19 etc. once or twice in a month followed by once or twice in a week (32.00%) and a few times in a year (16.00%) respectively. While concerning with the IFS farm families it was found that 40.00 per cent of them were experiencing the occurrence of diseases like cough, cold, fever, covid-19 etc. once or twice in a month followed by a few times in a year (38.00%) and once or twice in a week 22.00 per cent respectively.

As regarding the prevalence of chronic diseases like asthma, TB, diabetes, heart problem etc. in the family it was satisfying to note that more than half (56.00%) of the CFS farm families were not having any cases of chronic diseases in the family and 44.00 per cent were admitted the prevalence of chronic diseases in the family. Similarly in case of IFS farm

Table 4: Perceived health security of CFS and IFS farm families (n=100)

Component	Haryana	
	CFS (n=50) F (%)	IFS (n=50) F (%)
Accessibility of government/private hospital		
0-2 Km	8(16.00)	12(24.00)
>2-4 Km	26(52.00)	28(56.00)
>4-6 Km	12(24.00)	8(16.00)
>6-8 Km	3(6.00)	2(4.00)
Beyond 8 Km	1(2.00)	-
Household's ability to afford professional treatment		
Yes, household can afford it	9(18.00)	30(60.00)
Yes, by borrowing money	29(58.00)	18(36.00)
Yes, with much difficulty	12(24.00)	2(4.00)
Health insurance		
Ayushman Bharat Yojana	22(44.00)	29(58.00)
Pradhan Mantri Suraksha Bima Yojana	11(22.00)	11(22.00)
Insurance policy	17(34.00)	10(20.00)
Getting medical facilities and means of transport in case of emergency		
Always	22(44.00)	26(52.00)
Sometimes	26(52.00)	23(46.00)
Never	2(4.00)	1(2.00)
Occurrence of acute diseases like cough, cold, fever, covid-19 etc.		
Once or twice in a week	16(32.00)	11(22.00)
Once or twice in a month	26(52.00)	20(40.00)
A few times in a year	8(16.00)	19(38.00)
Prevalence of chronic illness like Asthma, TB, Diabetes, Heart Problem etc. in the family		
Yes	22(44.00)	13(26.00)
No	28(56.00)	37(74.00)
Addicted to Alcohol/Tobacco		
Yes	11(22.00)	9(18.00)
No	39(78.00)	41(82.00)

Figures in parenthesis indicate percentage

families, 74.00 per cent households were free from prevalence of chronic diseases in the family and 26.00 per cent were suffering one and another kind of chronic diseases.

Further exploration of the Table 4 depicts that majority of the respondents (78.00%) involved in CFS were not addicted to alcohol/ tobacco and it was disappointing to note that 22.00 per cent were addicted to any kind of alcohol/ tobacco. Likewise in case of IFS respondents it was satisfying to note that 82.00 per cent were not addicted to alcohol/ tobacco and remaining, 18.00 per cent were addicted to any kind of alcohol/ tobacco.

Relationship between livelihood securities of CFS and IFS farm families with independent variables in Haryana was assessed and presented in the Table 5. From the table it can be seen that livelihood securities of CFS farm families had positive and significant correlation with education of the respondent (r=0.826**), monthly family income (r=0.810**), land holding (r=0.772**), farming experience (r=0.882**), livestock possession (r=0.855**), possession of agricultural implements/ equipments (r=0.912**) and possession of household assets (r=0.870**) at 0.1 level of significance. Whereas age of the respondents (r=0.045 ^{NS}) and source of irrigation (r=0.084^{NS}) were not correlated with livelihood securities. With respect to the relationship between livelihood securities of IFS farm families, it was noted that livelihood securities of IFS farm families were positively and significantly correlated with education (r=0.855**), monthly family income (r=0.904**), land holding (r=0.902**), farming experience (r=0.844**), livestock possession (r=0.986**), possession of agricultural implements/

Table 5: Relationship between livelihood securities of farm families with independent variables

Variable	Correlation coefficient (r-value)	
	CFS Haryana	IFS Haryana
Age	0.045^{NS}	0.043^{NS}
Education	0.826**	0.855**
Monthly family income	0.810**	0.904**
Land holding	0.772**	0.902**
Farming experience	0.882**	0.844**
Source of irrigation	0.084^{NS}	0.087^{NS}
Livestock possession	0.855**	0.986**
Possession of agricultural implements/ equipments	0.912**	0.973**
Possession of household assets	0.870**	0.920**

*-Significant at 0.5 level; **- Significant at 0.1 level; ^{NS} – Not significant

equipments (r=0.973**) and possession of household assets (r=0.920**) at 0.1 level of significance. Whereas age of the respondents (r=0.043 ^{NS}) and source of irrigation (r=0.087 ^{NS}) had non significant correlation with livelihood securities of the IFS farm families in Haryana. The results are in line with Amsalu and Wendimu (2013) who found that household heads' level of education had a positive impact on household food security. As being educated household head is more receptive to adopt technology to maximize the output he/she generated from farm activities. Suchitra (2017) also noted that family size and family education were positively significantly correlated with human capital/ assets. Mutisya *et al.* (2016) also reported that increased educational attainment, monthly family income, livestock possession and possession of household assets were associated with increased probability of being more food secure. As all these parameters directly or indirectly strengthen the small and marginal farm families to gain knowledge, information, skill, credit and power to purchase tangible and intangible resources to achieve sustainable livelihood security. The findings are also in tuned with Jodha (2018), Preeti (2018) and Khusbu (2020).

Relationship between livelihood securities of CFS and IFS farm families with communication and psychological variables, presented in the table-6 depict that livelihood securities of CFS farm families were positively and significantly correlated with social participation (r=0.922**), extension participation (r=0.892**), mass media exposure (r=0.942**), training exposure(r=0.924**), exposure to e- services (r=0.972**) and risk orientation (r=0.811*) respectively.

Table 6: Relationship between livelihood securities of farm families with communication and psychological variables

Variable	Correlation coefficient (r-value)	
	CFS Haryana	IFS Haryana
Social participation	0.922**	0.931**
Extension participation	0.892**	0.944**
Mass media exposure	0.942**	0.953**
Training exposure	0.924**	0.955**
Exposure to e- services	0.972**	0.983**
Risk orientation	0.811*	0.860*

*Significant at 0.5 level; **- Significant at 0.1 level

As far as the relationship between livelihood securities of IFS farm families with communication and psychological variables of the respondents was concerned it was noted that social participation (r=0.931**), extension participation (r=0.944**), mass media exposure (r=0.953**), training exposure (r=0.955**), exposure to e- services (r=0.983**) and risk orientation (r=0.860*) had also positive significant correlation with livelihood securities. The findings are supported by Khatiwada *et al.* (2017) who concluded that education, access to credit, land holding, agriculture and skill training and proximity to the road and market center are the most important influencing factors on the adoption of higher returning livelihood strategies by the farm families and Khusbu (2020) who also reported that livelihood security status of small and marginal farmers was positively significantly correlated with mass media exposure, social participation, extension participation, risk orientation, economic motivation and innovativeness.

CONCLUSION

From the present study it can be concluded that the livelihoods of IFS farm families was more secured in comparison to CFS farm families, hence there is need to demonstrate, disseminate and empower farmers at grass root level to adopt IFS models and contribute towards doubling of their income. Simultaneously, there is need to identify and develop appropriate market led extension strategies to popularize the developed models. Horticulture based integrated farming system can increase the livelihoods of small and marginal farm families, ensures nutritional security and minimizes external inputs. Provide them a steady income throughout the year and employment generation through value addition. Crop based locally available value added food products such as jaggery, millets and pulses, honey, value added products of fruit and vegetable can be included in state funded supplementary /nutrition programmes, to enhance food and nutrition security in rural masses.

Conflicts of interest: The authors have no conflicts of interest.

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Research Article

Physical Activity and Body Mass Index of Farming Families in Punjab

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ABSTRACT

The present study was conducted in Punjab and aimed to investigate the Body Mass Index (BMI) and physical activity of farming families. A sample of 180 respondents, including 60 men, 60 women, and 60 children from farming families in Punjab, was selected for data collection. An interview schedule was employed to gather information from the respondents. The primary focus was to analyze the Body Mass Index (BMI) and determine the frequency of physical activity within these farming families. The classification of the respondents according to BMI indicated that more of females were overweight than males. The majority of the male respondents were found to be with normal BMI. It was observed that meal pattern and frequency of consumption of fats & oil were positively and significantly correlated with BMI of child respondents. However, the frequency of consumption of roots & tuber and intake of fat was positively and significantly correlated with BMI of female respondents and negative correlation was found between the consumption pattern of other vegetables with BMI of females. The consumption of cereals was found to be positively and significantly correlated with the BMI of male respondents. No association was found between dietary choices of the respondents with BMI. In addition, more than fifty percent of the respondents performed low level of physical activity. The least percentage of respondents were found in good level of physical activity. Physical activity was also reported to be significantly correlated with the BMI of female.

Keywords: Physical activity, Body mass index, Farming families

INTRODUCTION

Health and nutrition contribute important factors in human development, thus a diet that is well balanced and nutritious is of utmost importance in maintaining good health. Health at every stage of life depends not only on eating habits but also upon the type of work a person is involved. Good nutrition and regular physical activity play a very vital role in the maintenance of proper health and helps in the prevention of various nutritional deficiency diseases by lowering the risk of obesity, high blood pressure, and high blood cholesterol which all are major factors that can lead to serious diseases. The sooner we make healthy eating and physically active life our priority, the quicker the health benefits we observe because, in today's society food, good nutrition, and physical fitness are the three major foundation pillars that promote good health and fitness (Duyff, 2006).

Optimal food choices and portion control are crucial for maintaining good health, physical fitness, and achieving an ideal body weight (Liu, 2021). Additionally, maintaining a healthy body mass index (BMI) and engaging in regular physical activity are essential for attaining a high level of physical fitness (Dewi and Rimawati, 2021). Consistent exercise leads to improvements in BMI, physical activity levels, and overall physical fitness (Jiang *et al.,* 2021). Physical activity encompasses any bodily movement involving

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muscle work and energy expenditure (Hill *et al.,* 2015). It plays a significant role in influencing metabolism, psychological well-being, overall health, and quality of life (Malm *et al.,* 2019).

Furthermore, physical activity has been shown to have a positive impact on the immune system, reducing the risk of contracting infectious diseases such as bacterial and viral infections. Some of the researches indicate that obese adolescents tend to engage in lighter physical activity compared to their non-obese counterparts. This light physical activity results in lower energy expenditure, creating an energy imbalance where energy intake exceeds energy output. Consequently, this imbalance increases the risk of overweight conditions and the development of degenerative diseases like hypertension (Ding and Jiang, 2020). Regarding the importance of physical activity on an individual's health status it was felt important to assess the relationship between level of physical activity and BMI of farming families.

MATERIALS AND METHOS

The research was carried out in Punjab's three socio-cultural regions: Malwa, Majha, and Doaba. The main objective was to obtain a representative sample of farming families throughout Punjab. To achieve this, twenty farming families were deliberately chosen from each zone. The selection criteria ensured that each family included one adult male, one adult female, and one child aged between 9 and 12 years. Consequently, the study included a total of 180 participants. The chosen participants underwent personal interviews. Physical activity of the respondents was measured on eight-point scale i.e. never, once a week, twice a week, thrice a week, four times a week, five times a week, six times a week, and daily which was analyzed by assigning the score from 1-8 respectively. Further on the basis of scores obtained the respondents were grouped into the following categories.

Physical Activity	Score range
Poor	8-26
Average	27-45
Good	46-64

Further, Body Mass Index (BMI) for males and females was calculated from the height and weight of the respondents by using the formula stated by Garrow (1981).

$$BMI = (Weight\ (kg)\ /\ (Height\ (m^2)$$

The BMI for children was calculated by using the Anthro Plus software by WHO (2006). The respondents were classified into underweight, normal, over-weight, obese groups based on the classification given by WHO (2004).

BMI	BMI Category
<18.5	Underweight
18.5-24.9	Normal
25-29.9	Overweight
30-34.9	Obese

The collected data were organized into tables and then subjected to statistical analysis for interpretation. Statistical methods such as percentage calculations, frequency analysis, Karl Pearson Coefficient of correlation, and Chi- square test were employed to analyze the data.

RESULTS AND DISCUSSION

The effect of physical activity on the health of an individual is an important parameter. So, an effort was made to study the physical activity pattern of the respondents. The data in the Table 1 reveals the physical activity of the respondents. The physical activity of the respondents was distributed into three categories i.e., poor, average and good. It was observed from the data that the majority of the respondents i.e., 53.33 per cent of the respondents had poor physical activity followed by 42.78 per cent of the respondents who were having average physical activity and only 3.89 per cent had good physical activity. Further, the data also reveals that 68.33 per cent of the female respondents have poor physical activity in comparison to male (41.67%) and child (50%) respondents. The results are in conformity with those of Kim *et al.* (2015) who reported that the physical activity of females was poorer than males. The data also revealed that only 8.33 per cent of the male respondents were having good physical activity followed by 1.67 per cent of each of the female and child respondents.

Poor physical activity of the farming families might be due to mechanization and dependency upon labour for various agricultural and household activities and children were reported to be spending their time on

Table 1: Distribution of the respondents according to their level of physical activity (n=180)

Level of Physical Activity	Male (n_1=60) f(%)	Female (n_2= 60) f(%)	Child (n_3=60) f(%)	Total (n=180) f(%)
Poor (8-26)	25(41.67)	41(68.33)	30(50.00)	96(53.33)
Average (27-45)	30(50.00)	18(30.00)	29(48.33)	77(42.78)
Good (46-64)	5(8.33)	1(1.67)	1(1.67)	7(3.89)

digital games or social media. The same findings were also reported by Saikia (2020) who revealed that a large proportion of farming families had a low level of physical activity.

Body mass index (BMI) is the metric used for determining anthropometric (height amd weight) measured in adults and children. BMI was developed as a risk indicator of diseases. As BMI increases the risk of some diseases increases such as diabetes, high blood pressure, cardiovascular diseases, premature death, etc. (WHO). Therefore, to assess the health of farming families BMI of each respondent was also calculated.

In Table 2 the respondents are distributed according to their body mass index and are classified into different categories i.e., underweight, normal, overweight, and obese. In this table, data reveals that overall, 26.67 per cent of the respondents were underweight while 41.67 per cent of the respondents were found to be under the normal category followed by 23.33 percent of respondents in the overweight category and the least percent of the respondents (8.33%) were found to be obese. The results further indicated that the majority of the child respondents (73.33%) were underweight as compared to female respondents (6.67%) though the nutrient intake of the children was found to be fairly good but them being underweight could be due to other factors like consumption of poor-quality food or suffering from parasitic infestation like tapeworm, roundworm, hookworm etc. The results are in confirmation with Olumakaiye *et al.* (2010) who stated that in rural areas more percentage of the children were underweight. More percentage of male respondents (58.33%) were found in the normal BMI category as compared to female (40%) and child respondents (26.67%). Variation was observed in the overweight category with 45 percent female respondents, 25 per cent male respondents and none of the child respondents falls under this category. Findings are in contrast with those of Acharya *et al.* (2017) and Halvani *et al.* (2012) who reported that the majority (62.9%) of the rural women were under the normal category and 7.44 per cent of the farmers were obese. However, the same results were reported by Dutt *et al.* (2020) who concluded that only a few children from rural areas were overweight or obese.

The data in Table 3 shows the relationship of physical activity with the BMI of the respondents. The data revealed that there was a negative and significant correlation between the physical activity of females with their BMI (-0.259) at 5% level of significance which

Table 3: Relationship of physical activity with BMI of the respondents

Physical Activity	BMI (r-value)
Male (n_1=60)	0.053
Female (n_2=60)	-0.259*
Child (n_3=60)	0.162

*Significant at 5% level of significance

Table 2: Classification of the respondents according to Body Mass Index, BMI (n=180)

Classificationof BMI	Male (n_1=60) f (%)	Female (n_2=60) f (%)	Child (n_3=60) f (%)	Total (n=180) f (%)
Under-weight	–	4(6.67)	44(73.33)	48(26.67)
Normal	35(58.33)	24(40.00)	16(26.67)	75(41.67)
Over-weight	15(25.00)	27(45.00)	–	42(23.33)
Obese	10(16.67)	5(8.33)	–	15(8.33)

means that with the decrease in the physical activity, BMI increases. However, no correlation can be seen between the physical activity and BMI of males and children. The findings of the study oppose the result of Rauner *et al.* (2013) which reported an inverse relation between physical activity and BMI of children.

CONCLUSION

WHO recommended that physical activity contributes in preventing and managing diseases such as heart diseases, diabetes, hypertension, body weight, etc. But it was found in the study that the majority of the respondents performed low level of physical activity. Whereas, negative and significant correlation was found between the physical activity of females and BMI. It can therefore be concluded that being actively involved in physical activity will help in increasing physical wellbeing of the individuals. However, further research can be conducted on large sample in order to generalize the findings.

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Research Article

Dietary Intake During Covid-19 and its Association with Non-communicable Diseases among Telangana Community

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ABSTRACT

Long-term imbalanced dietary intake such as lower consumption of fruits and vegetables, milk and milk products, egg and legumes and higher consumption of salt, meat, fats and sugars have been found to be significantly associated with increased BMI and elevated levels of blood glucose, blood cholesterol and blood pressure. In this study, association of dietary intake with non-communicable diseases (NCDs) during covid-19 was observed among 200 adults from Kothagudem, Telangana. Dietary information was collected using 24-hour recall and information on NCDs was collected using closed ended questionnaire and hospital records. Results indicated that energy intake was positively associated with anaemia, overweight, obesity and diabetes; protein intake was negatively associated with diabetes, hypertension, overweight, obesity and atherosclerosis and fat intake was positively associated with obesity, hypertension, atherosclerosis and anemia.

Keywords: Adults, Association, Covid-19, Dietary intake, Imbalanced, NCDs

INTRODUCTION

Nutrient supply either sufficient or insufficient from daily diets indicate the health status of any community in long term. Availability and consumption of local food grains and fruits and vegetables play significant role in achieving good health. Unhealthy diets are a significant behavioral risk factor followed by low availability, affordability that contribute significantly towards non-communicable diseases (NCDs). Unhealthy food choices can be modified by acquiring knowledge of food groups and nutrients supplied by particular food groups, optimum and safe intake of each food group.

NCDs encompass a broad range of morbidity or co-morbidities including obesity, cardiovascular diseases, diabetes, anemia, cancers, chronic respiratory disease, mental-health problems and musculo–skeletal disorders. The first four in this list account for about fifty per cent of mortality worldwide (Unwin and Alberti, 2006). Imbalanced diets, physical inactivity (Dhillon and Kumar, 2022), smoking and alcohol consumption are the crucial factors that affect the development of NCDs risk factors like elevated blood pressure, glucose, lipids, and BMI (Rani and Singh, 2023). Non communicable diseases are extremely dangerous to one's health and are associated with significant mortality and morbidity. NCDs are exacerbated by high intake of energy-dense foods, refined and fatty foods, processed or convenience foods and animal foods, salty and sugary snacks, and a poor intake of whole grains, vegetables, fruits, and nuts, as well as smoking, alcohol consumption and physical inactivity.

Covid-19 has significant influence on daily dietary intake and lifestyle-related habits (Singh and Wadhawan, 2023) in a significant manner as the pandemic progresses through its different phases. Public dietary and health recommendations and government measures taken to decrease infection have indirectly impacted food availability, dietary quality, normal daily activities, access to recreational public settings, social activities,

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work and financial security. Above all, reduced income of millions of people in India who were working on daily wages has deteriorated quality of diet significantly. In addition to lower dietary intake, increased alcohol, smoking, stress, lack of sleep, anxiety contributed a lot to metabolic complications such as obesity, diabetes and cardiovascular disorders among people of low-income group (Gornicka *et al*., 2020; Tripathi et *al*., 2022). Due to covid-19 people had limited day-to-day social engagements such as workplace interactions, participation in recreational activities, socializing and eating out which might lead to an increase in mental health distress. On the other hand, among people belong to middle and upper class covid-19 had a mixed effect on the lifestyle related behavior with a significant improvement in regular meal consumption pattern and consumption of greens and medicinal herbs and reduction in unhealthy food intake as positive indicators and significant reduction in physical activity and increase in sitting time, screen time and stress as negative indicator (Chopra *et al*., 2020).

Indian Council of Medical Research (ICMR) decide the recommended daily intake (RDI) of specific food groups and recommended dietary allowances (RDA) of specific nutrients during particular age, gender and physiological condition. The expert committee revise these recommendations periodically and recently were revised in 2020. Excess consumption of energy, salt, poor quality of fat especially trans-fat and bad cholesterol containing foods may alter metabolism and start the progression of overweight, obesity, diabetes, hypertension and atherosclerosis. A diet consisting of 400-500g of vegetables, 150g of fruits, 300ml of milk, 300g of cereals, 90g of pulses, 30g of nuts, 20g of fat and an egg a day is considered healthy for an adult (ICMR, 2020). Additionally, to keep one healthy, a 45 minutes physical activity other than household chores is also recommended. Any compromise from recommended diet and physical activity may affect health and one can easily become victim of either oversupply of sodium, fat and energy or deficiency of iron, folic acid, iodine, calcium, vitamin-D, vitamin-A, and B-complex vitamins and may invite NCDs in near future. This study was planned to observe the association of dietary consumption with NCDs during covid-19 among adult population of Kothagudem, Telangana.

MATERIALS AND METHODS

A total sample size of 200 respondents (equal number of male and females; from rural and urban backgrounds) aged between 30-50 years, were selected from Kothagudem, Telangana randomly for this study. A closed ended questionnaire during personal interview was used to collect information pertaining to general background and prevalence of non-communicable diseases. Personal hospital records were checked and discussed and documented thoroughly. Data on anthropometric measurements and dietary intake through 24-hour recall was collected twice.

Height (cm) was measured with a vertical anthropometric rod at the nearest 0.1 cm (WHO, 2006). Weight (kg) was measured with digital scale with a precision of 0.1 kg. The scale was placed on a horizontally flat surface. Respondent was weighed barefooted and wearing a minimum of clothing and without touching any other surface or object. Body mass index (BMI) was calculated using height in meter square divided by weight in kilogram. Waist circumference was measured to the narrowest point between the tenth rib and the iliac crest, with a flexible non-extensible tape placed directly on the skin while the subject standing balanced on both feet. Readings were taken to the nearest 0.1 mm (Lohman, 1998). Hip circumference was measured around the widest part of the buttocks at the left, with a flexible non-extensible tape placed parallel to the floor (WHO, 2008). WHR was calculated as the ratio of waist circumference to hip circumference. Cut-off values for WHR they were $\geq$ 0.90 for men and $\geq$ 0.85 for women.

The 24-h recall is a method to determine the food intake from various food groups of an individual during the immediately preceding 24 hours as remembered by the subjects (Den *et al*., 2006). Food intake was assessed in terms of household measures. The adaptation was consisted of requesting the respondent to use separated known-weight utensils on the recall day to help them visualize the amount of food consumed (Gibson and Ferugson, 1999). To reduce day-to- day variation in the mean intake of nutrient found in high concentration in a few foods, the recall was done on two days (Gibson and Ferugson, 1999). To avoid dependency of intake of 2 consecutive days caused by the use of leftovers, a minimum gap

of 2 days and a maximum of 11 days were given between two recall days. Weekend and special events days were excluded. A food list of all the possible cooked food products, food products from market, sweet shops, street vendors and restaurants, raw ingredients was prepared and recited to the subjects to recall maximum what they had during previous 24-hour. Any ingredient consumed more than five gram was taken into account.

Mean daily food intake of the adults was compared with the Recommended Dietary Intakes of ICMR (2020). The mean daily nutrient intake was calculated taking mean of two days' diet intake by using 'DietCal' software. Average daily nutrient intake was compared with the Recommended Dietary Allowances (RDA) defined and released by ICMR (2020). To make meaningful judgements, the data was quantified and subjected to statistical analysis. Software called Statistical Analysis System (SAS; version 9.4) was used to conduct the statistical analysis. Frequency and percentage were used to tabulate the data of socio- demographic variables. Mean and standard deviation were used to tabulate the data of anthropometric measurements and foods and nutrient intake. One sample t-test was used to compare the means of anthropometric measurements and foods and nutrient intake with reference values. Pearson correlations were computed to explore an association between major macro and micro nutrients with NCDs. *P* value less than 0.05 were considered statistically significant.

RESULTS AND DISCUSSION

This study was conducted among 200 adults having equal number of male and female and equal number of adults from rural and urban background, aged between thirty to fifty years. Results of socio-demographic profile of adults indicated that majority of the adults were married (96.5%) and having small family size (83.0%). The education level of the adults was quite good; fifty-two adults had completed college level followed by forty-nine adults who had completed education up to plus two levels. Regarding annual family income, sixty-one percent of them had earned between two to five lacs whereas, twenty-six percent of them had earned more than five lacs. Majority of the female adults (80%) were engaged as home makers

Table 1: Socio-demographic profile of adults under study

Characteristics	Categories	Male (f) (n=100)	Female (f) (n=100)	Total (f, %) (n=200)
Marital status	Married	96	97	193(96.5)
	Unmarried	04	03	07(3.5)
Size of family	Small (≤4)	79	87	166(83.0)
	Medium (5-7)	12	06	18(9.0)
	Large (≥8)	09	07	16(8.0)
Education level	Primary school	05	31	36(18.0)
	Middle School	11	07	18(9.0)
	High school	21	24	45(22.5)
	10+2	30	19	49(24.5)
	College/university completed	33	19	52(26.0)
Family annual income	<2,00,000	16	10	26(13.0)
	2,00,000-5,00,000	64	58	122(61.0)
	>5,00,000	20	32	52(26.0)
Employment status	Service	41	13	54(27.0)
	Labour work	45	02	47(23.5)
	Homemaker	-	80	80(40.0)
	Unemployed	04	03	07(3.5)
	Small scale Business	10	02	12(6.0)

however, in case of male majority of adults (86.0%) were engaged in service and labour work (Table 1). Results of socio-demographic profile of adults observed in present are corroborated with earlier findings of Chopra *et al.* (2012) and Singh *et al.* (2017). High income as well as high education in community have been found to be associated with more access to food and improved diet quality. The findings of Araujo *et al.* (2014) in a similar study revealed that with rising income among men, the frequency of inadequate consumption declined for seven of the eleven nutrients examined. (Ca, P, Zn, thiamin and vitamins B_{12}, A and C). More the income people have they have higher tendency to spend more it on to buy fruits, vegetable, nuts, milk and milk products.

Observed values of height, weight, BMI, waist to hip ratio of adults were compared to reference values (Table 2) defined by ICMR, 2020 and WHO, 2008 and it was found that irrespective of gender, adults were having significantly lower height than their respective reference values whereas, having significantly higher weight, BMI and waist to hip ratio indicating that adults were having overweight and central adiposity (Table 2). Abdomen adiposity have been considered more dangerous than overall obesity for the development of NCDs. Height lower than the reference values in a community generally indicate the chronic protein deficiency. Results of anthropometric measurements as observed in present study are in the close proximity of the findings of Ahranjani *et al.* (2012) and (Gadekar *et al.*, 2020).

Data presented in Table 3 indicated that prevalence of NCDs among female adults was considerable as they were suffering from anaemia (45.0%), hypertension (18.0%), diabetes (15.0%) and overweight (13.0%). Similarly, the prevalence of NCDs among male adults was also found to be considerable as they were suffering from overweight (22.0%), diabetes (12.0%) and hypertension (11.0%). Further, it was observed that prevalence of two or more co-morbidities was even worst and varied between 1.0-11.5 per cent (Table 3). The studied prevalence of NCDs was found to be in close agreement of earlier findings observed by Singh *et al.* (2015), (Olatana *et al.*, 2018) and Meshram *et al.* (2022). The prevalence of two or more co-morbidities have been considered more life threatening than the single NCDs.

Table 3: Prevalence of non-communicable diseases among adults

NCDs	Male (100) f	Female (100) f	Total (200) f (%)
Diabetes	12.0	15.0	27.0 (13.5)
Hypertension	11.0	18.0	29.0 (14.5)
Overweight	22.0	13.0	35.0 (17.5)
Obesity	05	03	08 (4.0)
Atherosclerosis	04	03	07 (3.5)
Anemia	4.0	45.0	49.0 (24.5)
Diabetes, Overweight	12.0	11.0	23.0 (11.5)
Hypertension, Overweight	03	16.0	19.0 (9.5)
Overweight, Anemia	03	14.0	17.0 (8.5)
Overweight, Atherosclerosis	02	03	05 (2.5)
Diabetes, Anemia	01	04	05 (2.5)
Obesity, Anemia	-	03	03 (1.5)
Diabetes, Overweight, Anemia	04	02	06 (3.0)
Hypertension, Overweight, Anemia	03	04	07 (6.5)
Diabetes, Hypertension, Obesity	-	02	02 (1.5)
Diabetes, Hypertension, Overweight	02	03	05 (2.5)
Diabetes, Obesity, Anemia	-	02	02 (1.0)

Table 2: Anthropometric measurements of adults

Variable	Reference value (male)	Male (n=100)	t value	Reference value (female)	Female (n=100)	t value
Height (cm)	175.00	167.04±0.72	10.98*	162.00	157.30±0.68	6.81*
Weight (kg)	65.00	69.28±0.96	4.43*	55.00	62.05±0.92	7.63*
BMI (kg/m^2)	18.50–24.90	25.43±1.50	2.34*	18.50–24.90	26.85±1.38	2.48*
Waist-to-Hip Ratio[a]	≥0.90	0.94±0.03	7.63*	≥0.85	0.92±0.04	11.72*

Values are Mean ± SD; *Significant at 5% level; Reference values ICMR (2020); [a]WHO (2008) standards

Similar trend for daily mean food intake from different food groups was observed among male and female adults (Table 4). The consumption of cereals and millets and fats and oils was found to be significantly higher than their respective recommended level of intakes and that may be considered harmful towards contributing excess energy whereas, the consumption of pulses, milk and milk products, vegetables, fruits, oil seeds and nuts was found to be significantly low than their respective and that may lead protein, vitamins and minerals deficiencies among adults if such diets will be maintained for longer period. Results of imbalance dietary intake among adults observed in present study are in close agreement of results observed earlier by Misra *et al.* (2001); Singh *et al.* (2015) and Sarkar *et al.* (2021).

It was observed from the results presented in Table 5 that both the male and female adults were consuming significantly higher energy and fat than the recommended dietary allowances and that may develop overweight and obesity if continued in long-term. On the other hand, consumption of fibre and protein was significantly lower than RDA and that may cause protein deficiency and high cholesterol level as fibre play significant role in reducing blood cholesterol level. The consumption of iron, calcium, zinc, vitamin A and vitamin C was far below than the RDAs (Table 5) and

Table 4: Daily mean food intake from various food groups among adults

Food groups	RDI[a]	Male (n=100)		RDI	Female (n=100)	
	(g/day)	Actual intake	t value[b]	(g/day)	Actual intake	t value[b]
Cereals and millets	360	382.96±7.3	↑ 2.13*	300	↑ 358.02±5.8	3.93*
Pulses/ Flesh foods	120	75.44±7.2	↓ 13.59*	90	↓ 53.37±2.6	11.06*
Milk and milk products	300	178.39±8.1	↓ 15.08*	300	↓ 163.38±6.3	21.68*
Roots and tubers (excluding potatoes)	100	82.16±4.8	↓ 2.41*	100	↓ 76.28±3.9	2.29*
Green leafy vegetables	150	89.13±3.6	↓ 13.01*	150	↓ 85.70±5.5	12.59*
Other vegetables	200	159.91±7.7	↓ 4.17*	200	↓ 151.1±6.8	5.16*
Fruits	150	50.30±3.8	↓ 25.59*	150	↓ 43.9±3.9	31.55*
Fats &oils	30	35.58±1.4	↑ 2.51*	20	↑ 29.08±1.2	8.34*
Oil seeds and Nuts	30	7.12±3.2	↓ 12.62*	30	↓ 6.82±4.08	13.92*

Values are Mean ±Standard Deviation; [a]Recommended Dietary Intake (ICMR 2020)
[b]t values indicate comparison of observed and reference values; * Significant at 5% level

Table 5: Daily mean nutrient intake among adults

Nutrients	RDA[a]	Male (n=100)		RDI	Female (n=100)	
		Actual intake	t value[b]		Actual intake	t value[b]
Energy (Kcal)	2710	2819±27	↑ 4.30*	2130	2258±21	↑ 5.38*
Protein (g)	54	49.79±1.1	↓ 2.42*	45.7	40.84±1.0	↓ 2.51*
Fat (g)	30	35.58±1.4	↑ 2.61*	20	29.08±1.2	↑ 3.34*
Fibre (g)	40	33.78±1.0	↓ 5.81*	40	30.9±1.0	↓ 9.00*
Iron (mg)	19	14.20±0.4	↓ 15.18*	29	10.91±0.4	↓ 42.3*
Calcium (mg)	800	550±14.7	↓ 30.56*	800	454±13.9	↓ 38.9*
Zinc (mg)	17	9.18±0.19	↓ 39.55*	13.2	7.95±0.19	↓ 5.73*
Vitamin A (µg)	1000	760± 4.99	↓ 48.00*	840	662±5.1	↓ 34.27*
Vitamin C (mg)	80	66.25± 5.01	↓ 2.74*	65	51.15± 5.5	↓ 2.81*

Values are Mean ±SE; [a]Recommended Dietary Allowance (ICMR 2020)
[b]t values indicate comparison of observed and reference values; *Significant at 5% level

Table 6: Correlation of macro and micronutrient intake with non-communicable diseases

	Diabetes	Hypertension	Overweight	Obesity	Atherosclerosis	Anemia
Energy	0.43*	0.11^{NS}	0.36*	0.25*	0.13^{NS}	0.26*
Protein	-0.37*	-0.29*	-0.43*	-0.59*	-0.44*	0.12^{NS}
Fat	0.14^{NS}	0.54*	0.44*	0.23*	0.52*	0.51*
Iron	-0.15^{NS}	-0.16^{NS}	-0.16^{NS}	-0.11^{NS}	-0.29*	-0.58*
Calcium	-0.11^{NS}	-0.19^{NS}	-0.13^{NS}	-0.17^{NS}	-0.15^{NS}	0.42*
Zinc	-0.27*	-0.37*	-0.25*	-0.41*	-0.55*	0.15^{NS}
Vitamin A	-0.11^{NS}	0.23*	-0.15^{NS}	-0.09^{NS}	-0.27*	0.11^{NS}
Vitamin C	-0.309*	0.032^{NS}	0.026^{NS}	0.054^{NS}	-0.30*	-0.63*

*Correlation Significant at 5% level

if it is continued for long-term may cause anaemia, infection, low vision and weak bones etc. results of present study are supported by Misra *et al.* (2001); Singh *et al.* (2015) and Sarkar *et al.* (2021).

Results presented in Table 6 indicated that energy intake was positively associated with diabetes (r=0.43), overweight (r=0.36), obesity (r=0.25) and anaemia (r=0.26). Fat intake was also found to be positively associated with hypertension (r=0.54), overweight (r=0.44), obesity (r=0.23), atherosclerosis (r=0.52) and anaemia (r=0.51). This might be because the diet rich in energy and fat was containing negligible amount of vegetable and nuts and oil seeds which play significant role in prevention of these diseases. Further, it was observed that protein and zinc intake were negatively associated with the prevalence of diabetes, hypertension, overweight, obesity and atherosclerosis (Table 6). Protein and zinc both the nutrient protect body from infection and that is why lower intake was positively associated with NCDs. Both the vitamin C and vitamin A intakes were negatively associated with atherosclerosis since both the vitamins acts as antioxidants and prevent body from degeneration initiated by harmful free radicals (Sehgal *et al.*, 2022). In a previous study, high sodium intake, diet low in whole grain, low in fruits and vegetables have been observed as the main dietary risk factors for the mortality (Afshin *et al.*, 2017). Results of present study regarding association of macro and micro nutrients with NCDs have been found supported by previous findings (Sowmya *et al.*, 2016; Angeles-Adegappa *et al.,* 2020; Mahjoub *et al.* 2022) who also have also observed similar associations.

CONCLUSION

It may be concluded that the studied adult population form Kothagudem, Telangana was found to have good education level with average income and being stunted as a result of chronic protein deficiency during their early and late adolescent age. Both the male and female were having overweight, higher BMI and adiposity. Their diet was dominating in having more foods from cereals and millets and fats and oils food groups. As a consequence, their diet was found to be excessed in energy and fats, the major contributing factor of overweight, obesity, diabetes, hypertension and atherosclerosis. Excessive energy and fat were found to be positively associated with NCDs whereas lower intake of protein, vitamins and minerals were found to be negatively associated with NCDs. People should include local and seasonal fruits (150g) and vegetables (500) and nutrient dense local ingredients such as mushrooms and spirulina in their daily diets to avoid non communicable diseases. They should learn the innovative ways and innovative recipes to add more and more vegetables in their diets.

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Research Article

Optimization and Sensory Acceptability of Teff Based Products: A Step Forward to Diversified Crops Adaptability

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ABSTRACT

Teff is a warm-season annual low-risk cereal crop and a suitable example of diversified crop. For very first time in India, it was adopted by a farmer in Karnataka with the seeds assisted by CFTRI, Mysore and supplied organically grown red teff seed for this study. Teff grain is gluten-free, can be utilized in a range of foods, and offers advantages to people with celiac disease or gluten intolerance. Gluten is a crucial protein for developing extruded products however, a large number of population worldwide has gluten sensitivity. There is a continuously demand for gluten free extruded products in recent years due to the rising frequency of gluten sensitivity. The current study was aimed to develop and assess the organoleptic acceptability of gluten free (GF) products developed using teff, sorghum, and soybean flour. The current study's findings on the organoleptic evaluation of developed control, type I, type II, and type III formulations of pasta and noodles made from blends of teff, sorghum, and soybean flour revealed that the blends at 50:30:20 ratios, respectively, brought out the acceptable food products and also fell into the category of "liked very much."

Keywords: Diversified-crop, Extruded-products, Gluten-free, Sensory-acceptability, Teff

INTRODUCTION

Teff *(Eragrostis tef)* is an annual crop of *Poaceae* grass family (Bultosa, 2016). It is a significant and indigenous food crop to Ethiopia and Eritrea and is used to make a variety of traditional dishes and beverages, including *tella* (opaque beer), *injera* (flatbread), and *kitta* (unleavened bread) however, remains a minor cereal in other parts of the world. Teff may be considered a climate resilient crop as it can grow in various environmental circumstances, including drought and standing water and when big crops may fail, they can thrive in some difficult climate settings (Assefa *et al.*, 2015). Moreover, compared to conventional grains, teff is far less vulnerable to weevil and other pest infestations during storage.

In agricultural systems, crop biodiversity may provide the link between stress and resilience because a diversity of organisms is required for ecosystems to function and provide services. Crop diversification refers to the addition of new crops or cropping systems to agricultural production on a particular farm taking into account the different returns from value- added crops with complementary marketing opportunities (Srivastava and Srivastava, 2022). It is an important instrument for economic growth (Clements *et al.*, 2011). Adopting Teff in Indian agriculture is a great example of crop diversification. Introducing teff to the existing crop system will not only minimize the climatic and market risks, however will provide diverse and nutritious food at the household level. Mr. R.S. Patil, Gadag from Karnataka had adopted teff crop in his field very first in India with the seeds assisted by CFTRI, Mysore and many more farmers are looking forward.

In recent years, intensive research has been conducted to make convenience foods such as pasta

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and noodles free of gluten which is more challenging. A gluten-free (GF) diet primarily consists of grains like rice, maize, millets, corn, sorghum, soy, and pseudocereals like amaranth, quinoa, and teff (Woomer and Adedeji, 2021; Sciarini *et al*., 2010; Sharma and Hussain, 2022). Although the majority of them have nutrient profiles that are similar to those of common grains, the main obstacle to their acceptance is the quality difference from gluten-containing counterparts and nutrient imbalance that results from the use of food processing aids like starch, gums, and enzymes (Woomer and Adedeji, 2021). Compared to other gluten-free grains, food technologists still need to create high-quality teff-based extruded products with acceptable sensory characteristics (Zhu *et al*., 2018).

Teff has recently become more well-known worldwide because of its appealing nutritional qualities. Several regions of the world, including the USA, India, and Australia, have successfully adapted it for cultivation. Teff grain is free of gluten and has the potential to be used in a variety of foods and beverages to benefit those who have celiac disease (Gebremariam *et al*., 2014). Teff has several health advantages, including reducing the risk of malaria, anaemia, and diabetes because of its distinct chemical composition and whole-grain form. Recently the importance of small millets, coarse cereals and under utilized garins such as teff have been realized to make climate more resilient and to improve livelihood and nutrition security (Mishra, 2023).

In developing teff-based gluten-free extruded products, functional additives or blending with other types of flour may be used to bring out acceptable quality products. Therefore, this study attempts to develop acceptable teff, sorghum, and soybean flour incorporated in gluten-free extruded products such as pasta and noodles.

MATERIALS AND METHODS

Red- brown teff seeds were used to develop various baked and extruded products. Teff grains were purchased from R.S. Patil, an organic farmer in Gadag, Karnataka, who had planted the teff crop in his field in India with help from CFTRI, Mysore, in the past. Sorghum, soybeans, and other components were purchased in a single lot from the local market in Hisar, Haryana, to produce food products. To develop fine flour, the grains of teff, sorghum, and soybeans were properly cleaned and processed into a powder. Before the food was prepared and evaluated, all the grain and flour samples were physically cleaned and carefully sieved to remove foreign particles.

Based on preliminary evaluation, to improve sensorial acceptability of teff flour based products sorghum, and soybean flour were chosen to synthesize the flour blends to develop gluten-free extruded products with acceptable sensory and quality features. Teff, sorghum, and soybeans flours in the development of the type I, type II, and type III formulations, and the control products from refined wheat flour were used in the extruded products like pasta and noodles.

The raw materials do not have an acceptable structure consistency (elasticity) during pre-development, which poses a technological problem for the production of gluten-free extruded products. To make up for the lack of gluten in the dough preparation, it was required to include various gluten substitutes or alternatives, such as proteins, starches, gums, and hydrocolloids with water-binding and structure-building characteristics (Zannini *et al*., 2012). After taking up many trials, guar gum in pasta and noodles preparations was used as gluten alternatives.

Pasta and noodles were developed using varying proportions of teff, sorghum and soybean flour (Table 1).

Table 1: Required proportions of various flour for product development

Ingredients	Control	Type I	Type II	Type III
Refined wheat flour (g)	100	-	-	-
Teff flour (g)	-	50	70	100
Sorghum flour (g)	-	30	20	-
Soybean flour (g)	-	20	10	-

Pasta is a type of modern food made from a mixture of unleavened dough, which is formed by heat and pressure using dies of different shapes and then usually cooked by boiling.

Pasta was developed using a benchtop single barrel cold extrusion system (Imperia and monferrina S.p.A., Dolly-2012, Italy) equipped with a pasta-making nozzle (Die diameter-0.59 mm; Etrusion speed-12 kg/h;

Motor power-750 W). The standardized 4 types of formulations consist of the following ingredients: teff flour, sorghum flour, soybean flour, guar gum powder (at 1% level), and water (maximum of 10% at 45°C). Dry ingredients were sieved, mixed with water manually, and sifted into the mixing roller chamber of the pasta-making machine. Per batch, 250 grams of dough were produced with a total mixing time of 10 mins. The dough was extruded and cut randomly at an average length of 3 cm using a cutting sheet. Extruded pasta was dried at 55ºC in a hot air oven till complete drying and used for preparing cooked pasta. Boiled pasta was seasoned with spices, chopped vegetables and white sauce.

Noodles are modern foods made from unleavened dough which is stretched, rolled, and cut into long strips. Gluten-free flour blends were mixed with a 1% level of guar gum powder. Dough was made with the required level of water and processed through noodle hand extruder. Dough passed through a hand extruder cut randomly for the required length using cutting sheet and dried at 55ºC for 5 hrs.

Organoleptic evaluation of all the developed gluten free products was conducted by a panel of 10 judges from the Department of Foods and Nutrition at Choudhary Charan Singh Haryana Agricultural University, who used a 9-point hedonic rating scale to evaluate the sensory qualities of colour, appearance, aroma, texture, and overall acceptability. The maximum score is 9, "liked extremely," and the lowest score is 1, "dislike extremely."

Analysis of variance (One way-ANOVA) was evaluated by looking for significant differences between means of ten replicates of the organoleptic scores on colour, appearance, aroma, texture, taste, and overall acceptability using the OP STAT SOFTWARE method developed by (Sheoran and Pannu, 1999).

RESULTS AND DISCUSSION

Regarding colour, appearance, aroma, texture, taste, and overall acceptability of pasta prepared with teff incorporated with sorghum and soybean and control formulations have been presented in Table 2 to 3.

Pasta is the most popular food in the world because of its versatility, extended shelf life, and relatively affordable price (Paola *et al.*, 2015). It is usually made by combining wheat flour and water to create unleavened extruded wheat dough. Wheat-made pasta is a good source of simple carbohydrates, in contrary being poor in protein quality, low in micronutrients, and lacking in dietary fiber due to the loss of bran and germ during wheat milling into maida. This offers a chance to use unconventional raw ingredients to improve the nutritional value of pasta (Petitot *et al.*, 2010). Though, the removal or avoidance of the viscoelastic gluten protein in the development of extruded products is a technical hurdle. In actuality, the so-called "gluten-free products" contain 20 milligrams of gluten or less per kilogram of the product rather than being completely devoid of gluten (Collin *et al.*, 2004; CODEX FAO/WHO, 2008). Optimizing the amount of substitute grains is also necessary for getting products of high nutritional and sensory quality as well as to be compatible with the technology (Kore *et al.*, 2022).

In this study, teff, sorghum, and soybean flours were selected to fully substitute wheat flour to prepare pasta. Furthermore, the guar gum powder at a 1% level was incorporated to provide stability and increase the firmness of GF pasta. Because during preliminary

Table 2: Mean scores of organoleptic acceptability of Pasta developed from teff, sorghum, and soybean flour blends

Products	Colour	Appearance	Aroma	Texture	Taste	Overall acceptability
Control (100% refined wheat flour)	8.50±0.16	8.90±0.10	8.80±0.13	8.8±0.10	8.70±0.13	8.71±0.02
Type I (50:30:20)	8.40±0.22	8.10±0.18	8.10±0.18	8.4±0.17	8.40±0.16	8.29±0.14
Type II (70:20:10)	8.40±0.21	7.90±0.18	7.35±0.18	7.3±0.15	8.00±0.15	7.84±0.09
Type III (100:0:0)	8.10±0.27	7.75±0.17	7.10±0.23	7.3±0.27	7.40±0.18	7.60±0.14
C.D. ($P \leq 0.05$)	N/A	0.46	0.53	0.54	0.46	0.35

Values are mean ± SE of ten independent determinations

testing, teff, sorghum and soybean flours along with the water were absent to provide stability during cooking.

The data in the Table 2 indicated the organoleptic acceptability of pasta prepared from teff, sorghum, and soybean flour blends. A control Pasta was prepared only using refined wheat flour (100%) while the other three types of Pasta were prepared using teff, sorghum, and soybean (T:S:SB) flour blends in the ratio of (50:30:20) for type I, (70:20:10) for type II, (100:0:0) for type III, respectively. Mean organoleptic scores for Pasta showed that the colour of all the developed pasta falls in the category of "liked very much". The appearance, aroma, texture, and overall acceptability of control and type I Pasta were "liked very much" while type II and type III pasta were "liked moderately". A taste of control, type I and type II Pasta was "liked very much" whereas type III was "liked moderately" by the selected panel of judges. Means sensory scores of sensory attributes such as appearance, aroma, texture, taste and overall acceptability of developed pasta were differed significantly whereas means sensory scores for colour of developed pasta products were not differed significantly. The overall acceptability score of type I Pasta was "liked very much" with highest score of 8.29 on a scale of 9.00 compared to other blend proportions.

Instant noodles were first made popular in Japan and have since spread throughout the world. However, Asia still consumes 80% of the world's instant noodles (Rani *et al.*, 2019). India is the fourth-largest consumer of instant noodles worldwide (WINA, 2018).

The data in Table 3 indicated the organoleptic acceptability of Noodles prepared from teff, sorghum, and soybean flour blends. Control Noodles were prepared only using refined wheat flour (100 %) while the other three types of Noodles were prepared using teff, sorghum, and soybean (T:S:SB) flour blends in the ratio of (50:30:20) for type I, (70:20:10) for type II, (100:0:0) for type III, respectively. Mean organoleptic scores for Noodles showed that appearance, aroma, texture, and overall acceptability of control and type I Noodles were "liked very much" while type II and type III Noodles were "liked moderately". The colour and taste scores of control, type I, type II fell in the category of "liked very much" whereas type III was "liked moderately". Means sensory scores of sensory attributes such as colour, appearance, aroma, texture, taste, and overall acceptability of all the developed Noodles differed significantly.

Results of present study are in close agreement of Rani *et al.* (2019); Prathyusha *et al.* (2023) and Dubey *et al.* (2023). In a similar study Kahlon and Chiu, (2015) developed gluten-free pasta without eggs using a variety of pseudocereals including teff, buckwheat, quinoa, and amaranth. Teff pasta's texture and mouthfeel, as well as its odour, were both noticeably superior to those of quinoa and amaranth pasta. Teff and buckwheat pasta had a similar taste and flavour and were noticeably superior to quinoa and amaranth pasta. Oat and teff gluten-free pasta had a similar texture to wheat pasta, although it was much less elastic (Hager *et al.*, 2012). The complementary food developed through extrusion cooking with teff, soybean, and orange-fleshed sweet potato composite flour was formulated at the percentage ratio of 70:20:10, respectively (Tenagashaw *et al.*, 2017). Padalino *et al.* (2014) used hydrocolloids such as pectin, guar flour, and agar to enhance the overall sensory quality of the enriched gluten-free spaghetti with chickpea flour.

Table 3: Mean scores of organoleptic acceptability of Noodles developed from teff, sorghum, and soybean flour blends

Food products	Colour	Appearance	Aroma	Texture	Taste	Overall acceptability
Control (100% refined wheat flour)	8.70±00.15	8.60±0.30	8.60±0.30	8.50±0.24	8.60±0.21	8.60±0.22
Type I (50:30:20)	8.10±0.10	8.30±0.15	8.30±0.21	8.10±0.15	8.20±0.13	8.20±0.10
Type II (70:20:10)	8.10±0.18	7.90±0.23	7.50±0.21	7.80±0.20	8.10±0.18	7.90±0.17
Type III (100:0:0)	7.50±0.18	7.40±0.21	7.30±0.21	7.40±0.22	7.50±0.32	7.40±0.18
C.D. ($P \leq 0.05$)	0.46	0.67	0.69	0.59	0.63	0.50

Values are mean ± SE of ten independent determinations

CONCLUSION

In recent years, the focus of agricultural strategies is on climate resilience through diversified crop. Teff, a crop of minimum inputs and drought resistant has become a great example of diversified crop system. For the very first time in India farmers from Karnataka has adopted this crop. Beside crop diversification it is an excellent source of diversified nutrients in human diets including additional benefit of gluten free. Demand for gluten free products has been high, which urges the need for food technologists and researchers to develop convenience gluten-free foods due to their lesser availability over traditional gluten free foods. In this present study, teff, sorghum, and soybean flours were used to develop gluten free extruded products. Generally, sorghum and soybean flours are used to improve the functional and nutritional qualities and sensory acceptability of developed products. Teff being whole grain is an superb alternative to develop gluten free extruded products. Results indicated that pasta and noodles developed using teff, sorghum, and soybean flour blends in the ratios of 50:30:20 brought out the acceptable food products fell in the group of "liked very much". It may be concluded that teff combined with sorghum and soybean flour may be used to develop pasta and noodles of desirable quality. Future research should also be recommended to discover the interaction between the flour blends at the molecular and the nutritional level of the final products.

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Research Article

Characterisation the Relationship of Groundwater Quality with Land Use using Factor Analysis in District Jaipur of Rajasthan

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ABSTRACT

The groundwater quality is deteriorating severely in semi-arid regions of Rajasthan owing to rapid industrialization, rigorous agricultural practices and over-exploitation of groundwater. The widespread application of fertilizers and pesticides; and poor management of land use have indorsed pollutants to infiltrate through unsaturated soil and ultimately reach the underlying unconfined groundwater system. Thus, the quality of the water stored in the aquifers has been considerably affected by land use. The study is aimed to illustrate the relationships between groundwater quality and LULC considering the material properties of unsaturated soil. The study combines 14 groundwater quality parameters sampled from 94 monitoring wells, area percentage of eight LULC categories in the vicinity of 3 Km for these 94 monitoring well locations and thickness of four types of materials in the unsaturated/vadose zone of these wells, based on lithological cross-section of borehole data obtained all through the establishment, using factor analysis considering variability in them. Factor Analysis depicts that eight factors were responsible, being eigen values more than 1.0 with 77.397 per cent of cumulative variability. But, only four factors were considered to avoid the complexity of analysis, which represents 57.558 per cent of cumulative variability. Factor 1 represents 21.138 per cent of the total variability with strong correlation for EC, TDS, Na, HCO_3 and fluoride, moderate correlation for chloride and carbonate and the land under fallow land. The blend of EC, TDS, sodium, chloride can be interpreted as salinity factor, occurred due to dissolution of rock materials i.e. schist, mica in the groundwater and over-exploitation of groundwater resources. Factor 2 shows strong correlation for calcium, magnesium, sulphate and total hardness, moderate correlation for potassium and nitrate and the land used for forest land with 20.527 per cent of the total variability. Factor 2 can be designated as alkanity due to agricultural and domestic waste disposal. The findings has also been proven through rock-water interaction dominant factor, controlling groundwater chemistry using Gibb's diagram and Na-HCO_3 and Na-Cl-SO_4 hydro-chemical facies acquired by Piper's diagram. Factors 3 and 4 have shown 8.031and 7.863 percentage of variance, with strong factor loading for built-up land and moderate factor loadings for barren land and gullied/ravenous land and strong factor loadings for fine sand, respectively. These factors were neglected owing to no significant loadings and weak negative loadings. Based on the geographical (spatial) distribution of the factor scores for the first two factors correlating with groundwater quality parameters and land use patterns, it can be concluded that southern and south-eastern portion of district is covered under fallow land due to high salinity and great thickness of clay/silt unsaturated soil and north-eastern part of the district which is confined under forest land, exhibits highest concentration of nitrate and magnesium due to biological nitrate fixation under deciduous forest and proximity with agricultural cropland. It is recommended to prioritize the areas where intensive application of fertilizers and pesticides are being practiced and evaluate the land use practices and new measures like organic fertilizer; need to be adopted to avoid or control groundwater pollution.

Keywords: Groundwater quality, Gibb's diagram, Hydro-chemical facies, Factor analysis, Variability, Spatial distribution, Factor score

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INTRODUCTION

Groundwater is a vital source of freshwater for meeting water demands in domestic, agricultural, industrial and other sectors as well as sustaining ecosystems in many countries across the globe. However, the aquifers has been rendering more vulnerable due to anthropogenic influences, such as over-exploitation, intensification of agriculture, changes in land use/land cover, burgeoning population (particularly in the developing world), increasing pollution and mismanagement, rapidly growing urbanization and industrialization (Molden, 2007; Hetzel *et al.,* 2008; Green *et al.,* 2011; Taylor *et al.,* 2013; Foster and Gun, 2016; Wakode *et al.,* 2018).

India accounts for 2.2 per cent of the global land and 4 per cent of the world water resources and 16 per cent of the world population. It is estimated that one third of the world's population use groundwater for drinking (Ministry of Water Resources, 2012; Borawake *et al.,* 2013). Therefore, water quality issues and its management options need to be given greater attention in the country. Groundwater resources are being used in various sectors, i.e. domestic, industrial, irrigation; more than 85 per cent of India's rural domestic water prerequisites, 50 per cent of its urban water necessities and in excess of 50 per cent of its irrigation necessities (CGWB, 2018).

The behavior of groundwater in the Indian sub-continent is extremely complicated owing to the existence of diversified geological formations with substantial lithological and consecutive variations, climatologically variations and various hydro-chemical conditions (Jha *et al.,* 2010). There are two major sources of the groundwater quality degradation, i.e., natural (geogenic) processes and anthropogenic activities. For example, in agricultural areas, excessive use of fertilizers has resulted in nitrate contaminations in groundwater well above the water quality guidelines (e.g., Machiwal *et al.,* 2011; Paradis *et al.,* 2016). The chemical composition of the groundwater is a direct concern of water entering the aquifer owing to various natural processes and anthropogenic activities. Groundwater contamination initiates from various sources of land use activities i.e. industrialization, agricultural and municipal activities, and is carried out following undefined pathways of unsaturated soil that is, vadose zone, through water infiltration to ultimately receptor reaching the water in the underlying aquifer (Lerner and Harris, 2009). A shallow unconfined aquifer is more susceptible to contamination released from anthropogenic activities. Hence, the effect of land use activities and thickness and materials of the unsaturated vadose zone, which affects the flow rate and flow direction of water to the underlying aquifer, on groundwater quality is a major concern.

Groundwater is becoming a major source of water supply especially in semi-arid and arid regions of the state Rajasthan, where availability of surface water supply has a very limited extent. In Rajasthan, groundwater plays a vital role as it contributes 71 per cent of irrigation water and 90 per cent of domestic water supply sources (Rathore, 2003). The groundwater quality is deteriorating drastically in semi-arid regions of Rajasthan owing to rapid industrialization, intensive usage of fertilizers and pesticides and over-exploitation of groundwater.

According to Groundwater resource assessment report (2018), All the blocks in Jaipur district have shown the groundwater under severe stress, being over-exploited and seven of the blocks (Bassi, Shahpura, Govindgarh, Sanganer, Sambhar, Amber, Jhotwara) are categorized under 'notified' where no more deployment is permitted. Prolonged groundwater quality analysis in Jaipur District have revealed obvious contamination of the groundwater in several locations in the district, with measured concentration levels of some groundwater quality parameters in excess of the permissible levels specified by the Bureau of Indian Standard (BIS) and World Health Organization (WHO), 2011 (Sharma *et al.,* 1990; Singh and Chandel, 2008; Tatawat and Chandel, 2007; Jain *et al.,* 2015; Sarker *et al.*, 2017).

The groundwater sources needs to be protected from contamination through human activities. Various studies have been made on the relationship between groundwater quality and land use (Wang, 1989; Eckhardt and Stackelberg, 1995; Jeong, 2001; Ouyang *et al.,* 2014; Penha *et al.,* 2016). All the aforementioned studies carry important understandings into the relationship between groundwater quality and land use. It is worth mentioning at this point, that the characteristics of unsaturated soil beneath the land

surface of a shallow unconfined aquifer considerably affect the impact of land use on groundwater quality. The material properties of unsaturated soil also play an important role in deciding aquifer vulnerability. However, the existing studies on this topic are rather scarce and yet inclusion of material properties of unsaturated soil is in limited extent. Therefore, this study aims to characterize the relationships between groundwater quality and landuse, considering the material properties of the unsaturated soil. The study combines the data regarding groundwater quality parameters, landuse patterns, and material properties of unsaturated soil using factor analysis considering variability in them.

MATERIALS AND METHODS

The Jaipur district is located under semi-arid climatic zone with geographical area of 11061.44 km^2, extending between north latitudes 26°25' and 27°51' and east longitudes 74°55' and 76°18' and administrated by 13 blocks (Figure 1). The normal annual rainfall in the district is 565 mm. The area under irrigation is about 35.27% of the total area of the district. The absolute annual potential evapo-transpiration is 1744.7 mm. The district is characterized by broad continuum of landscapes including hillocks, pediments, undulating fluvial plains, aeolian dune fields, fluvial-aeolian origin forming landforms of river terraces, floodplains, ravines, palaeo-channels etc.

Groundwater in the district occurs both in unconsolidated quaternary formations and consolidated formations of Bhilwara and Delhi super groups, and also post-Delhi granites. In a large portion of the district, alluvial deposits mainly fine sand and silt serve as potential aquifers in addition to gravel zones. Ground water in the district is contained in several different lithologic units ranging in age from Younger alluvium

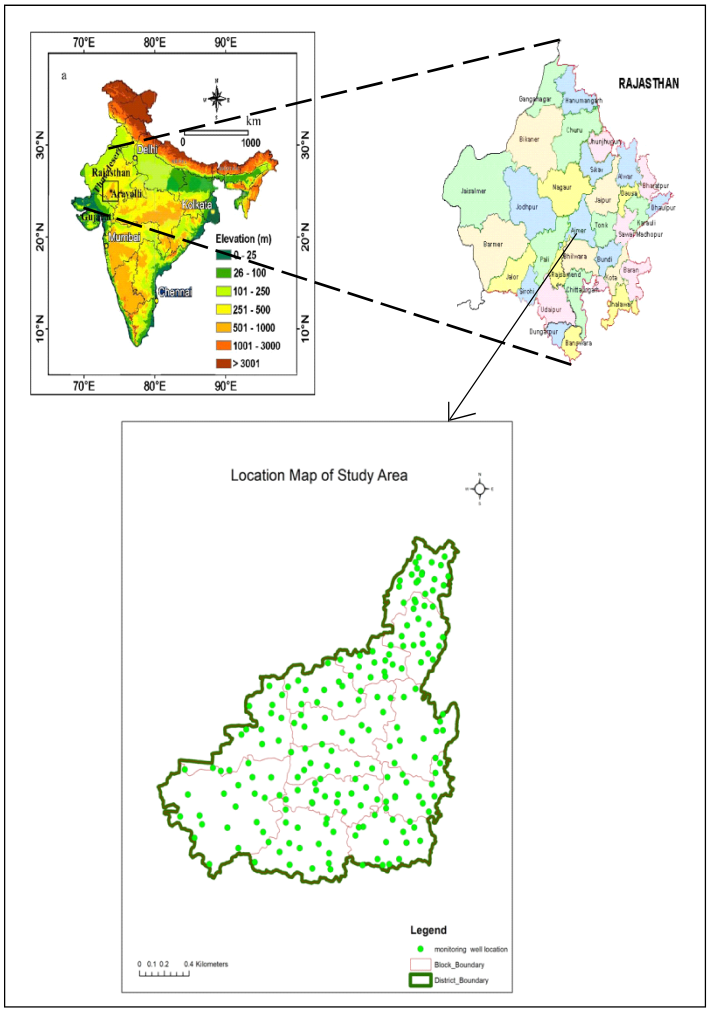

Figure 1: Location Map of the Study Area

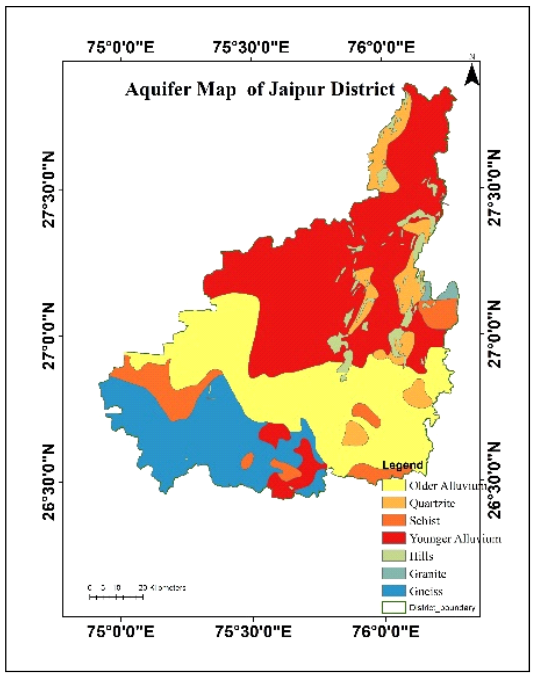

Figure 2: Aquifer Map of District Jaipur

Table 1: Landuse and Land Cover Classification

Class	Description	Occurrence
Agriculture Land	It can be classified under two categories i.e. cropland (rabi and Kharif crops) and fallow land (no cultivation)	Out of total of 70.4% farmland, only 35.88% of the district falls under cultivation, covering mainly north, southern-west, central portion. Rest comes under no cultivation, due to hazardous water quality and weathered/fractured rock material underneath
Built-up	This class addresses the inhabited areas, business foundations, industrialized zones, streets and other cleared surfaces	It covers only 4.96% of the district area
Barren Land	This class includes rock-flung, and other soil surfaces that stay without vegetation consistently	This category is found in almost 11% of the area, comprising Bassi, Sanganer, Govindgarh, Janwa Ramgarh, Bairath
Gullied/ Ravinous Land	It represents the areas in which all diagnostic soil perspectives have been removed by flowing water, V-shaped/U shaped channel	
Deciduous Forest Land	These forests are also monsoon forests, less rainfall occurring region	Almost 8.77% is covered with deciduous forest and shrublands. It comprises in the north-western and north-eastern and central part of the district i.e. Janwa Ramgarh, Amber, Jhotwara, Kotputli, Shahpura
Shrub Land	These lands are dominated by shrubs, bushes and other herbaceous plants of low height woody plants	
Water	The open water bodies such as ponds, lakes, rivers are included in this classification	The area is facing a water crisis as it contributes only 2.80% of surface water.

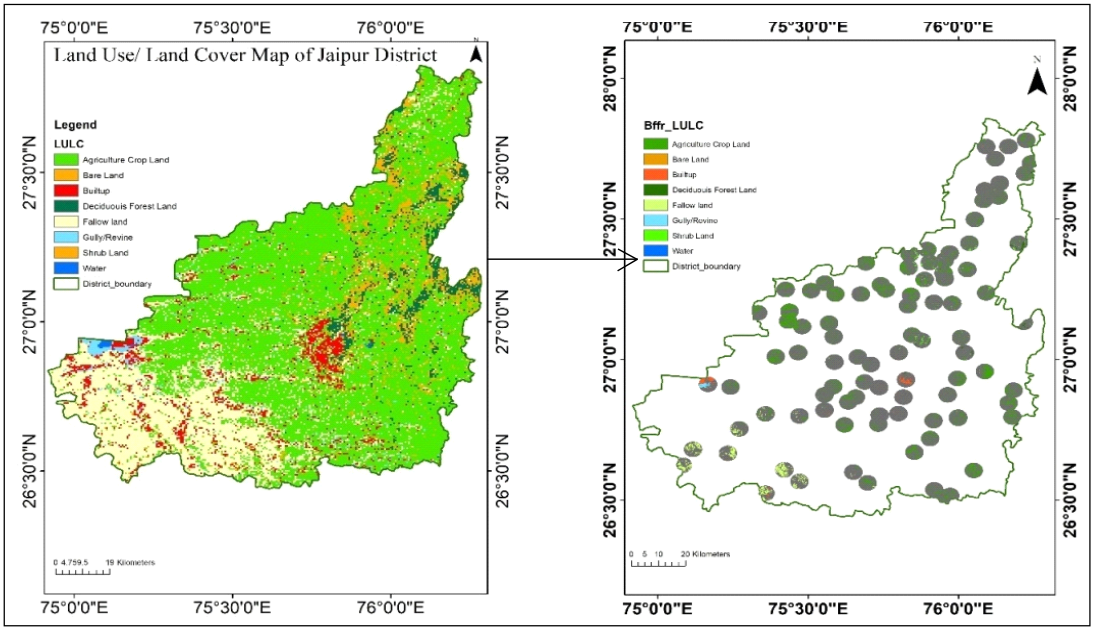

Figure 3: Landuse Activities in the Vicinity of Each Monitoring Well Location

to old Gneisses (Figure 2). Important aquifers are formed in Younger alluvium, which occupies about 39% area of all the aquifers in the district, followed by Older alluvium, Gneiss, Schist, Quartzite and partly in Granite. Some parts of these aquifers are saline also. Depth of wells in the district generally varies from 50 to 100 m in alluvium and 50 to 200 m in combination/ consolidated formation areas.

Soils in the study area can be delegated loamy sand to sandy topsoil, sandy dirt topsoil, sandy mud, windblown sand and river sand. Of the total area, about 20 per cent region is not appropriate for cultivation

due to backwoods, slopes, pastureland, unfertile grounds, and lakes. Likewise, about 21 per cent zone is discovered appropriate for cultivation yet is as of now not under cultivation because of the non-accessibility of water system, water sources and different reasons.

Data required for characterizing the relationship between groundwater quality and landuse pattern are groundwater quality parameters, landuse categories and thickness of various types of material in the unsaturated zone. The average data of 14 groundwater quality parameters of 94 monitoring well locations for a period of 4 years (2013-2018, *note: GWQ data for year 2015 and 2016 not available*) were used for this purpose.

The landuse was categorized through the process of image interpretation and supervised classification of multispectral images LANDSAT 8 (*http: usgs.gov.in*), comprising of 11 spectral bands. In this research, seven bands were selected for the classification of landuse categories. In the research, the maximum likelihood method was adopted for LULC classification using ArcGIS 10.1. A total of eight LULC classes namely agriculture cropland, built-up, barren land, deciduous forest, shrub land, fallow land, water bodies, gullied/ ravenous land were identified as shown in Table 1. Further, the land use classification map was categorized into different land-use categories in area percentage to facilitate the execution of factor analysis. The area percentage of different land uses categories has been estimated in the vicinity / buffering zone of 3 km for each 94 monitoring well locations through intersecting with the LULC map, as shown in Figure 3.

The type of geological material in the unsaturated soil/ vadose zone plays a vital role in controlling the movement of pollutants from the land surface to the aquifer, affecting the permeability of these geological features. The thickness of various types of materials constituted in the vadose zone was calculated from a lithological cross-section of borehole data at the time of their deployment, obtained from Central Ground Water Board, Jaipur.

Exploratory factor analysis (EFA) has been employed to determine composite inter-relationship among variables, which are groundwater quality parameters, landuse categorization and thickness of geological materials in the unsaturated soil. The factor analysis has been done using the Principal Component Analysis extraction method and variamx rotation method for the present study. It extracts the maximum variance and puts them into the first factor. Afterwards, it removes the variance explained by the first factor and extracts the second factor, and so on till the last factor. The factor rotation is to ensure that all variables have high loadings only on one factor to improve interpretability (Zeng and Rasmussen, 2005). Also, factor score values were estimated using regression method to designate a variable's relative importance on a latent factor. The XLSTAT 2014 software was used to implement factor analysis.

RESULTS AND DISCUSSION

The scree plot (Figure 4) shows both the eigenvalues and cumulative variability for all the twenty-five parameters of groundwater quality, landuse pattern and unsaturated soil materials. It displays that eight factors were responsible for the variances of 26 variables, being eigenvalues more than 1.0 and cumulative variability of 77.397 per cent. However, only four factors were considered to avoid the complexity of analysis, which represents 57.558 per cent of cumulative variability.

Table 2 represents rotated factor loadings using varimax rotation method along with cumulative variability for each factor and commonalties for each variable. As commonalities of various variables defined by four factors extracted were occurred high enough, then it can be concluded that the variables can be well explained by the four factors. The factor loadings have been classified into three categories as 'strong',

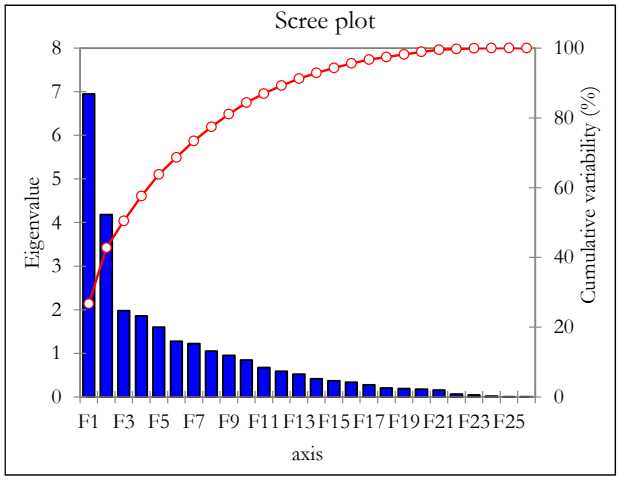

Figure 4: Scree Plot Curve

Table 2: Factor Loadings after Varimax Rotation

Parameters	F1	F2	F3	F4	Commonality
EC	**0.825**	0.494	0.050	-0.076	0.948
TDS	**0.804**	0.530	0.053	-0.061	0.953
pH	**0.294**	-0.036	-0.236	0.126	0.637
Na+	**0.884**	0.264	0.057	-0.048	0.893
K+	0.006	**0.407**	0.081	-0.370	0.727
Ca++	0.005	**0.799**	0.032	0.206	0.739
Mg++	0.151	**0.864**	-0.066	-0.220	0.853
Cl-	**0.665**	0.519	0.052	-0.019	0.833
SO4—	0.362	**0.822**	0.105	0.021	0.852
CO3—	**0.663**	-0.276	-0.024	0.071	0.638
HCO3-	**0.758**	-0.193	-0.040	-0.095	0.798
NO3—	0.021	**0.679**	0.013	-0.128	0.762
F-	**0.815**	-0.087	0.023	-0.107	0.749
TH	0.116	**0.942**	-0.028	-0.075	0.936
Agricultural Crop Land	0.000	**0.486**	-0.364	0.239	0.826
Barren Land	0.013	-0.157	**0.560**	-0.130	0.461
Built-up	-0.026	0.287	**0.687**	0.072	0.793
Forest Land	-0.429	**0.433**	-0.426	-0.045	0.855
Fallow Land	**0.495**	0.251	0.364	-0.339	0.680
Gully/Ravines	0.158	-0.015	**0.521**	0.257	0.564
Shrubland	-0.458	0.327	**-0.496**	-0.007	0.747
Thickness	-0.078	0.005	-0.073	**0.896**	0.834
Gravel	-0.261	0.007	**-0.318**	-0.167	0.472
Coarse sand	**-0.333**	0.208	0.073	0.066	0.794
Fine Sand	-0.158	-0.174	0.167	**0.792**	0.919
Clay	**0.371**	-0.001	-0.324	0.126	0.860
Variability (%)	21.138	20.528	8.031	7.863	
Cumulative %	21.138	41.665	49.696	57.558	

'moderate' and 'weak' corresponding to absolute values of >0.75, 0.40-0.75 and <0.40, respectively (Liu *et al.,* 2003).

Factor 1 explained 21.138 per cent of the total variability (Table 2) and has strong positive loadings for EC, TDS, sodium, bicarbonate and fluoride, moderate loadings for chloride and carbonate and land used for fallow land. There was a weak loading for clay unsaturated material. The high positive loading is known for the strong linear relationship between the factors and parameters. The blend of EC, TDS, sodium, chloride can be interpreted as salinity factor reveals due to dissolution of rock materials i.e. schist, mica in the groundwater and over-exploitation of groundwater resources. Bicarbonate is another form of the rock-water interaction process in which dissolution of carbonates and/or silicate minerals takes place from the unsaturated soil and rocks by carbonic acid and from the soil zone CO_2 through chemical weathering reactions.

The spatial distribution of factor score 1 and its associated parameters showing strong loadings are represented in Figures 5 (A) and 5 (B), respectively. It was observed that the highest factor scores for factor

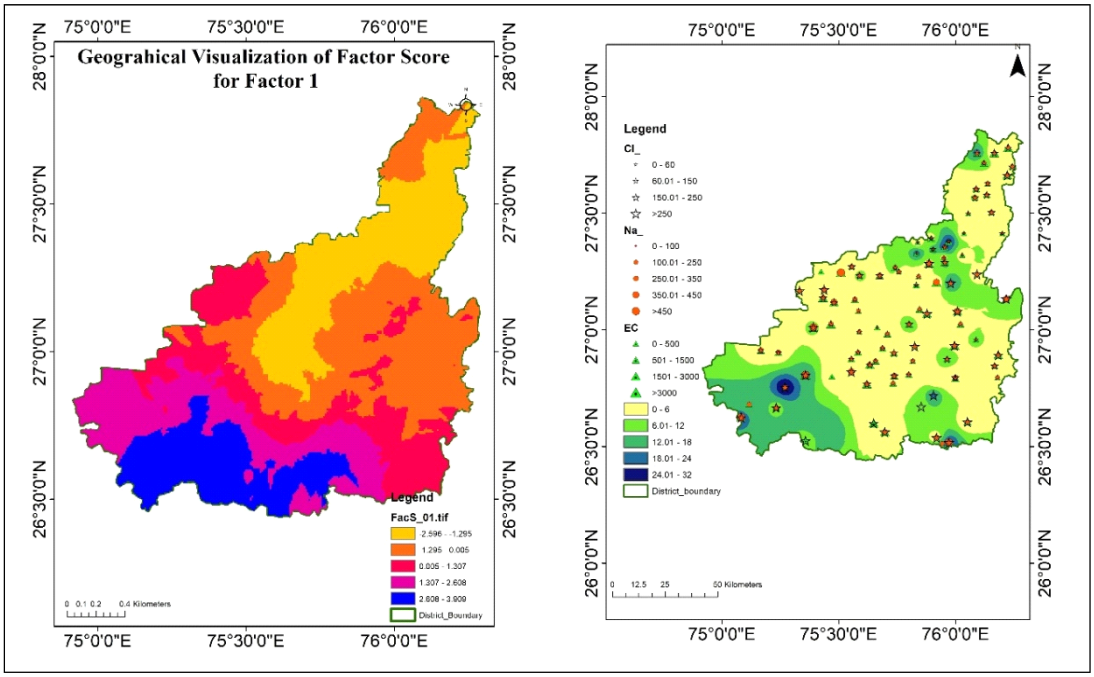

Figure 5: Spatial Distribution of (A) Factor Scores of Factor 1 (B) Clay/Silt Unsaturated Soil, Electrical Conductivity, Concentration of Sodium and Chloride

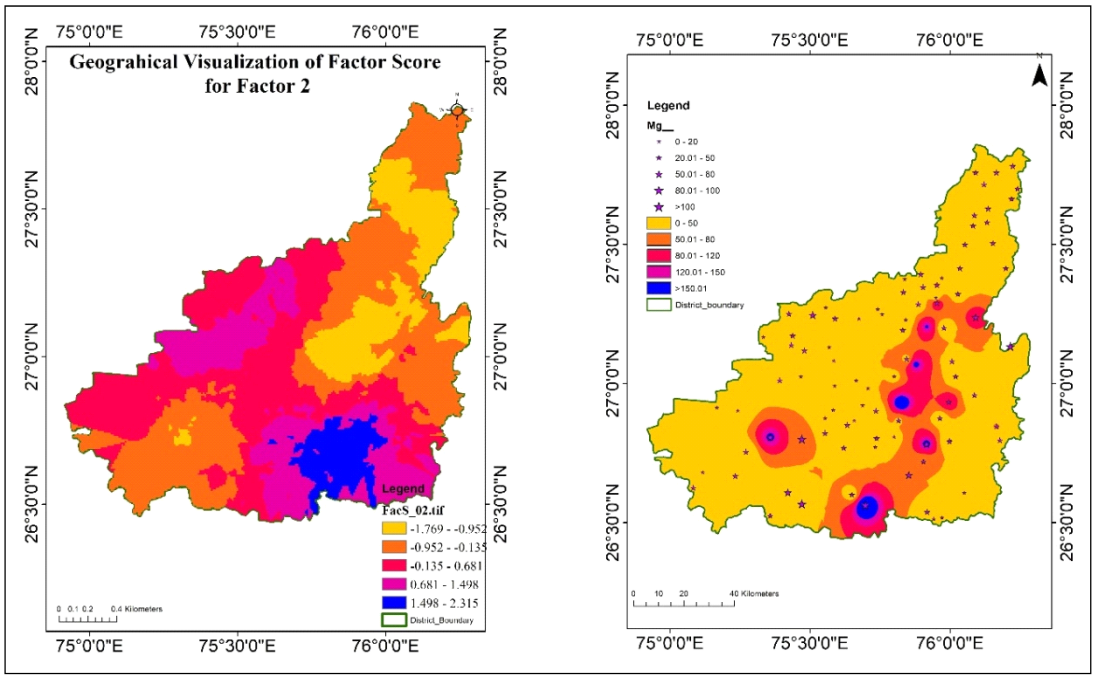

Figure 6: Spatial Distribution of (A) Factor Scores of Factor 2 (B) Concentration of Magnesium and Nitrate

1 represented in south-eastern and south of the district i.e. Dudu and Phagi. Likewise, high concentration of chloride, sodium and electrical conductivity were observed in the same region owing to rock-water interaction process. This portion of the area is mainly covered by fallow land due to the high salinity factor, as shown in Figure 3.

Factor 2 was comprised of strong factor loadings for calcium, magnesium, sulfate and total hardness, moderate factor loadings for potassium and nitrate and land used for forest land. It also displayed moderate loading for agricultural cropland. It explained 20.527 % of the total variability. Factor 2 can be designated as alkanity due to agricultural and domestic waste

disposal. The spatial distribution of factor scores of factor 2 has represented in Figure 6 and revealed that highest factor scores were identified in the south and north-eastern part of the district i.e. Phagi, Bassi, Janwa Ramgarh and Amber blocks. The highest concentration of nitrate and magnesium were also observed in the same part of the district as well. It was revealed from the LULC map (Figure 3) that the north-eastern part of the district has mainly confined with forest land due to biological nitrate fixation under deciduous forest and proximity with agricultural cropland.

Factors 3 and 4 have shown 8.031 and 7.863 percentage of variance, respectively. These factors were neglected owing to no significant loadings and weak negative loadings. However, factor 3 exhibited moderate loading for barren land and built-up and strong loading for fine sand for factor 4.

CONCLUSION

In the study, an attempt was made to characterize the relationship between groundwater quality and landuse, with consideration of the characteristics of the unsaturated soil/ vadose zone, applying factor analysis. Groundwater quality parameters, landuse categories and thickness of various types of material in the unsaturated zone have been used for this purpose. The area percentage of different land uses categories has been estimated in the vicinity / buffering zone of 3 km for each 94 monitoring well locations through intersecting with the LULC map.

Four factors were extracted with 57.558 per cent of cumulative variability. Factor 1 explained 21.138 per cent of the total variability and has strong positive loadings for EC, TDS, sodium, bicarbonate and fluoride, moderate loadings for chloride and carbonate and land used for fallow land. It has been interpreted as salinity factor due to dissolution of rock materials i.e. schist, mica in the groundwater, over-exploitation of groundwater resources and rock-water interaction process. It identified mostly in south-eastern and south part of the district, which is primarily covered by fallow land due to the high salinity factor.

Factor 2 explained 20.527 per cent of the total variability, comprising strong factor loadings for calcium, magnesium, sulfate and total hardness, moderate factor loadings for potassium and nitrate and land used for forest land. It can be designated as alkanity due to agricultural and domestic waste disposal. It identified in south and north-eastern part of the district, which is mainly confined with forest land due to biological nitrate fixation under deciduous forest and proximity with agricultural cropland. Fertilizers used for agricultural activities were considered as the main sources of potassium and nitrate in the groundwater as these pollutants are held by clay particles and go down into groundwater through the soil strata

Factor 3 and Factor 4 were neglected owing to no significant loadings and weak negative loadings.

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Research Article

Perceived Effects of Climate Change on Crop-Livestock Farming System in the Murrah Buffalo Breeding Tracts of Haryana

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ABSTRACT

Perception is the act of being aware of one's surroundings through sensory experiences, and it indicates a person's ability to understand. Farmers perceptions are considered to be crucial for adaptation so an attempt was made to study the perception levels of farmers on climate change and its impact on crop-livestock farming. The current study was carried out in Hisar, Jind and Rohatk districts of Haryana. Primary data was collected from 360 respondents through well structured interview schedule. Findings revealed that around two fifth of the respondents had higher level of perception on climate change and its impacts. Largely perceived components were increasing temperatures and temperature humidity index, reduced feed intake and increased water intake, decreased milk production during heat stress, change in current management practices, change in feeding pattern of animals, profuse sweating, open mouth breathing(panting) during severe heat stress, high infestation of parasites, tics, mites etc., increased incidence of anestrous and low conception rates due to heat stress and change in crop calendar and increasing pest and disease infestation.

Keywords: Climate change, Crop, Farmers, Livestock, Murrah buffalo, Perception

INTRODUCTION

The climate change is posing unprecedented challenges for the society in general and the farming community in particular, the world over. Agriculture and livestock are among the most climate sensitive economic sectors (GCA, 2019). Krishnan *et al.* (2020) reported that India's average temperature has risen by around 0.7°C during 1901-2018 and projected to rise by approximately 4.4°C by 2100 relative to the recent past. Monsoon rainfall has also been declined around 6 percent from 1951-2015. Both the frequency and spatial extent of droughts have increased significantly during 1951–2016. Global warming is likely to impact productivity of buffaloes due to their sensitivity to temperature changes. Air temperature, humidity, wind velocity and solar radiation are the main climate variables that affect buffalo production in tropical climate. Both milk production and reproductive functions of Murrah buffaloes are likely to be affected due to warming effects (Upadhyay *et al.*, 2007). Climate change is a grave threat to livestock production because of the impact on the milk production and productivity, livestock diseases, animal growth, water availability as well as feed and fodder production and availability (Rojas *et al.,* 2017). More specifically, the impact of temperature rise on total milk production for India has been estimated about more than 15 MT in 2050 (Upadhyay *et al.*, 2013). Hence, dairy farming in India is highly exposed to weather and climate risks and transformational changes in some practices will be required to address the risks of climate change. FAO estimates that over 500 million smallholder farms, producing more than 80 per cent of the world's food in terms of value, and 750 million extremely poor

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people working in agriculture – usually as smallholder family farmers – are vulnerable to the effects of climate change. At present, 20-80 per cent of the inter-annual variability of crop yields is associated with weather phenomena and 5-10 per cent of agricultural production losses are associated with climate variability (FAO, 2019). The Haryana state has about 113 Murrah buffalo per square kilometer (Highest population density of Murrah buffalo among all the states). It has earned the distinction of being the home tract of the world famous Murrah buffalo. In present changing climatic scenario, Rao *et al.* (2016) assesses the climate change vulnerability using 38 indicators and classified 162 districts covering Indo-Gangetic plains. The study result revealed that out of 22 districts in Haryana, 15 districts came in the range of medium to high vulnerability towards climate change (Rao *et al.*, 2016). Given the importance of buffaloes based cropping system in Haryana and the fact that they are better able to cope with climate change than crops, understanding how farmers perceive the effects of climate change on production can help assess the degree to which the sector still needs to adapt in order to cope with the anticipated changes. Farmers' adoption and successful implementation of climate resilient technologies in their ecosystems are dependent on their ability to perceive and respond favourably to changing climatic scenarios.

MATERIALS AND METHODS

The study was conducted in the purposively selected Hisar, Jind and Rohtak districts of Haryana state as these three districts are known as the home of the elite Murrah buffalo. Two blocks from each district were selected randomly. Therefore, total six blocks namely, Agroha and Barwala block from Hisar district, Pillukhera and Safindo block from Jind district and Meham and Rohtak block of Rohtak district were covered for present study. Subsequently, four villages having good number of Murrah or graded Murrah buffalo, were selected randomly from each selected block, thus 24 villages in total. Subsequently, 15 farmers from each village who are rearing Murrah buffalo since last 10 years and having a minimum herd size of 04 Murrah buffalo were selected randomly. Hence, a total sample size of the present study was 360. Personal interview with observation method was followed with the help of pre-tested structure interview schedule which was prepared according to the objectives of the study. The respondents were contacted at their door steps and/or livestock farm and/or field of crop production. The primary data was collected at the time of interview, purpose of the study was explained to the respondents. Only one respondent was interviewed at a time. Respondents were presented with a statements and were asked for their perception on a five point continuum strongly agree, agree, undecided, disagree and strongly disagree with a score of 5, 4, 3, 2 and 1 respectively for the positive statements and vice versa for the negative statements.

RESULTS AND DISCUSSION

The buffalo being highly sensitive to heat stress, it absorbs more heat and lost huge energy in heat dissipation. In summer, animal consumes less feed especially dry fodder as reported by large number of farmers with an index score of 0.827 as depicted in the results of Table 1 Due to scorching heat and humid weather during summer, farmers have opined with a highest index score of 0.957 that their buffalo needs more drinking water which is being provided at frequent intervals all through the day which aids in heat dissipation.

Table 1 also illustrates that, change in feeding of animals: time and type of feed was perceived by the farmers with an index score of 0.834. Almost all the famers have reported to feeding the animals during cooler parts of day i.e., early morning and late evening hours for better digestion, less energy spent in digestion and also less feed waste. Animals were fed slightly more quantity of concentrate feed and also mustard oil at the rate of 100-250ml/day/animal to meet the energy requirement during summer and farmers also perceived that the mustard oil helps in cooling the animal body during summer besides acting as rich source of fat supplement.

Results from the Table 1 shows that, considerably good number of farmers have perceived that the fodder shortage in the region with an index score of 0.738, especially during summer season with peak shortage from May to September period during which huge water was also catered for water intensive crops like paddy and sugarcane and also might be due to almost negligible grazing and entire stall feeding of animals, no silage or hay preparation. According to Birthal and Jha (2005), the most significant constraint

Table 1: Distribution of respondents according to their perception levels regarding impact of climate change on animal feed and fodder (n=360)

S.No.	Statements	Index score	Rank
1	Reduced feed intake during heat stress	0.827	III
2	Increased water intake during heat stress	0.957	I
3	Decreased water resources	0.552	V
4	Shortage of fodder	0.738	IV
5	Low palatability of fodder crops	0.537	VI
6	There is change in feeding of animals: Time and type of feed	0.834	II

in dairy production in India is feed scarcity, which accounts for nearly half of total losses. In its recent report, Niti Aayog (2018) noted that the production of dairy animals suffers significantly from a scarcity of fodder, feed, and drinking water. Due to the poor nutrition provided by dry residue, protein concentrate, and green fodder, the total productivity of the dairy industry is low.

Table 2 displays that large proportion of farmers have perceived the decrease in milk production during heat stress ranging from 1-4 litres/day/animal with an index score of 0.868. Farmers have also reported that though the decrease is observable with the onset of summer and till the end of summer, the maximum decrease in milk production of buffalo was observed from mid-May to end of August month. In comparison to summer, less proportion of farmers have reported to decrease in milk production during the winter with an index score of 0.581 as shown in the Table 2. Majority have expressed that the slight decrease ranging from 0.5-2.5 liters/day/animal will be in case of extreme cold waves during the period of middle of December to middle of January when there is completely cloudy and dense fog with almost no sun light.

Rise in maximum temperature during summer (>4°C) i.e., heat wave or fall in minimum temperature during winter (>3°C), i.e., cold wave causes a decline in milk yield from 10-30 per cent in 1st lactation and 5-20 per cent in 2nd lactation (Upadhyay *et al.*, 2013). Pawar *et al.* (2013) has reported that, milk yield in Murrah buffaloes decreased by 0.028 kg for every point increase in THI value above threshold level. The critical threshold level of maximum temperature-humidity index (THI) was estimated to be 74 and whenever the THI crosses more than 82, which usually occurs in Haryana state from May and continues up to September and decrease milk productivity by more than 1% per unit increase in maximum THI over 82. The maximum temperature and minimum humidity (viz. maximum THI) are the most critical weather parameters causing thermal stress in animals (Choudhary and Sirohi, 2019).

All most all the respondents have experienced the substantial increase in the input cost of both crop and livestock farming with an index score of 0.864 as illustrated in the Table 2. Increase in pest and disease infestation, weed menace in crops has resulted in a more number of sprays, sometimes sudden and untimely rainfall immediately after plant protection

Table 2: Distribution of respondents according to their perception regarding impact of climate change on animal production (n=360)

S.No.	Statements	Index score	Rank
1	There is change in current management practices	0.836	III
2	Decrease in milk production during heat stress	0.868	I
3	Decrease in milk production during cold stress	0.581	IV
4	Low fat content of milk during heat stress	0.467	VI
5	Decrease in lactation length and increase in dry period	0.540	V
6	Increase in input cost of both crop-livestock farming and decrease in Net income	0.864	II

chemical spray has caused them to repeat the spraying operation. poor monsoon seasons means more irrigation cost, input intensive crop varieties like Bt cotton, high cost of labour and other inputs like seeds, fertilizers, protection chemicals etc. Similarly in livestock, high cost of feed materials especially concentrates and oil cakes, animals falling sick at the start and end of the seasons has resulted in medication and maintenance charges, extra feed supplements during heat stress like multi vitamins and others, repeat breeding, low conception rate, cost incurred in micro climate modifications like fan, mist, pucca cattle sheds, cow mats etc were the various reasons put forth by respondents for the increase in input cost.

Results from the Table 3 displays that large majority have reported to profuse sweating, open mouth breathing (panting), increased salivation with an index score of 0.899 during hot humid season due to which animals become weak/falling sick, decrease in milk production and reduced feed intake. Substantial number of respondents have perceived that the changing climatic conditions have resulted in the increased infestation of parasites, tics, mites etc. with an index score of 0.696 as shown in the Table 3. Further discussions with farmers revealed that this infestation was more during monsoon season. They also perceived that animal were falling sick during very high infestation and also observed slight dip in milk production. Increased temperatures and decreased rainfall will lead to the severe infestation of ectothermic tics and in the transmission of tick born pests. Increased precipitations coupled with humidity will accelerate the breeding of parasites and their rate of transmission (Rocklov and Dubrow, 2020). A study by Verma *et al.* (2007) in Haryana state has also found that, gastrointestinal tract parasitic infestation was very common in cattle and buffaloes. Infection of strongyles, strongyloides and Toxocara species caused gastroenteritis in buffaloes and high mortality in calves. Ascariasis was also a leading cause of death among young buffalo calves.

Results from the Table 3 indicates that incidence of mastitis and other diseases was perceived by slightly less than half of the respondents with an index score of 0.587. The prevalence of FMD and HS was very low in the study region, reason being, the high coverage of vaccination programme by Haryana govt every year administering combined vaccine for both the foot and mouth (FMD) disease and Haemorrhagic Septicaemia (HS). Frequency of diseases like Foot-and-mouth disease (FMD), Haemorrhagic septicaemia (HS) and tick fever are most likely to be higher due to climate change (Upadhyay *et al.*, 2013). A study conducted in Haryana state has reported that Foot and mouth disease had been reported from every district throughout the year prior to the launch of the FMD control programme by mass vaccination on January 23, 2004, but since then, there have not been any significant outbreaks in the state, which is a crucial step in establishing an FMD-free zone. Similarly, there were many HS epidemics from 1995 to 1998 before there was a vaccine drive. The disease occurred more frequently from July to March, indicating that the rainy or humid conditions are congenial for the disease occurrence. Mastitis cases were reported all over the state, causing significant economic losses. The most common type was subclinical mastitis and pneumonia was common during the winter months (December and/ January) due to inadequate protection from extreme cold (2-3°C), resulting in stress and making them susceptible to exogenous and endogenous microbes leading to pneumonia (Verma *et al.*, 2007).

Table 3: Distribution of respondents according to their perception regarding impact of climate change on animal health and disease (n=360)

S.No.	Statements	Index score	Rank
1	Increase in infestation of parasites, tics, mites etc.	0.696	II
2	High incidence of mastitis and other diseases	0.587	III
3	Reduced bodyweight gain of animal during heat stress	0.476	V
4	Profuse sweating, open mouth breathing (panting), increased salivation during severe heat stress	0.899	I
5	Rumination would be decreased	0.569	IV

Table 4: Distribution of respondents according to their perception regarding impact of climate change on animal reproduction (n=360)

S.No.	Statements	Index score	Rank
1	Delayed puberty and maturity	0.397	IV
2	Increased post post-partum disorders	0.569	III
3	Increased incidence of anestrous due to heat stress	0.704	I
4	Low conception rate due to heat stress	0.700	II

Increased incidence of anoestrous is one of the major reproductive problems perceived by the farmers in the region with an index score of 0.704 as shown in the Table 4. and it was prevalent slightly more during the humid summer months. Though farmers were not aware of the exact cause, poor feeding practices and high animal stress might be the reasons. The prevalence of anestrus was higher in buffaloes than in cows, which may be due to more heat stress in buffaloes, which may induce summer anestrus (Wilfenson and Meidan, 2000; Hedaoo *et al.*, 2008). Results of the study by Kumar *et al.* (2022) indicated that Anestrus (59.55%) had the highest prevalence among various etiological factors, followed by repeat breeding (17.80%). According to studies, the incidence of anestrus reduced with increasing parity and was significantly influenced by the buffaloes' age in terms of parity. Parity had a highly significant effect on the incidence of anestrus in Murrah and Jaffarabadi buffaloes (Gautam and Kharche, 1992; Singla and Verma, 1994 and Tharaphder, 2002). Younger buffaloes spend the majority of their energy on producing milk and building up their bodies (Roberts, 1971), and the left-over energy is insufficient for carrying out reproductive functions. Inadequate nutrition suppresses estrus more strongly in young growing females than in older females, resulting in ovarian inactivity and anoestrous (Hafez, 1974). Proper feeding mechanisms and mineral supplements may therefore be able to address this issue. A research study has also found the effect of season where Murrah buffaloes calved in winter and summer season had higher incidence of anestrus than rainy and autumn season (Singh *et al.*, 2019).

Table 4 exhibits that the farmers have also perceived the low conception rate of Murrah buffaloes particularly during the heat stress with an index score of 0.700. Probable causes as also reported by researches include effect of THI which is found to have significant effect on pregnancy rate of Murrah buffaloes calved for first time and overall pregnancy rate. The critical heat stress months of May and June were found to have a maximum drop-in pregnancy rate of 7% for every unit increase in THI value above critical threshold level. The study highlights the management interventions to ameliorate the decline in pregnancy rate during this period (Dash *et al.*, 2015). When compared to heifers bred throughout the rest of the year, heifers inseminated in the summer had a fourfold lower chance of becoming pregnant after the first insemination (Donovan *et al.*, 2003). Numerous factors can affect conception rates. 96 per cent of the difference in conception rates may be attributed to management and environmental factors. Significant variations in conception rates may result from herd differences in nutrition, semen quality, metabolic disorders, reproductive health, heat detection, timing of insemination relative to the estrous cycle, skills of the AI operator, insemination techniques, and climate (Kathy, 2004).

Results of the Table 4 demonstrates that the increased post-partum problems/disorders like retention of placenta, delay in fall of placenta, metritis, decreased milk production were perceived by slightly more than half of farmers with an index score of 0.569, who have also expressed that problem is comparatively more during hot and humid monsoons. Results of the study by Singh *et al.* (2019) indicated that incidence of postpartum abnormal discharge (PPAD) and retention of placenta (ROP) increases as the animal become older and incidence of ROP and PPAD are more during rainy season.

Table 5 clearly describes that, as already discussed above, a large portion of farmers had felt the high cost of inputs both in agriculture and livestock sector with an index score of 0.900 and total cost of cultivation (COC) in general in the recent times. The

Table 5: Distribution of respondents according to their perception regarding impact of climate change on crop farming (n=360)

S.No.	Statements	Index score	Rank
1	Burning of crop/fodder residues, grains and other materials in the field contributes to climate change	0.666	IV
2	Change in the time of farm operations: Delayed/early sowing, inter cultivation, harvesting etc.	0.760	II
3	High pest and disease infestation on crops	0.696	III
4	Reduction in yield of major crops	0.492	VI
5	Availability of less water for crops	0.527	V
6	High cost of inputs	0.900	I

findings of the study by Srivastava *et al.* (2017) also revealed that from 2007–2008 to 2014–2015, the average annual inflation rate for cultivation costs peaked at 13 per cent. Labor costs alone were responsible for 53% of the rise, followed by the cost of machinery, fertiliser, seeds, pesticides, and animal labour, which each contributed 16, 9, 7, 2 and 2 per cent to the increase. Additionally, the findings showed that the physical use of inputs increased at a slower rate overall, and a significant portion of the increase in the COC was related to the rising cost of inputs.

Results from the Table 5 shows that the considerable majority of respondents had expressed that there is significant change in their crop calendar and farming operations with an index score of 0.760. Changing climatic conditions had forced the farmers to alter their routine farm operations. Paddy in the previous year was transplanted late by at least a fortnight due to delay in the monsoon season but again during the harvesting stage, sudden untimely rainfall has caused crop yield losses. Wheat had been sown by few farmers early and few have enquired about early varieties due to the high march temperature at the harvest season which is adversely affecting the grain yields. Wang *et al.* (2022) in their study have reported that, crop calendar adjustment has the potential to reverse yield loss caused by temperature rises while also lowering water requirements by utilising monsoon precipitation. The study indicates a growing tendency toward planting rabi wheat earlier in order to reduce heat stress during the reproductive period. Additionally, earlier kharif rice planting can enable earlier wheat sowing, aid to use monsoon moisture, and prevent cold stress of kharif rice during anthesis. Arunachalam and Sasmitha (2021) has developed a suggestive Climate led Transfer of Technology (ToT) Module to cope up with unseasonal and irregular rainfall.

Farmers have perceived that there was high pest and disease infestation in the crops in the recent years with an index score of 0.696 as shown in the results of the Table 5. Small-scale climate variability such as temperature increase, increase in atmospheric CO_2, changing precipitation patterns, relative humidity, and other factors are among the climate change uncertainties that are relevant to insect pests. Global climate warming could trigger their relationships with host plants and natural enemies, changes in their geographic range, overwintering survival rates, number of generations, risk of invasive insect species, and risk of insect-transmitted plant diseases. As climate change exacerbates the pest problem, there is a great need for future pest management strategies (Skendzic *et al.*, 2021).

Bharat *et al.* (2022) in their study has revealed that farmers were well versed and perceiving the impacts of climate change and variability realizing in terms of economic fluctuations, changing agro-climatic factors affecting the crop nature, increased pest and diseases attack, impacting crops yields, water resources and animals in an adverse manner. Meena *et al.* (2022) in their study has also found that farmers of semi-arid region were perceiving climate change and its adverse effects and also social vulnerability index showed that more than half of respondents were moderate socially vulnerable in climate-changing scenarios.

CONCLUSION

It is concluded from the study that most of the respondents had high level of perception on climate change and its impact on crop-livestock farming.

Reduced feed intake, decreased milk production during heat stress, change in feeding pattern of animals, profuse sweating, open mouth breathing(panting) during severe heat stress, high infestation of parasites, tics, mites etc., increased incidence of anestrous and change in crop calendar are the components that were largely perceived by farmers. Farmers perceptions are considered to be crucial for adaptation of climate resilient practices to combat the adverse effects of changing climatic scenario on crop-livestock farming. It becomes vital for the extension agents to create awareness and also disseminate climate related information and knowledge through various mechanism which will lead to high perception levels and also create favourable condition for adoption of the climate resilient farming practices.

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Research Article

Performance of Cluster Frontline Demonstrations on Productivity and Profitability of Pigeonpea (*Cajanus Cajan* L.) Through Improved Technologies Under Rainfed Conditions

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ABSTRACT

The present exploration was carried out on the Cluster Frontline Demonstrations (CFLDs) in the farmer fields during 2019-20, 2020-21 and 2021-22 (three consecutive years) to evaluate the performance of improved variety in pigeonpea (LRG-52) by adopting good agricultural practices to enhance the productivity and profitability under scarcity zone of Andhra Pradesh. The CFLDs were conducted in an area of 20 ha with 50 farmers' field locations of two clusters namely Bathalapalli and Rapthadu Mandals (Blocks) of Anantapuramu district in Andhra Pradesh. In contrast to the 570 kg/ha recorded in farmers' practice, the results showed that the three-year average seed yield of pigeonpea under cluster front line demonstrations was 692 kg ha^{-1}, with an average yield increase of 19.7 per cent and additional monetary net returns of Rs. 10861 ha^{-1} under rainfed conditions. The seed yield of pigeonpea was increased by 37.8, 20.1 and 12.4 per cent in 2019-20, 2020-21 and 2021-22, respectively as compared to farmers' practice. According to the average of three consecutive years, it was found that the benefit-cost ratio (B: C ratio) of improved technology was 2.08 as against to 1.49 in farmers' practice. Hence, the present findings clearly indicated that the use of improved pigeonpea varieties coupled with good agricultural practices increased the pigeonpea productivity and profitability in scarce rainfall zone of Andhra Pradesh, India.

Keywords: Improved technology, Farmers' practice, Extension gap, Technology gap, Index

INTRODUCTION

India is the largest producer, consumer of Pigeon pea (*Cajanus cajan*) and this is second most popular pulse crop after chick pea cultivated throughout India. India contributes about 80 per cent of the world's pigeonpea production (Chaitanya *et al.,* 2020). Pigeonpea predominantly grown during kharif season both as a sole crop and as an intercrop, though found in wide range of agro-ecological situations. It has multiple uses and occupies an important place in the prevailing farming systems in the country (Daniel *et al.,* 2019). Its deep rooting and drought tolerant characters makes it a successful crop in the areas of low and uncertain rainfall. The plants owe a large measure of its popularity to the fact that it possesses valuable properties as restorative of nitrogen to the soil and adds lot of organic matter to the soil through enormous leaf shedding and thus, pigeonpea finds a promising place in crop rotation and crop mixtures. Pigeonpea is a mini-fertilizer factory as the crop has unique characteristics of restoring and maintaining soil fertility through fixing

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atmospheric nitrogen in symbiotic association with Rhizobium bacteria present in the root nodules. Its deep rooting system helps in extracting the nutrient and moisture from deeper soil layers, thus making it suitable for rainfed conditions (Kumari and Sahadeva, 2021).

Pigeonpea is used in more diversified ways than other pulses. Pulses are considered to be the major sources of protein among the vegetarians in India and complement the staple cereals in the diet with proteins, essential amino acids, vitamins and minerals. It contains 22-25 per cent protein, which compares well with that of other important grain legumes which is almost twice the protein in wheat and thrice that of rice (Veeranna *et al.,* 2020). It is mainly consumed in split form as 'dal' and is a preferential pulse for Indians. Seeds are also rich in iron, iodine, and essential amino acids like lycine, tyrocene, cystine and arginine. The outer seed layer and the kernel part provide a valuable feed/concentrate to milch cattle. The husk of pods and leaves constitute a valuable cattle fodder (Sowmya *et al.,* 2022).

Red gram is cultivating in 2.46 lakh acres in Andhra Pradesh state with 1.2 lakh MT production. The average productivity of red gram is 504 kg/ha. It is an integral component of various cropping systems and is grown sole or as an intercrop with groundnut, millets, cotton and other pulses. Pigeonpea is the second largest crop in Anantapuramu district after groundnut with the cultivable area of 65,000 hectares as a sole or intercrop during Kharif season under Rainfed conditions (Subbaiah *et al.,* 2022). Various production constrains such as low fertile soils, ill and erratic distribution of rainfall and prolonged dry spells during crop growing period coupled with severe infestation of pests and diseases viz., spotted pod borer, pod fly and sterility mosaic disease limits the yield drastically (Mahalakshmi *et al.,* 2016). A significant number of technologies that have developed in pegionpea cultivation are not being recognised and implemented to its fullest potential by the farmers. A major concern for the scientific fraternity is the gap between recommendations proposed by the scientists and actual practice followed by the farmers in pegionpea cultivation. Thus, there is need for enhancement of the productivity of pigeonpea by implementing improved varieties and technologies. The extent of implementation of advanced agricultural technologies is a key aspect under diffusion of innovation cycle to increase agricultural production at a faster pace (Ravikishore and Swamy, 2020). Hence, to meet domestic pulse needs, the Indian government has initiated National Food Security Mission (NFSM) with an objective to enhance the domestic production of pulses, reduce import dependency, ensure food security, and enhance the income and livelihoods of pulse farmers in India by increasing the area under pulse cultivation and by enhancing productivity (Anonymous, 2011).

The Department of Agriculture, Cooperation & Farmers Welfare (DAC&FW), had approved the project Cluster Frontline Demonstrations (CFLDs) in pulses under NFSM which is the practice of organizing and conducting cluster demonstrations at the grassroots level to showcase innovative agricultural technologies, practices, and interventions. Cluster Front Line demonstration is a long-term educational activity conducted in a systematic manner at farmers' fields to show worth of a new technology on "Seeing is Believing" principle. These demonstrations are conducted with an aim to provide first-hand experience and knowledge to farmers, extension workers, and other stakeholders in the agriculture sector (Ganga *et al.,* 2020). In general, the varieties cultivated by the farmers are low yielding and susceptible to one or the other biotic and abiotic stresses. The higher redgram yield per unit area per unit time can be enhanced by introducing newly evolved redgram varieties with high yielding potential. The information on the comparative performance of newly developed varieties is lacking in order to recommend to the farmers. Keeping this in view, Krishi Vigyan Kendra (KVK), Reddipalli has implemented the CFLDs in farmers' fields with improved pigeonpea variety (LRG-52) in different clusters of Anantapuramu district, Andhra Pradesh to enhance the productivity by assessing the performance of pigeonpea over farmer practice under rainfed red soils.

MATERIALS AND METHODS

Indian Council of Agricultural Research (ICAR) – Agricultural Technology Application Research Institute (ATARI) Zone-X has sanctioned CFLDs in pigeonpea to the KVK, Reddipalli, Anantapuramu district of Andhra Pradesh during *kharif* season. With the approval from ATARI, the demonstrations were implemented

in farmers' fields of Raghavampalli, Lingareddipalli, Venkatagaripalli and Chapatla villages of Bathalapalli and Rapthadu mandals during three consecutive years *i.e.,* from 2019-20 to 2021-22 for evaluating the performance of improved pigeonpea variety (LRG-52) over the check variety (LRG-41). The Good Agricultural Practices (GAP) on pigeonpea production and productivity was demonstrated in an area of 60 hectares covering a total of 150 farmers with the objective to demonstrate the improved pulses production technologies in different villages. A total area of 20 hectares in every year was fixed for the demonstration of improved technologies along with farmers practice as control plot.

An informal discussion was organized for selection of interested farmers to implement CFLDs in befitting manner followed by the awareness programme (pre-season training) to selected farmers was organised to assess the adoption gap of recommended technologies before laying out the CFLDs in farmers' fields and also imparted knowledge on the improved technological interventions in pigeonpea cultivation. Critical inputs like seed (LRG-52), recommended chemicals were distributed to the farmers along with literature. The technological interventions demonstrated and varietal characters depicted in the Table 1 and Table 2 respectively. Soil tests were conducted in all selected demonstration plots of the farmers. The soil was neutral in reaction (pH) (7.1), low in electrical conductivity (EC) (0.37 dSm^{-1}), low in organic carbon (0.29%), medium in available phosphorous (34.5 kg ha^{-1}) and available potassium (234.6 kg ha^{-1}). KVK scientists conducted regular field visits to the demonstrated plots for collecting biometrical data. Finally, field day was conducted involving all the demonstration holding farmers, fellow farmers, scientists from university and officials from Department of Agriculture to validate the results of demonstrations.

The data with respect to grain yield from FLD plots and farmers plots of the area were collected and evaluated. Potential yield was taken in to consideration on the basis of standard plant population and average yield per plant under recommended package of practices. Different parameters as suggested by Yadav *et al* (2004) was used for gap analysis, and calculating the economics. The details of different parameters and formula adopted for analysis are as under

Cost of cultivation (Rs/ha) was determined taking into account the prevailing charges of agricultural operations and the market price of the involved inputs. During the course of studies, gross returns were obtained by translating the harvest into monetary terms at the prevalent market rate.

Gross Returns (Rs/ha) = (Seed yield x Sale Price)

Net returns were obtained by deducting total cost of cultivation from gross returns

Net Returns (Rs/ha) = Gross Returns (Rs/ha) – Cost of cultivation (Rs/ha)

The benefit: cost ratio was determined by dividing gross returns by the cultivation costs

$$\text{Benefit: Cost ratio} = \frac{\text{Gross Returns (Rs/ha)}}{\text{Cost of Cultivation (Rs/ha)}}$$

For the study, technology gap, extension gap and technology index were calculated following the formulae given by Yadav *et al.* (2004) as follow:

Technology gap = Potential yield – Demonstration yield

Extension gap = Demonstration yield – Farmers practice yield

$$\text{Technology index} = \frac{\text{(Potential yield - Demonstration yield)}}{\text{Potential yield}} \times 100$$

RESULTS AND DISCUSSION

A comparison of yield performance between demonstrated practices and local checks is depicted in Table 3. From the perusal of Table 3 it was observed that, during the 2019–20 growing season, farmers' practices produced 410 kg/ha of seed while improved technology produced 565 kg/ha of seed, with 37.8 percent yield increase over the Farmers Practice (FP). Similar results were obtained in 2020-21 and 2021-22 with improved technology (IT) where the CFLD plot (IT) resulted 20.1 and 12.4 per cent higher seed yield respectively as compared to FP plots. The CFLD plots (IT) recorded higher mean seed yield (692 kg/ha) as compared to FP plot (570 kg/ha) with 19.7 per cent average increase in seed yield over the FP.

The difference in yield observed during different years was due to variation in rainfall distribution at different places, dissimilarities in soil fertility levels, pest and disease incidence, improper usage of manures and

Table 1: Technological Interventions implemented under CFLDs in relation to farmers' practice

Particulars	Technological intervention in FLD	Farmers practices	Gap
Variety	LRG-52	LRG-41	Full gap
Seed rate	7.5 kg/ha	10 kg/ha	High seed rate
Sowing method/ Spacing	150 x 20 cm, sowing with seed cum fertilizer drill	Broad casting, un even plant population	Partial gap
Time of Sowing	June 15th to 31st July	June 15th to 15th July	Partial gap
Seed treatment	Seed treatment was done with *Rhiozibium*	Seed treatment was not by done	Full gap
Fertilizer Dose	Balanced fertilization as per soil test values 44 kg of urea in split doses and 312.5 kg of SSP as basal dose.	Imbalance use of fertilizer 20 kg urea as basal and 50 kg DAP as top dressing.	Full gap
Weed management	Imazethapyr 10SL 75g a.i. ha^{-1} at15-20 DAS.	Manual weeding/weeding with bullocks	Full gap
Plant Protection	Neem oil @ 5ml/lit and cholrophyriphos @ 2.5 ml/lit for control of suckingpest.	Injudicious use of and insecticides and fungicides.	Full gap

Table 2: Varietal characters of demonstrated variety (LRG-52) and farmers practice (LRG-41)

Variety	Year of release	Maturity (days)	Potential yield (q/ha)	Special characters
LRG-52 (Amaravathi)	2015	150-170	18-20	➢ Indeterminate ➢ Semi spreading ➢ Moderately resistant to Helicoverpa and Maruca pests ➢ Resistant to fusarium wilt and sterility mosaic disease ➢ Bold seed and good *dal* recovery
LRG-41	2006	180	17-18	➢ Resistant to Helicoverpa ➢ Suitable to black soils also

fertilizers. This improved technology resulted in a higher seed production, which was primarily attributable to the inherent potential of the resistant variety, as well as to its high yielding capacity, effective crop management techniques, and maintenance of the plant population at an optimum level. The findings are in agreement with the results of Jayalakshmi *et al.* (2018), who conducted demonstrations on improving pigeonpea productivity through enhanced crop variety.

The technology gap is the difference between the potential yield and the demonstration yield. It was shown that there were significant technological gaps in terms of suggested varieties, seed quality, sowing period, seed spacing, fertilizer dose, fertilizer application techniques and plant protection measures. The technology gap was measured at 1235 kg/ha, 1013 kg/ha, and 1075 kg/ha, during 2019–20, 2020–21, and 2021–22, respectively. The average technology gap of pigeonpea was 1107 kg/ha (Table 3) during all three years. During different years the disparity in technology gap may be attributed to more viability of preferred technologies, differential pattern of rainfall over different years.

The discrepancy between the demonstration yield and farmers' actual production is known as the extension gap. It was found that 122 kg/ha was the average extension gap across all years. In the years 2019–20, 2020-21, and 2021–22, the extension gap varied between 155 kg/ha and 80 kg/ha (Table 3). The research period's extension gap, which ranged from 80 to 155 kg/ha, clearly demonstrated the need to teach farmers how to use advanced agricultural technologies in order to reverse the trend of large extension gap.

The technology index shows the feasibility of new technology at the farmer's fields and the lower the value of technology index more is the feasibility of the technology. The average technology index was 41.7 per cent in Anantapuramu district during study period (Table 3). Higher technology index reflected inadequate

Table 3: Yield parameters, technology gap, extension gap and technology index of improved variety of pigeonpea LRG-52 in comparison with farmers practice under rainfed conditions

Year and Season	Area (ha)	No. of farmers	Variety (Demo)	Check	Yield (kg/ha)			% increase in yield	Technology gap (kg/ha)	Extension gap (kg/ha)	Technology index (%)
					Potential yield	IT	FP				
2019-20	20	50	LRG 52	LRG 41	1800	565	410	37.8	1235	155	68.6
2020-21	20	50	LRG 52	LRG 41	1800	787	655	20.1	1013	132	56.2
2021-22	20	50	LRG-52	LRG 41	1800	725	645	12.4	1075	80	59.7
Total/Mean	60	150			1800	692	570	19.7	1107	122	41.7

IT: Improved Technology FP: Farmers Practice

Table 4: Economics of CFLD in improved variety of pigeonpea LRG-52 in comparison with farmers practice under rainfed conditions

Year	Gross Returns (Rs/ha)		Cost of Cultivation (Rs/ha)		Net Returns (Rs/ha)		Additional net returns	B:C Ratio	
	IT	FP	IT	FP	IT	FP		IT	FP
2019-20	40225	30150	22500	23750	17725	6400	11325	1.78	1.26
2020-21	45646	37990	17250	21875	28396	16115	12281	2.64	1.73
2021-22	49637	41699	26992	28033	22645	13666	8979	1.83	1.48
Total/Mean	45169	36613	22247	24552	22922	12060	10861	2.08	1.49

IT: Improved Technology; FP: Farmers Practice

proven technology for transfer to farmers, and inadequate extension services for transfer of technology. The study concludes that, there is lot of scope for improvement in production and productivity of pigeonpea in Anantapuramu District. Hence, it can be inferred that the awareness and adoption of improved varieties with recommended scientific package of practices can enhance the productivity. The findings are in line with the findings of Jayalakshmi *et al.* (2018) who conducted demonstrations on productivity enhancement of pigeonpea through improved production technologies/ frontline demonstrations in which the technology index was recorded as 35.3 under rainfed conditions. These findings were also in the conformity of the results of study carried out by Meena and Singh (2017).

The economics of pigeonpea production under CFLD was presented in Table 4. During the three-year period higher average gross return was recorded with demonstration plots (22922 Rs/ha) as compared to FP plots (12060 Rs/ha). During 2019-20 improved technology realized higher gross return (17725 Rs/ha) compared to farmers practice (6400 Rs/ha). Results obtained during 2020-21 and 2021-22 where demonstration gave higher gross returns in comparison to FP plot due to higher seed yield obtained. Higher net returns among demonstration plots were due to higher seed yield obtained and lower cost of cultivation as compared to FP plots. The B:C ratio during 2019-20 was 1.78:1 in demonstrated plot as compared to FP plot (1.26:1). Similarly, during 2020-21 and 2021-22 demonstration plots obtained higher B:C ratio *i.e.,* 2.6:1 and 1.8:1, respectively. The variability in benefit cost ratio throughout the three years can be attributed primarily to yield performance and cost of inputs in those specific years. However, favourable B:C ratios showed the economic feasibility of the demonstrated intervention and persuaded the farmers on the effectiveness of intervention.

CONCLUSION

The findings of the study revealed that gap exists in yields of CFLD plots and FP plots is due to technology and extension gaps. The increase in yield of pigeonpea in CFLDs over the farmers practice created greater consciousness and inspired other farmers to adopt the improved package of practices of pigeonpea. CFLD recipient farmers also play a significant role as a source of knowledge and source of quality seed for further

distribution of improved pigeonpea varieties to the fellow farmers. It can be concluded that the red gram production could be enhanced by adoption of improved technologies through Cluster Front Line Demonstrations. Hence, there is a need to disseminate the improved technologies among the farmers with effective extension methods like trainings and demonstrations. Pigeonpea can therefore be a successful crop especially in low rainfall areas and areas of rainfed regions in Anantapuramu district of Andhra Pradesh.

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Research Article

Locale Differences in Perception of Social Support among Indian Adolescents

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ABSTRACT

Adolescence is characterized by the modification and expansion of the social ties of family members, teachers and friends. Social support is practical, emotional and informational aid from one's social surroundings, notably parents, friends, and other significant individuals, and is a strong predictor of one's accessible interpersonal resources. This research aimed to study locale differences in the perception of social support among adolescents. A total of 500 participants were selected from rural and urban government senior secondary schools of Ludhiana district using random sampling for this cross-sectional study. A self-reported questionnaire was used to collect data, including Demaray and Malecki's 60 items social support scale to assess the presence of perceived of social support among adolescents. Significant locale differences were reported in the perceived presence of social support. Urban adolescents perceived more support from parents, teachers, classmates, close friends and overall sources as compared to rural adolescents. On the other hand, rural adolescents scored higher than their counterparts in social support from school staff. There is a need to improve access to sources available for social support for rural adolescents. Further, research using large samples is also recommended.

Keywords: Social support, Adolescents, Rural and urban

INTRODUCTION

Adolescence is commonly understood as the stage of life when one gains the capabilities necessary to lead a productive, responsible life. Although most young people navigate this period successfully, even those without significant troubles or health difficulties, experience normative worries and might require assistance, support, and guidance to successfully move from childhood to adulthood. Investigations in certain areas around the world have indicated that it is becoming more challenging for youngsters to accomplish the typical tasks of their adolescent stage due to weakened parental supervision, greater diversity of potential choices causing more puzzlement, greater individualism, and the diminished significance of traditional cultural norms (Frydenberg, 1997). The decline of traditional support provided by families can be attributed to alterations in the social and economic landscape such as greater educational attainment in more urban locations, and more job prospects for young women in the modern job market (Barker, 2007).

Social support is a person's perception of general support from people in their social network, which improves functioning and shields them from adverse outcomes (Demaray and Malecki, 2002). Furthermore, the type of support can be (1) evaluative, (2) emotional, (3) instrumental and (4) informative (Sarason *et al.,* 1990). Having a parent who is understanding, compassionate, and attentive gives children a safe environment in which they can learn, conquer tasks, and develop their independence (Bowlby, 1973; Mikulincer and Shaver, 2016; Young *et al.,* 2019). By contrast, Poor parent-child relationships can prevent the child from finding meaning in life. (Weibel *et al.,* 2017). Self-esteem will not be developed if they feel

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unaccepted or neglected by their parents. Having doubt in abilities will create a negative idea of oneself.

Adolescence, usually defined as the period between 10 and 19 years (WHO, 1986) is characterised by social changes with increasing independence from parents and closer relationships with peers. Adolescents not only receive support and guidance from family and close friends, but may also be subtly influenced by the environment and those around them at school, including teachers and classmates. (Eccles and Roeser, 2011). There is a significant shift in social behaviour as adolescents increasingly begin to discover themselves and depend more on their peers than their parents (Collins and Laursen, 2004). This includes the pursuit of independence and a greater reliance on friends. Teachers and significant others can serve as role models and mentors in assisting students to maintain their well-being and create strong value systems and life ambitions (Bundick and Tirri, 2014). Ideally, the development of a healthy self-concept and feeling of purpose emerges in childhood, influenced by both internal and external experiences. To achieve their goals, children must develop a sense of being loved as well as the ability to give love.

High levels of social support were frequently associated with academic and psychosocial adjustment (Dubow *et al.,* 1991). The impact of perceived social support on children was investigated by Kashani *et al.* (1994). Children who perceived less parental and societal support were more disengaged and inattentive, as well as more injurious to others, destructive to property, and uncooperative. Furthermore, children who reported less supporting people in their life expressed higher degrees of despair. These findings imply that youngsters require a sense of care and support in order to prevent major difficulties and feelings of hopelessness. Cheng *et al.* (2014) explored the association between social support and mental health among 2393 adolescents in 5 countries including India. Results demonstrated that having a strong social support system like a caring female adult in home and connectedness to neighbours were positively associated with hope while negatively contributed towards stress and depression. The study concluded that improving social support may contribute positively towards adolescents' well-being.

Research has confirmed the significance of strong, caring relationships and favourable connections with people and institutions to lessen the chances of something going wrong and support healthy growth. The present study assesses the perceived presence of social support from Parents, Teachers, Classmates, Close friends and Other school staff. The study's main objective is to assess the locale differences in the perception of social support among adolescents.

MATERIALS AND METHODS

This cross-sectional study was conducted in the Ludhiana district of Punjab. In the present study, an equal number (n=250) of adolescents were selected from rural and urban senior secondary government schools which were further classified into 125 boys and 125 girls comprising a total sample of 500 adolescents (16-18 years). Written consent for inclusion was obtained from the participants.

Data was collected from 500 adolescents, including 250 boys and 250 girls. The inclusion criteria: (1) Age range between16-18 years, (2) voluntary participation in the study (3) students attending Government Schools (4) signing informed consent. The research protocol was approved by the Ethical Committee of the Department of Human Development and Family Studies, Punjab Agricultural University, Ludhiana.

A self-structured information sheet was used to collect the demographic information from the respondents. Another self-administered, predesigned and pretested Child and Adolescent Social Support Scale by Demaray and Malecki (2002) was used to assess adolescents' perceived presence of social support from different sources. The scale consisted of 60 items divided into 5 subscales: Parents, teachers, Classmates, Close friends and other school staff.

The IBM SPSS version 26 statistical package was used to organize and scrutinize the data based on the objective to make meaningful and valid deductions using frequency, percentage, arithmetic mean, standard deviation, z-test and t-test.

RESULTS AND DISCUSSION

The data put forth in Table 1 depicts the gender-wise locale differences in the distribution of adolescents across various dimensions and levels of social support.

Table 1: Gender-wise locale differences in distribution of the respondents across various dimensions and levels of social support (n=500)

Dimensions	Levels	Boys				Z-value	Girls				Z-value
		Rural (n_1=125)		Urban (n_2=125)			Rural (n_3=125)		Urban (n_4=125)		
		f	%	f	%		f	%	f	%	
Parent Support	High	44	35.2	62	49.6	2.30**	64	51.2	73	58.4	1.14
	Medium	53	42.4	47	37.6	0.77	45	36.0	42	33.6	0.39
	Low	28	22.4	16	12.8	1.99**	16	12.8	10	8.0	1.24
Teacher Support	High	37	29.6	67	53.6	3.84***	50	40.0	58	46.4	1.02
	Medium	40	32.0	42	33.6	0.26	51	40.8	48	38.4	0.38
	Low	48	38.4	16	12.8	4.63***	24	19.2	19	15.2	0.83
Classmate	High	34	27.2	45	36.0	1.49	44	35.2	49	39.2	0.65
Support	Medium	53	42.4	60	48.0	0.89	50	40.0	51	40.8	0.12
	Low	38	30.4	20	16.0	2.69***	31	24.8	25	20.0	0.91
Close friend	High	28	22.4	57	45.6	3.87***	75	60.0	82	65.6	0.91
Support	Medium	60	48.0	37	29.6	2.98***	37	29.6	31	24.8	0.85
	Low	37	29.6	31	24.8	0.85	13	10.4	12	9.6	0.21
School Support	High	51	40.8	74	59.2	2.90***	26	20.8	27	21.6	0.15
	Medium	53	42.4	36	28.8	2.24**	76	60.8	84	67.2	1.05
	Low	21	16.8	15	12.0	1.08	23	18.4	14	11.2	1.60
Total Support	High	26	20.8	51	40.8	3.42***	55	44.0	73	58.4	2.27**
	Medium	57	45.6	73	58.4	2.02**	52	41.6	41	32.8	1.43
	Low	17	13.6	26	20.8	1.50	18	14.4	11	8.8	1.38

***Significant at the 0.01 level (2-tailed); **Significant at the 0.05 level (2-tailed)

Among rural sample, a significant difference (Z=2.30; $p \leq 0.05$) was found at high level of parent support where urban boys (49.6%) perceived more support than rural boys (35.2%). Contrary to this, a significantly (Z=1.99; $p \leq 0.05$) higher proportion of rural boys (22.4%) clustered at low level than urban boys (12.8%). In the dimension of teacher support, urban boys (53.6%) were found more than rural boys (29.6%) at high level with a significant difference (Z=3.84; $p \leq 0.01$), whereas, the percentage of rural boys (38.4%) in low level was significantly (Z=4.63; $p \leq 0.01$) more than urban boys (12.8%). For the third dimension of social support i.e. classmate support, nearly one-third (30.4%) of rural boys were located at low level compared to a minority (16.0%) of urban boys with a statistical significance of (Z=2.69; $p \leq 0.01$). If we now turn to close friend support, urban boys (45.6%) perceived more support (Z=3.87; $p \leq 0.01$) than rural boys (22.4%). A higher proportion of rural boys (42.4%) clustered at medium level than urban boys (29.6%) with a significant difference of (Z=2.98; $p \leq 0.01$). A significant difference (Z=2.90; $p \leq 0.01$) was seen at high level of school support where urban boys (59.2%) perceived more support from school than rural boys (40.8%), whereas, at medium level, rural boys (42.4%) superseded urban boys (28.8%) with a significant difference of (Z=2.24; $p \leq 0.05$). In total support, 40.8 per cent of urban boys perceived more total support than rural boys (20.8%) with a significant difference of (Z=3.42; $p \leq 0.01$) and at medium level, more boys (58.4%) were found than girls (45.6%) with a significant difference of (Z=2.02; $p \leq 0.05$).

Among girls, significant differences were seen in high level of total support. Majority of the urban girls (58.4%) perceived more (Z=2.27; $p \leq 0.05$) social support from all the sources than rural girls (44.0%). No significant differences were found in any other dimensions and levels of social support. In parent

support, more than half of the rural girls (51.2%) and urban girls (58.4%) were at high levels, followed by medium and low levels. A similar trend was seen in teacher support, close friend support and total support where the high level is followed by medium and low level, whereas, in classmate support proportion of rural girls and urban girls were found approximately close to each other, with nearly 40.0 per cent of rural girls and 40.8 per cent of urban girls at medium level followed by high (rural girls: 35.2% and urban girls: 39.2%) and low level (rural girls: 24.8% and urban girls: 20.0%). Similarly in school support medium level is followed by high and low levels.

Table 2 illustrates locale differences in distribution of the respondents across various dimensions and levels of social support. The analysis reflected that a greater proportion of urban adolescents (54.0%) gathered high level of parent support than rural adolescents (43.2%) with a significant difference of ($Z=2.41$; $p\leq0.05$), whereas at low level, rural adolescents (17.6%) outnumbered urban adolescents (10.4%) with a significant difference of ($Z=2.32$; $p\leq0.05$). Half (50.0%) of the urban adolescents perceived higher ($Z=3.43$; $p\leq0.01$) teacher support than one-third (34.8%) of rural adolescents. At low level of teacher support, the percentage of rural adolescents (28.8%) was significantly ($Z=4.03$; $p\leq0.01$) more than urban adolescents (14.0%). In the dimension of classmate support, rural adolescents (27.6%) reported more support than urban adolescents (18.0%) at low level with a significant difference of ($Z=2.55$; $p\leq0.05$). In school support, 40.4 per cent of urban adolescents perceived more support than rural adolescents (30.8%) with a significant difference of ($Z=2.24$; $p\leq0.05$) and at low level, more rural adolescents (17.6%) were found than urban adolescents (11.6%) with a significant difference ($Z=1.90$; $p\leq0.10$). No significant locale differences were observed in the dimension of total support.

Table 3 illustrates gender-wise locale differences in mean scores (± S.D) of the adolescents across various dimensions of social support. Among boys, results revealed significant differences in parent support with urban boys (28.3±5.5) having higher mean scores

Table 2: Locale differences in the distribution of respondents across various dimensions and levels of social support

Dimensions	Levels	Rural (n_1=250)		Urban (n_2=250)		Z-value	Total (n=500)	
		f	%	f	%		f	%
Parent Support	High	108	43.2	135	54.0	2.41**	243	48.6
	Medium	98	39.2	89	35.6	0.83	187	37.4
	Low	44	17.6	26	10.4	2.32**	70	14.0
Teacher Support	High	87	34.8	125	50.0	3.43***	212	42.4
	Medium	91	36.4	90	36.0	0.09	181	36.2
	Low	72	28.8	35	14.0	4.03***	107	21.4
Classmate Support	High	78	31.2	94	37.6	1.50	172	34.4
	Medium	103	41.2	111	44.4	0.72	214	42.8
	Low	69	27.6	45	18.0	2.55**	114	22.8
Close friend Support	High	103	41.2	119	47.6	1.44	222	44.4
	Medium	97	38.8	88	35.2	0.83	185	37.0
	Low	50	20.0	43	17.2	0.80	93	18.6
School Support	High	77	30.8	101	40.4	2.24**	178	35.6
	Medium	129	51.6	120	48.0	0.80	249	49.8
	Low	44	17.6	29	11.6	1.90*	73	14.6
Total Support	High	106	42.4	99	39.6	0.63	205	41.0
	Medium	109	43.6	114	45.6	0.45	209	41.8
	Low	35	14.0	37	14.8	0.25	72	14.4

*Significant at the 0.10 level (2-tailed); **Significant at the 0.05 level (2-tailed); ***Significant at the 0.01 level (2-tailed)

Table 3: Gender wise locale differences in mean scores (± S.D) of the respondents across various dimensions of social support (n=500)

Dimensions of Social Support	Boys		t-value	Girls		t-value
	Rural (n_1=125) Mean ± S.D	Urban (n_2=125) Mean ± S.D		Rural (n_3=125) Mean ± S.D	Urban (n_4=125) Mean ± S.D	
Parent Support	26.1±5.2	28.3±5.5	3.25***	28.0±5.5	29.1±5.1	1.64*
Teacher Support	24.3±5.4	26.7±5.5	3.48***	26.5±5.6	27.7±5.4	1.72*
Classmate Support	23.2±5.3	24.5±5.6	1.88*	25.0±5.6	25.7±5.5	0.99
Close friend Support	26.3±5.2	28.2±5.8	2.72***	28.4±4.9	29.0±4.7	0.98
School Support	26.2±5.3	23.7±5.8	3.55***	24.6±5.4	25.2±5.1	0.90
Total Support	126.6±22.6	131.6±23.2	1.72*	132.6±23.7	137.2±22.7	1.56

***Significant at the 0.01 level (2-tailed); *Significant at the 0.10 level (2-tailed).

(t=2.78; p≤0.01) than rural boys (26.1±5.2). Significant differences existed in teacher support (t=3.48; p≤0.01), classmate support (t=1.88; p≤0.10) and close friend support (t=2.72; p≤0.01) where urban boys (26.7±5.5, 24.5±5.6, 28.2±5.8) outscored their counterparts (24.3±5.4, 23.2±5.3, 26.3±5.2) in respective dimensions. Contrary to this, unlike results were seen in the dimension of school support where rural boys (26.2±5.3) were found to have greater mean scores (t=3.55; p≤0.01) than urban boys (23.7±5.8). Further analysis of total support depicted that urban boys (131.6±23.2) perceived higher overall support (t=1.72; p≤0.10) than boys (126.6±22.6). It could be concluded that social support among rural boys and urban boys differed significantly with urban boys perceiving higher support than rural boys.

Among girls, statistically significant mean differences were reported among rural girls and urban girls in parent support (t=1.64; p≤0.10) and teacher support (t=1.72; p≤0.10) where urban girls (29.1±5.1, 27.7±5.4) had higher mean scores than rural girls (28.0±5.5, 26.5±5.6). Furthermore, non-significant differences were noted in the remaining dimensions of social support. However, the pattern of mean scores exemplified that urban girls felt more classmate support (25.7±5.5), close friend support (29.0±4.7) school support (25.2±5.1) and total support (137.2±22.7) as compared to their counterparts (25.0±5.6, 28.4±4.9, 24.6±5.4, 132.6±23.7).

The perusal of data presented in Table 4 revealed that mean scores ± S.D of urban adolescents showed higher mean scores in parent support (28.70±5.38), teacher support (27.22±5.53), classmate support (25.19±5.58), close friend support (28.63±4.90) and total support (134.45±23.12) than the adolescents of rural areas as they scored (27.10±5.48) (25.44±5.66) (24.19±5.55) (27.38±5.19) (129.64±23.31) for parent support (t=3.57; p≤0.01), teacher support (t=3.62; p≤0.01), classmate support (t=2.03; p≤0.05), close friend support (t=2.90; p≤0.01) and total support (t=2.31; p≤0.05) respectively. A contradicting result was found in the dimension of school support where rural

Table 4: Locale differences in mean scores (± S.D) of the respondents across various dimensions of social support (n=500)

Dimensions of Social Support	Rural (n_1=250) Mean ± S.D	Urban (n_2=250) Mean ± S.D	t-value
Parent Support	27.10±5.48	28.70±5.38	3.34***
Teacher Support	25.44±5.66	27.22±5.53	3.62***
Classmate Support	24.19±5.55	25.19±5.58	2.03**
Close friend Support	27.38±5.19	28.63±4.90	2.90***
School Support	25.41±5.42	24.48±5.51	2.05**
Total Support	129.64±23.31	134.45±23.12	2.31**

***Significant at the 0.01 level (2-tailed); **Significant at the 0.05 level (2-tailed)

adolescents (25.41±5.42) were found to have greater mean scores than urban adolescents (24.48±5.51) with a significant difference ($t=2.05$; $p\leq0.05$). So, the results demonstrated that urban adolescents perceived more support in all the dimensions of social support other than school support as compared to their counterparts.

Similarly, Lyons *et al.* (2015) reported that rural males received considerably less social aid than urban males, which included a lack of general support, material comfort, and a feeling of belonging. Other studies have also illustrated that urban-born adolescents are able to obtain more social support compared to those living in rural areas. This disparity is largely attributed to differences in socioeconomic circumstances such as income levels, parental education and access to welfare benefits (Zhuang and Wong, 2017). In order to combat this, it is necessary to create connections with people and create methods of social support that are more accessible to rural populations. This could come in the form of virtual support groups, or initiatives designed to bring the rural and urban populations closer together. Moreover, empowering rural adolescents to help build a sense of community among their peers could help to reduce feelings of loneliness and isolation. Initiatives such as organising small social gatherings, or providing peer support can help to promote an environment of cooperation and give rural adolescents a sense of belongingness. Overall, it is important to bring awareness to the social support needs of the rural population and develop initiatives to close the gap between the experiences of rural and urban adolescents. Parents of urban adolescents need to keep a check on the social circle of teenagers whereas parents of rural adolescents should create and reinforce sources of social support accessible to the youngsters.

CONCLUSION

The present research found significant locale differences in perceived social support among adolescents. In future research, it is possible to evaluate the significance of different kinds of social backing and establish if perceiving a great amount of support from one source can offset getting minimal help from other sources in the environment. This approach replicates the ideas of ecological approaches, which suggests many social aspects working collectively can have an effect on the development of an individual (Bronfenbrenner and Morris, 1998). This data may be useful for formulating strategies to address the issue and identifying who may be best suited to assist in these interventions. It could be beneficial to include friends and teachers along with parents in intervention programs for adolescents aged 16-18, as it could make these programs more age-appropriate and potentially more successful. Parental involvement remains important, but focusing on the teens' social environment could strengthen the effectiveness of the treatment.

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Research Article

Knowledge of Women Regarding Women Empowerment Schemes in Bikaner District of Rajasthan

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ABSTRACT

Women empowerment refers to increasing the spiritual, political, social, educational, gender or economic strength of individuals and communities of women. Policies on Women empowerment exist at the national, state and local (Panchayat) levels in many sectors, including health, education, economic opportunities, and gender based violence and political participation. Hence the Govt. of India launched many schemes especially for women. Hence to find out the actual progress of the schemes at ground level, it was essential to examine the extent of knowledge about the scheme in women, whether the women are aware of those schemes or not, whether they have easy access to these schemes or not, whether they are getting benefits of these schemes or not, what are the difficulties women are facing. Hence, an attempt will be made to study the knowledge of the women about the selected women empowerment schemes, and the constraints faced by them in gaining the benefits of the selected schemes. The knowledge may vary from person to person. Therefore a study to measure knowledge of the respondents on selected women empowerment schemes was undertaken. The study was conducted in both rural and urban area. For rural area out of nine panchayat samiti Bikaner panchayat samiti was selected, from Bikaner one gram panchayat namely husangsar was selected and two villages namely Husangsar and Nagasar were selected. For urban area out of two zones i.e. (East and West) two wards namely ward no. 58 (east zone) and ward no. 39 (west zone).Thirty respondents were selected from each village and each ward thus selecting 120 respondents. A self–structured interview schedule was used to collect the information through personal interview to check the knowledge of the respondents about women empowerment schemes. Majority of the respondents had medium knowledge level of women empowerment schemes.

Keywords: Knowledge, Women empowerment

INTRODUCTION

"Woman is the builder and moulder of nation's destiny. Though delicate and soft as lily, she has a heart, far stronger and bolder than of man. She is supreme inspiration for man's onward march" said Indian great poet, Noble prize winner Rabindra Nath Tagore. Women play role as the productive, the reproductive and the community management, are emphasized and their decision making abilities are encouraged (Parpart,2002). Empowerment is a multidimensional process, which should enable women to realize their full identify and power in all spheres of life. It consists of greater access to knowledge and resources, greater autonomy in decision making to enable them to have greater availability to plan their level or to have greater control over the circumstances that influence their lives and free from shocks imposed on them by customs, beliefs and practices. Women empowerment refers to increasing the spiritual, political, social, educational, gender or economic strength of individuals and communities of women. Women are an integral part of every economy. Women empowerment as a

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concept was introduced at the International Women Conference in 1985 at Nairobi, which defined it as 'redistribution of social power and control of resources in favour of women'. Mass illiteracy, unemployment, ill health and their limited access to economic assets, mark the situation of women in India (Sachan, 2016). Therefore women empowerment in India principally aims at enhancing their social functioning by a quantitative and qualitative change, particularly in the field of education, health and employment. Redistribution of social power and a change in the control of resources in favour of women in any society is not possible unless they are healthy, educated and provided with some gainful employment opportunities.

Women empowerment in India is heavily dependent on many different variables that include geographical location (urban / rural), educational status, social status (caste and class) and age. Policies on Women empowerment exist at the national, state and local (Panchayat) levels in many sectors, including health, education, economic opportunities, gender based violence and political participation.

The findings of this study have vast practical utility. This study would be useful for the stakeholders, policy makers, governmental and non-governmental agencies, cooperatives, and other inventories which are working for the development of women. Ministry of rural development, Government of India has taken initiatives for empowerment of women to all the rural poor families i.e. BPL and available decent quality of life. Various women empowerment schemes have initiatives which emerge as an important strategy for empowering women by providing loan subsidy to members of SHG and also enables livelihood opportunities for village women through microcredit with existing banks in the area.

MATERIALS AND METHODS

The present study was conducted in rural and urban area of Bikaner district of Rajasthan which was purposively selected due to the convenience and easy approachability and also no such research study has been conducted in this area. Secondly, Bikaner district comes under arid zone and vast variability of traditional and indigenous practices was found in this area.

There are nine panchayat samitis in Bikaner district namely – Bikaner, Kolayat, Khajuwala, Lunkaransar, Nokha, Shri Dungargarh, Panchu, Pugal, Bajju. Out of which Bikaner panchayat samiti was selected randomly by lottery method for rural respondents. For selection of urban respondents, both zones i.e. east and west as per election commission were selected. One gram panchayat namely Husangsar from Bikaner panhayat samiti was selected randomly. Two villages namely Husangsar and Nagasar were selected randomly from selected gram panchayat. From each zone one ward i.e. ward no. 58 east zone and ward no.39 west zone was selected randomly using lottery method respectively. A total of 120 respondents were selected for the study purpose. 30 women from each village and ward i.e. Husangsar and Nagasar, ward no. (East zone 58) and (West zone 39) were randomly selected.

RESULTS AND DISCUSSION

Knowledge was operationalized as the information possessed by the respondents about various women empowerment schemes. The knowledge of the individual respondents was measured through a schedule prepared for the study purpose. On the basis of mean knowledge score, the respondents were categorized into low, medium and high knowledge on the basis of equal intervals and presented in the following table1. It was evident from the Table 1 that nearly two-third (65.83%) of the respondents had medium knowledge regarding women empowerment schemes followed by 19.17 per cent of the respondents had possessed low level of knowledge on various women empowerment schemes. About 15.00 per cent of the respondents had high level of knowledge regarding women empowerment schemes. This result clearly indicated that more than three-fourth of the respondent in the study were aware about various women empowerment schemes and they also know what were the eligibility criteria and benefits they receive once they become the beneficiary of those schemes.

Table 1: Distribution of respondents according to Overall knowledge of various women empowerment schemes (n=120)

Overall knowledge	Knowledge score	Respondents	
		f	%
Low	Below 32.94	23	19.17
Medium	Between 32.94-58.34	79	65.83
High	Above 58.34	18	15.00
	Total	120	100.00

Supporting these results Maheshwarai (2014) found that 41.00 per cent of the respondents possessed medium knowledge about various aspects of Rastri krishi Vikash Yojana (RKVY) scheme. A considerable number of respondents (30.00%) were observed in high level of knowledge group and only 26.00 per cent of the respondents possessed low knowledge about RKVY scheme. Also Pate *et al.* (2016), revealed that about 58.00 per cent of women had adequate knowledge regarding antenatal care service provided by government in Janani Surakha Yojana free of cost by 42.00 per cent women had poor knowledge about antenatal care service.

The findings of this study has been parallel to the findings of Garg *et al.* (2012); Roy *et al.* (2013); Bari (2014); Chauhan *et al.* (2015) and Narwal *et al.* (2016).

As per the data shown in Table 2 it was evident that Self Help Group (SHG) was the major women empowerment scheme because higher percentage of the respondents had more knowledge about it also the knowledge index of that particular scheme was 79.67 per cent The SHG scheme was an older and very famous scheme, which had been deeply penetrated Into the society by the grassroots workers. Hence there was no surprise that the respondents had more knowledge about this scheme. Next to that, most of the respondents had more knowledge on Pradhan Mantri Janani Suraksha Yojana (PMJSY) scheme which had the knowledge index of 75.25 per cent. PMJSY is a centrally sponsored scheme, which integrates cash assistance with delivery and post-delivery care. The yojana has identified Accredited Social Health Activist (ASHA) as an effective link between the government and pregnant women. This scheme assisted the pregnant women, since in the study area majority of the women were married and having one or two children, among them maximum of them were benefited by this scheme, hence due to practical experience the respondents had more knowledge about this scheme. The third women empowerment scheme which had more knowledge index (69.92%) was, "Beti Bacho, Beti Padhao Scheme". The trend of decline in the Child Sex Ratio (CSR), defined as number of girls per 1000 of boys between 0-6 years of age, has been unabated since 1961. The decline from 945 in 1991 to 927 in 2001 and further to 918 in 2011 is alarming. The decline in the CSR is a major indicator of women disempowerment. Hence to improve the CSR, Government of India, did a typhoon campaign and made more awareness about this scheme, due to that majority of the respondents had good knowledge about this scheme.

The others women empowerment schemes "Pradhan Mantri Ujjwala Yojana (67.17%), Sukanya Samriddhi Yojana (66.83%), Bhamashah Yojana/ Jan Aadhar Scheme (65.42%), Pradhan Mantri Matru Vandana Yojana (65.25), Rashtriya POSHAN Abhiyaan (65.08%), I am Shakti Udaan Yojana (60.08%), and Sakhi Centre or One Stop Centre (51.67%). Overall it notes that respondents in the study area were aware and had knowledge about various empowerment schemes and their benefits.

The findings of this study has been parallel to the findings of Nandal (2013); Bori (2014); Chauhan *et al.*

Table 2: Knowledge index of respondents regarding women empowerment schemes (n=120)

Women empowerment scheme	Total score	Knowledge index	Mean Score
Beti Bacho, Beti Padhao Scheme	839	69.92	6.99
Self Help Group	956	79.67	7.97
Pradhan Mantri Ujjwala Yojana	806	67.17	6.72
Rashtriya POSHAN Abhiyaan	781	65.08	6.51
Sukanya Samriddhi Yojana	802	66.83	6.68
I am Shakti Udaan Yojana	721	60.08	6.01
Sakhi Centre or One stop centre	620	51.67	5.17
Pradhan Mantri Janani Suraksha Yojana	903	75.25	7.53
Bhamashah Yojana / Jan Aadhar Scheme	785	65.42	6.54
Pradhan Mantri Matru Vandana Yojana	783	65.25	6.53

(2015); Radhika *et al.* (2015); Pandey (2016); Pujar *et al.* (2017).

To find out the relationship between socio-personal and socio economic profile of the respondents with their knowledge towards selected women empowerment scheme, the Co-efficient of correlation was elaborated. Total eight socio- personal and socio–economic characteristics taken into account to worked out the relationship and results were presented as follows:

Age and Knowledge: Table 3 disclosed that there were was a positive and significant relationship at 5 per cent level between age and knowledge of the rural and urban respondents about the various women empowerment schemes investigated in the study with correlation co-efficient value (r= 0.235* and 0.281* respectively).

Education and knowledge: Table 3 showed that there were was a positive and significant relationship at 5 per cent level and 1 per cent level between education and knowledge of the rural respondents and urban respondents about the various women empowerment schemes investigated in the study with correlation co-efficient value (r= 0.315* and 0.424** respectively).

Family type and knowledge: Table 3 revealed that there was non- significant relationship between family type and knowledge of the rural and urban respondents about the various women empowerment schemes investigated in the study with correlation co-efficient value (r= 0.115 and 110 respectively).

Table 3: Relationship between the independent variables and knowledge level of respondents regarding various women empowerment schemes (n=120)

Characteristics	'r' value	
	Rural (n=60)	Urban (n=60)
Age	0.235*	0.281*
Education	0.315*	0.424**
Family type	0.115NS	0.110NS
Annual Income	0.172NS	0.194NS
Mass media utilization	0.410**	0.394*
Extension personnel contact	0.395*	0.295*
Social Participation	0.251*	0.100NS

NS = No Significant; * = Significant at 5%, ** = Significant at 1%.

Annual family income and knowledge: Table 3 disclosed that there was non- significant relationship between annual income and knowledge of the rural and urban respondents about the various women empowerment schemes investigated in the study with correlation co-efficient value (r= 0.172 and 194 respectively).

Mass media exposure and knowledge: Table 3 proved that there were was a positive and significant relationship at 1 per cent and 5 per cent level between mass media exposure and knowledge of the rural and urban respondents about the various women empowerment schemes investigated in the study with correlation co-efficient value (r= 0.410** and 0.394* respectively).

Extension personnel contact and knowledge: Table 3 disclosed that there were was a positive and significant relationship at 5 per cent level between extension personal contact and knowledge of the rural and urban respondents about the various women empowerment schemes investigated in the study with correlation co-efficient value (r= 0.395* and 0.295* respectively).

Social participation and knowledge: Table 3 disclosed that there was significant relationship at 5 per cent level between social participation and knowledge of the rural respondents about the various women empowerment schemes investigated in the study with correlation co-efficient value (r= 0.251*), whereas that there was non-significant relationship between social participation and knowledge of the urban respondents about the various women empowerment schemes investigated in the study with correlation co-efficient value (r=0.100).

It could be concluded that the finding of the above data that the variable age, caste, education, mass media exposure, and extension personal contact had positive relationship with knowledge of both rural and urban respondent about various women empowerment schemes. the findings of the study was found parallel to the studies of Sharma *et al.* (2012); Ramjiyani (2013); Singh (2014) and Vaishali (2019)

CONCLUSION

It can be concluded from above findings that majority of respondents rural and urban had medium

knowledge regarding women empowerment schemes, however they possess good knowledge regarding Beti Bachao Padhao, Pradhan Mantri Janani Suraksha Yojana, Jan Aadhar Scheme, (Self Help Group), Comparatively urban women had more knowledge than rural women regarding women empowerment schemes.

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Research Article

Awareness of Water Conservation and Constraints Faced by Farmers in Adoption of Drip Irrigation in Cotton Crop in Haryana

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ABSTRACT

Agriculture forms the backbone of the Indian society. Around 67 per cent of the population derives their subsistence from agriculture and allied activities. The crop diversification and the focus on the cash crops such as cotton have revitalized the entire scenario of Indian Agriculture. With added impetus coming from the novel technologies such as Drip Irrigation, the agriculture sector has truly looked beyond the horizon. The usage of drip irrigation technology has yielded incredible profits for the farmers at large. The current study was undertaken in the state of Haryana to gauge the intricacies involved in the implementation of drip irrigation system and the related constraints that come with it. Most of the respondents were aware of water conservation techniques such as drip irrigation systems (100.0%), laser levelling (91.7%), preventing leakage/wastage of water (85.0%), mulching (81.7%) and rainwater harvesting (80.0%). The constraints faced on the technical grounds such clogging, knowledge levels and administrative constraints on account of documentation, lack of coordination have crippled the impact of the drip irrigation at large. In addition to this, the economic and financial constraints also tend to be a shot in the leg for the farmers. High input cost coupled up with faulty credit facilities has made implementation of DIS a concern.

Keywords: Drip irrigation, Knowledge, Adoption, Socio-economic factors

INTRODUCTION

Cotton, considered as the "White Gold" plays an important role in the agricultural economy and our day-to-day life. The usage of cotton can be attributed to the fact that it is the most widely used fibre in the world. India, the leading producer of cotton as a commercial crop, account for around 25 per cent of the total global cotton production. The commercial crop provides the livelihood of around 6 million cotton farmers and 45 million odd people in the cotton industry (Cotton Sector, 2022). Cotton is seen largely as a water-intensive crop which puts pressure on the overall water levels. To tackle the dwindling water levels, innovative irrigation techniques have come up over some time. One such innovation is Drip Irrigation, also referred to as trickle irrigation which saves water and fertilizer usage by allowing water to drip slowly to the roots (Meti, 2012). The area under drip irrigation is 6,112.05 thousand ha which is around 9.2 per cent of the total irrigated land in the country (The Hindu, 2021). To further enhance the coverage under drip and micro irrigation, the government has implemented Per Drop More Crop scheme under PMKSY with assistance from Micro Irrigation Fund and NABARD (GoI, 2022). The state-wise area data shows that Andhra Pradesh has the highest area under drip irrigation followed closely by Maharashtra, Gujarat and Karnataka (Deshmukh and Kumbhar, 2021)

The general drip irrigation system has proved to be more beneficial than flood irrigation with irrigation operation reduced by 40 per cent, preparatory tillage by 26 per cent and seed sowing by 28 per cent (Pawar

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et al., 2015). Similar case studies on drip irrigation and rainfed crop cultivation nexus are also shown in the study undertaken by Narayanamoorthy (2008) and Singh *et al.* (2021). The research undertaken by Verma and Sharma (2017) in Rajasthan also showcased that DIS has an irrigation efficiency of around 80 per cent with yield increasing by 30 per cent. Although drip irrigation has reaped profitability on certain fronts the small size of land holding with the farmers has somewhat limited opportunities for technological advancements with climatic uncertainties and usage of fertilizers, herbicides etc. (Silva *et al.,* 2018). Hence, keeping in view the importance of drip irrigation the present study was planned to assess the awareness of cotton farmers about water conservation techniques and to know the constraints faced by them in adoption of drip irrigation system in cotton crop.

MATERIALS AND METHODS

The study was conducted in the Sirsa, Fatehabad, Hisar and Bhiwani districts of Haryana. From Sirsa district, Keharwala, Mammerkheda, Dukra and Raipur villages were selected and similarly, PiliMandori and KharaKheri from Fatehabad district; MangaliSurtia, DhaniJatan and Gawar from Hisar district and Sirsi, ChaharKhurd, ChaharKalan,Nangal, Bidhwan and Dariyapur from Bhiwani district were selected. Sixty respondents were taken randomly from the villages of these four districts.

To judge the different aspects of water conservation, questions were framed with the help of the literature and a Collaborator from the Cotton Section. A total of 10 questions were asked to assess the awareness of farmers about different techniques of water conservation. Further questions were framed to know the constraints faces by cotton growers in implementation of drip irrigation system. The information so collected through the responses of the respondents was suitably coded, tabulated and analysed to draw meaningful inferences by using statistical tools such as frequency distribution, percentages and rank order.

RESULTS AND DISCUSSION

Contextual matrix of the respondents concerning age, caste, education, marital status, family type and size, landholding, income, mass media exposure, social participation and SES was studied. Personal profiles of farmers revealed that more farmers belonged to up to 35 years age group (41.66%) followed by the 36 to 50 years age group (36.67%) and above 50 years age group (21.67%). Regarding the caste, the overwhelming majority hailed from general castes (91.67%) and only 8.33% belonged to backward castes. None was from Scheduled castes.

About one-third of respondents (31.67%) were educated up to the middle level followed by senior secondary level (28.33%) and graduation and above (26.67%). About three-fifths of the respondents (56.67%) were having land of about 10.1-25 acres. An overwhelming majority (93.33%) were married and had no membership of social organizations (85.00%). More than two-thirds of the respondents (68.33%) belonged to nuclear families and one-third to joint families (31.67%). More than two-third majority of the respondents (71.67%) were having high income followed by medium (28.33%). Two fifth the majority (43.33%) were having a medium level of mass media exposure and were belonging to medium (56.67%) and high (43.33%) socio-economic status.

The awareness of farmers about the importance of water conservation was assessed and the results are given in Table 1. It was observed that the overwhelming majority were aware of water conservation techniques such as drip irrigation systems (100.0%), laser levelling (91.7%), preventing leakage/wastage of water (85.0%), mulching (81.7%) and rainwater harvesting (80.0%).

Table 1: Awareness of farmers about water conservation techniques

Awareness about water conservation aspect	Frequency (%)	Preference rank order
Rainwater harvesting	48 (80.0)	-
Use of water-efficient techniques like DIS, SIS, etc	60 (100.0)	4.8
Prevent leakage/wastage of water	51 (85.0)	4.0
Mulching/reduced evaporation	49 (81.7)	3.0
Laser levelling	55 (91.7)	1.8
Draught tolerant crops	38 (63.3)	0.6
Rational grazing	23 (38.3)	-
Subsurface irrigation	12 (20.0)	-
Nutrient management	18 (30.0)	-
Agroforestry/any other	37 (61.7)	0.8

Figures in parentheses denote the percentage

The respondents were also asked to give the first five preferences of their choice regarding water conservation techniques and the highest rank was awarded to drip irrigation/sprinkler irrigation (4.8) followed by prevent leakage/wastage of water (4.0) and mulching/reduced evaporation (3.0).

The Drip Irrigation System over some time has shown remarkable results on varied components. The labor costs and irrigation charges have been reduced considerably with the introduction of DIS in various crops, although, the benefits are not reaped by all the farmers equivocally. Various dimensions based on personal constraints, technical challenges, financial burdens etc. have crippled the extent of DIS.

The constraints faced by farmers in the adoption of drip irrigation system in the cotton crop are given in Table 2. The requirement of more operational labour at starting time of DIS (85%) and frequent clogging of micro tubes due to the absence of sand filtration (75%) were found the main constraints faced by majority of farmers. The requirement of time-to-time attention for minor repairs and training requirement was observed as a constraint by three fifth farmers. The constraints such as smaller land size, low educational qualifications and low awareness have acted as major constraints. In addition to this, lower non-farm income (if any) and technicalities associated with the maintenance of the Drip Irrigation pipes have acted as a deterrent to the adoption of DIS (Chandran and Surendran, 2016 and Tassew, 2004). In the seminal work in Junagadh taluka of Gujarat, the researchers have put forth significant results which pointed towards structural and technical constraints in the adoption of DIS. The perception of farmers about constraints involved high initial investment, heavy maintenance, problem in farming operations, frequent irrigation etc. (Pandya and Dwivedi, 2016).

Table 2: Constraints faced by farmers in the adoption of DIS in cotton crop

Constraints	Frequency (n=60)
Requirement of more operational labour	51 (85.00)
Lack of technical know-how	19 (31.67))
Low price in the crop season	21 (35.00)
Frequent clogging of drippers and micro tubes	45 (75.00)
Require time-to-time attention for minor repairs	39 (65.00)
Training requirement	36 (60.00)

Figures in parentheses denote the percentage

Cotton is the major commercial crop throughout the world and India. The production of the crop has gone through monumental shifts be it in the adoption of Bt. Cotton or Drip Irrigation System. The adoption of DIS concerning the cotton crop has certain constraints which highlight the issues with the implementation of the system. To have a holistic view, the entire constraints are further discussed into the following subparts:

Technical constraints: The constraints in this segment include the improper demonstration of field and guidance, low knowledge of the maintenance of the DIS, clogging of drip irrigation pipes, below-par follow-up services from the dealer agencies, and low scientific knowledge of the quantity of water to be used in addition to the water-soluble fertilizers. The study conducted by Chovatia *et al.* (2019) in the Saurashtra region of Gujarat has pointed out that the technical constraints mentioned above have considerably hampered the growth of the DIS in the region. Similarly, the research on the adoption of DIS in the production of chilies in Madhya Pradesh showed that improper facilities was a big obstacle to the acceptability of DIS (Bhuriya *et al.*, 2014). A low level of knowledge or incomplete knowledge of DIS due to the low literacy rate and lack of technical guidance has also been an obstruction to administering drip irrigation in Maharashtra (Laxman *et al.,* 2022).

Administrative constraints: The administrative constraints concerning the late realization of subsidies and installation by government contractors, massive documentation, lack of coordination between various government departments and agencies and irregular electricity supply have hamstrung the adoption of DIS (Chovatia *et al.*, 2019). A similar study conducted by Vermani *et al.* (2014) analysed that all the respondents in the area had the major constraint related to the irregular electricity and power supply.

Economic and financial constraints: The economic and financial constraint is probably the biggest constraint when it comes to cotton production, more so concerning the Bt. Cotton (Sharma *et al.*, 2021). The faulty credit facilities, high initial investment combined

with the high cost of spare parts have led to the low adoption of DIS for cotton production. On a similar account, it was reported that for banana growers, the high initial input cost incurred was the main constraint in the implementation of the drip irrigation system (Hiremath and Makadia, 2021 and Gulkari *et al.,* 2017). Also, the high rate of interest that farmers have to pay to the money lenders, lack of finance for the purchase of inputs etc. have been major impediments to the adoption of newer technologies like DIS (Yadav *et al.*, 2018).

CONCLUSION

The comprehensive analysis of constraints in adoption of drip irrigation in cotton has put forth the hidden constraints which have made farmers susceptible to its adoption. The work undertaken in the state of Haryana has showcased results which are in overall consistency with the literature studied. The implementation of drip irrigation in cotton crop has yielded exponential results but not all farmers are able to either afford or manage the drip irrigation. The constraints on account of technical, economical, financial and administrative fronts have been identified and it is indicated that these constraints should be at the heart of any policy document in future. The policy making on futuristic schemes has to take into consideration all the constraints so that more farmers are brought under the ambit of DIS. The steps such as timely subsidisation, technical programmes for knowledge enhancement of cultivators and administrative assistance will lead farmers towards a brighter future for their families in particular and the entire agriculture in general. The proper adoption of DIS after tackling the related constraints will be a harbinger for change for the Indian agriculture.

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Research Article

Recognizing Socio-economic Factors Affecting the Adoption of Dairy Cooperative Society Membership: Market Oriented Study of Small Dairy Farmers from Jammu Region

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ABSTRACT

The present study was conducted in the tropics region of Jammu and Kashmir with the objective to know the socio economic factor which affect the adoption of the membership in dairy cooperative societies of JKMPCL. Two zones, namely, Kathua and Akhnoor were selected for the study. Systematic sampling method was employed to finally select 60 dairy farmers from each zone; thus, making a total sample size of 120 (treatment group). The results revealed that independent variables affecting membership of the co-operative society were distance from milk collection center, milk production, sources of income and total animals in lactation.

Keywords: Membership, Dairy cooperative society, JKMPCL and Tropics

INTRODUCTION

Increasing population, change in consumer lifestyle and rise in personal disposable income have led to an increase in demand for milk and milk products as they constitute an important part of the daily diet of people of Jammu and Kashmir. The total cattle and buffalo population of Jammu and Kashmir is 32.24 lakhs (Anonymous, 2019a) and milk production is mainly dominated by highly scattered smallholders having an average herd size of 3.31 (Wani *et al.,* 2015). Through the cooperative societies, the rural farmer will earn his livelihood and the urban consumer will get fresh and wholesome milk. Out of the total milk produced in the J&K only 1.70 per cent is being handled by the organized sector as reported by Wani and Wani (2010).

Producers organizations can play an important role in reducing transaction costs and therefore, assist in market integration (Staal *et al.,* 1997). The role of producers organizations in reducing transaction costs and facilitating larger market integration of smallholder communities is expected to be particularly significant in the dairy sector due to the perishable nature of milk which induces more likely opportunistic behaviour of the buyer in comparison with products that can be stored. Bravo-Ureta and Lee (1988) compared the socio-economic and technical characteristics of dairy cooperative members with those of nonmembers using Cobb Douglas and logit models in New England. The findings showed that demographic characteristics, such as age and education, had little influence on whether or not a dairy farmer was a member of a cooperative. However, the results of a log it analysis showed that the probability of being a cooperative member was positively related to extension service contacts and that operating a smaller farm had positive influences on the chances of a dairy farmer being a cooperative member. Jenson (1990) evaluated the factors that

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influenced the decision of dairy farmers to join cooperatives in milk marketing in Tennessee area. The study found that the provision of quality services was the main criteria for choosing between membership and non-membership in a dairy cooperative. The study also found that factors such as better price and an assured market were also significant in influencing cooperative membership. Additionally, conservative and orthodox farmers are less likely to join cooperatives than moderate ones. Huylenbroeck and Buysse (2013) investigated the main factors that inspire rural people to join the cooperatives in Northern Ethiopia. The finding of the binary choice model illustrated that information access, special skill, membership in a rural association, frequency of attending a public meeting/workshop, household head education, credit access, training access, number of family members in school, distance to the main market, availability of infrastructures, farmland ownership, and farmland sizes are the major explanatory variables that have statistically significant (p-value, 0.05) influence on the rural people joining in the cooperative societies in the study areas. Sharma (2015) analyzed determinants of market channel choices of small milk producers based on farm household surveys and has investigated what impacts these market channel choices may have on farmers' income and technology adoption in India. The study has found that though there has been emerging milk marketing channels, the traditional sector still dominates. The analysis has indicated that small dairy farmers are not excluded from the cooperatives but are excluded from the modern private sector. Kumar *et al.* (2019) studied the impact of traditional versus modern dairy value chains on food security on the Indian dairy sector using a large, national, and farm-level dataset from India. The results revealed that Indian dairy farmers' integration with the modern dairy value chain has a positive and significant impact on their food security. Participation in modern milk-marketing outlets significantly augments net returns per year, regardless of whether farmers choose one outlet or a combination. Wangu *et al.* (2021) demonstrated that irrespective of the external support provided through market opportunities such as farmers' organizations, smallholders' engagement in commercial farming and marketing in rural Kenya is dictated by the socioeconomic attributes and markets perceptions that are heterogeneous among households in a smallholder community. Therefore, the aim of this article is to assess the socio-economic factors which affect the adoption of the dairy cooperatives' membership amongst the small dairy farm holder in the tropics region of the Jammu in the Union Territory of Jammu and Kashmir.

MATERIALS AND METHODS

The study was conducted in the subtropics of the Jammu region of Jammu and Kashmir. The Union Territory of Jammu and Kashmir is located in the northwestern Himalayan region. The areas selected for the purpose of the study fall under the irrigated sub-tropical zone. The primary data were collected by personal interview method. The detailed information required for the study was collected from each of the selected households in 2018 on a pre-tested structured interview-schedule. A multi-stage sampling technique was employed for selecting the respondent dairy farmers from sub-tropics of the Jammu region. Two zones, namely, Kathua (Latitude 32.896957 and longitude 74.735489) and Akhnoor (Latitude 32.390320 and longitude 75.518204) were selected purposively, as societies of only these two zones were functional for more than one year (Table 1).

After consultations with the secretaries of the societies and going through the secondary data, seven societies, namely, Lower Devipur, Garar, Mattuan, Pangali, Sangrampura, Chanjwan and Chak Morh were finally selected from Akhnoor zone; and five societies, namely, Mehrajpur, Dhollian Jattan, Salalpur, Pattal and Marheen were finally selected from Kathua zone for selection of respondent dairy farmers. Systematic sampling method was employed to finally select 60 member[1] dairy farmers from each zone; thus, making a total sample size of 120 (treatment group). For control group, from each zone, 30 non-member[2] dairy farmers were selected from the operational areas of these societies by employing convenient sampling technique. A total of 60 dairy farmers were selected in the control group (Table 1).

[1]Members who have at least one milch animal and supplying milk to cooperative societies for at least last one year.

[2]Non-members are the dairy farmers from the operational areas of the Dairy Cooperative Societies (DCSs) who have at least one milch animal and not supplying the milk to milk cooperative society.

Table 1: Sampling plan

Societies sampled	JKMPCL		Non-JKMPCL
	Number ofdairy farmers in each society (N)	Sample size from each society (n)	No. of non-cooperative dairy farmers selected by convenient sampling method (n)
Akhnoor zone			
Lower Devipur	12	7	4
Garar	9	6	3
Mattuan	11	6	3
Pangali	7	3	1
Sangrampura	7	5	1
Chanjwan	39	30	15
ChakMorh	6	3	3
Total	91	60	30
Kathua zone			
Mehrajpur	24	21	11
DholianJattan	31	28	14
Salalpur	8	7	3
Pattal	6	2	1
Marheen	4	2	1
Total	73	60	30
Grand Total	164	120	60

Data were analysed using IBM SPSS 25 software. A binary logistic regression model was applied to assess the relationship between membership (1 = member; 0 = non-member) and socioeconomic characteristics. The probability of being a cooperative member can be modelled as a function of selected independent variables. The variable having a significant correlation with the dependent variables namely were entered in the regression model to find out the best predictors affecting dairy farmers' decision to opt for cooperative dairying. The binary logistic regression model was used to identify the key socio-personal, economic, biophysical, and market incentive variables affecting the decision of the dairy farmers to adopt a cooperative system of dairying. A score of "1" was given for being a member of dairy cooperatives and a score of "0" was for not being a member of a dairy cooperative. The forward stepwise criterion was followed to select the best predicting variables, as the main aim was to select the best predictors. At each step, the predictor which contributes most to prediction is added. For entry of predictor in the model, a default value of 5% significant level was adopted. We first worked out the correlation between independent variables entered in the model and used forward conditional model to eliminate co-linearity (i.e. combined effect of variables). Log it is defined as natural log of odds, and the model can be specified as:

Odds = p/1-p

The result of this type of regression can be expressed as follows:

$L_n [p\ D\ (1\text{-}p)] = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_3 + \ldots\ldots + b_k x_k$

Where,

p = the probability of an event

b_0 = y intercept (constant), and

x_1 to x_k = represents the independent variables included in the model.

For the validation of each model, Chi-square and Hosmer and Lameshow goodness of fit tests were used and the cases that were correctly classified were taken into account. The Nagelkerke's R^2 was used as a measure of determination of variation caused by

predictors. The significance of chi-square model indicated that variables in the model jointly cause a significant variation in the dependent variable. The non-significance of Hosmer and Lameshow's goodness-of-fit confirmed that there is no significant difference between the observed and predicted frequencies of respective categories. Sample for binary logistic regression model was comprised selected 120 respondents from JKMPCL.

RESULTS AND DISCUSSION

The results of research study revealed that the average age of cooperative and non-cooperative dairy farmers was less than 50 years, indicating that farmers were still within their economically active age group. The household of cooperative members have on an average fewer family member and are headed by older males having higher levels of education as compared to their counterparts in the unorganized sector. The *t*-test results show that the difference in dairy farming experience was statistically significant between the two groups. However, the two groups did not differ significantly so for as the average herd size, landholding, possession of mobile phones, average family members associated with crop production and dairying are concerned.

The binary logistic regression was applied on 38 socioeconomic variables of respondent dairy farmers under six main headings i.e., socio demographic profile, extension contacts, the relative location of the dairy farm, occupation, sources of income, and herd profile for assessing the likelihood of milk marketing cooperative membership (Table 2). The model was significant at 5 per cent level of significance. The outcome of the logistic regression revealed that, out of 38 variables selected for determining the likelihood of influencing the decision of the dairy farmers to join cooperative channels for disposal of milk, only four variables showed a significant tendency towards cooperative membership (Table 3). The independent variables having significant association with the dependent variables (i.e. membership in JKMPCL), namely, age, extension contacts, and experience in dairying were not the predictors of a dairy farmer joining a dairy cooperative. The forward stepwise binary logistic regression captured only four variables namely, distance from milk collection center, number of animals in lactation, total milk production, and number of sources of income (Table 3).

We found a negative relationship between distance to the milk collection center and the probability of cooperative membership. The obtained results are consistent with the finding of Chagwiza *et al.* (2016) who found that the cooperative membership and dairy performance among smallholders in Ethiopia, its finding revealed that out of the 8 variables included in the logistic regression model for assessing the likelihood of membership, 5 were significant. These were: age of household head, level of education, family size, size of landholdings, and distance to the cooperative milk collection center. The results showed that the distance to the milk collection center negatively and significantly influenced the probability of cooperative membership. Age and level of education of household head, as well as household size, were also found to have a significant and positive relationship with the probability of cooperative membership. There is a negative relationship between the size of landholding and membership, implying that the probability of cooperative membership declines with an increase in land size. The geographical location of a farm determines whether a farmer joins a cooperative or not. In remote places, it is difficult to find a cooperative. Ngigi *et al.* (2000) in Kenya, Francesconi (2006) in Ethiopia, and Sharma *et al.* (1991) in India have reported similar results. Our result is also in line with Fischer and Qaim (2012) and Abebaw and Haile (2013), who showed a non-linear relationship between the distance to the road and cooperative membership (agricultural cooperatives in general, not only in the dairy sector) among farmers in Tanzania and Ethiopia respectively. As the distance of milk collection centers increases, farmers tend to sell their output to traditional marketing channels as most of the traditional channel players and individual buyers collect milk from farmers' doorsteps (Njiru *et al.* 2015). Milk is a highly perishable item and transportation to the market by individual farmers is expensive. These high costs then prevent the farmers from marketing their milk individually. Holloway *et al.* (2000); Birhanu (2012); Eshetu (2015) and Chagwiza *et al.* (2016) also reported similar findings.

The cooperative membership was positively associated with the number of animals in lactation and

Table 2: Descriptive statistics of the sampled dairy farmers of Jammu

Particular	JKMPCL (n=120) 1	Non JKMPCL (n=60) 2	Difference (1-2)
Average age (years)	47.42±0.5	44.62±1.29	2.75
Age group (% farmers)			
15-42	34	42	8
43-62	58	56	2
63-95	7	2	5
Respondents' gender (%)			
Male	98	98	0
Female	2	2	0
Average education(formal schooling years)	8.02±0.292	7.56±0.463	0.19
Education (% farmers)			
Illiterate	8	12	4
Primary	12	18	6
Middle	31	32	1
Matriculate	39	28	11
Senior secondary	11	10	1
Graduate and above	0	2	2
Average household members associated with crop production	1.40±0.046	1.08±0.035	0.32
Average household members associated with dairying	1.01±0.008	1.00±0	0.01
Average no. of milch animals per household	2.34±0.17	2.35±0.10	0.01
Possession of mobile phone(% respondents)	92	83	9
Type of family (%)			
Joint	39	40	1
Nuclear	61	60	1
Gender per household (%)			
Male	53	52	1
Female	47	48	1
Average dairy farming experience (years)	22.45±0.88	17.83±1.26	4.62*
Average members per household	4.93	5.08	0.15
Family size (% farmers)			
3-8 members	95	93	2
9-14 members	5	4	1
15-32 members	0	3	3
Households' main occupation (%)			
Crop production	79	75	4
Dairying	2	00	2
Others	19	25	6

*± Std. Mean Error, *Significant at p<0.05. Figures corresponding to percentages have been rounded upto nearest whole number.*

total milk production. Milk production is characterized by season variability and with the availability of feed and fodder. Usually, during summer the milk production is low due to heat stress and low feed intake. Similarly, the risk of milk wastage is high during the glut period when production exceeds local demand. To overcome this, a dairy farmer needs a permanent source of market and tend to associate with dairy cooperatives which provide a reliable and permanent source of the market with stable price throughout the year. Their annual dividend from cooperatives also increases with an increase in patronage. Our results are in agreement with those of Sulastri and Mahajan (2002); Njiru *et al.* (2015) and Bultosa (2016). Dairy households having more number of sources of income showed a positive and significant association with the adoption of dairy cooperatives as milk marketing channels. Households' access to nonfarm income sources could have a positive influence as the labour scarcity discourages such households to sell milk in the open market. A great deal of labour is required in dairy production and product handling. This can be attributed to the fact that families having diverse sources of income are already falling short of labour and an easy access to the market through dairy cooperatives eases this constraint by Birthal *et al.* (2009). Chagwiza *et al.* (2016) also demonstrated the positive influence of family labour on cooperative membership.

CONCLUSION

The primary objective of this study was to investigate factors having significant bearing on farmers' decision to join Jammu and Kashmir Milk Producers Cooperative Limited, in Jammu region of Union Territory of Jammu and Kashmir. The primary information was collected from 120-member dairy farmers through multistage sampling technique. The binary logistic regression model was employed to workout determinants of farmers participation in JKMPCL. The result, findings show that number o animals in lactation, total milk production of household and multiplicity of sources of income of dairy households were positively and significantly impacting the decision of dairy farmers to join JKMPCL whereas relative distance from milk collection center had negative effect on the choice of farmers to opt for JKMPCL as market outlet. Development in market infrastructure, strengthening round-the-year cooperative network for last mile coverage to dairy producers will improve farmers participation in cooperatives.

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Research Article

Farmer's Participatory Evaluation of Wheat Establishment Methods Following *in situ* Rice Residue Management vis-à-vis Conventional Tillage in North-western India

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ABSTRACT

The rice residue management (RRM) before wheat establishment has been the major sustainability issue of worlds' largest rice-wheat cropping system due to large emission of greenhouse gases. This study evaluated farmer's perception towards different RRM technologies viz. residue retention with happy seeder (either directly) or following mulcher, straw management system (SMS), residue incorporation with super seeder, mould board plough (MBP) and rotavator tillage (RT), residue removal followed by zero tillage (ZT) sowing and open field residue burning followed by conventional tillage (CT) and wheat establishment with conventional seed-cum-fertilizer drill. The wheat grain yield varied between 5.60 and 6.21 q ha^{-1} in plots with different RRM technologies, as compared with between 5.65 and 6.19 Mg ha^{-1} in CT plots. Wheat grain yield in happy seeder technology with residue retention varied between 6.10 and 6.13 q ha^{-1}, as compared with between 5.60 and 5.99 q ha^{-1} in plots with *in situ* crop residue incorporation, and the highest (6.21 q ha^{-1}) in wheat where rice residue was removed with baler technology. Wheat grain yield among different rice residue management technologies did not differ significantly (p<0.05) from that of the CT. The average net returns (ANRs) varied between 1133 and 1282 US$ ha^{-1} for RRM technologies as compared with between 1093 and 1239 US$ ha^{-1} in CT. These results revealed the highest B-C ratio of wheat establishment with happy seeder (B-C ratio = 4.18) with surface retention of rice residues, followed by super seeder sown wheat (B-C ratio = 3.71). In happy seeder sown wheat plots, the number of irrigations were decreased by ~10.4%, compared with the plots with *in situ* residue incorporation (viz. super seeder, MBP and the RT methods. As compared with the CT, the average number of irrigations applied to wheat was decreased by ~11.5% with surface retention of rice residue in happy seeder sown plots. In CT plots, the infestation of pink stem borer was ~10-times lower than the plots where mulcher was used before wheat sowing with happy seeder.

Keywords: Economic efficiency, Happy seeder, Pink stem borer, Residue management, Water saving

INTRODUCTION

Wheat (*Triticum aestivum* L.) is an important winter crop cultivated in rotation with rice (*Oryza sativa* L.), constituting an annual rice-wheat cropping system (RWCS) (Bhatt *et al.,* 2019; Bhatt *et al.,* 2021). The RWCS covers ~26 Mha in the Indo-Gangetic Plans (IGPs) in South Asia covering India, Nepal, Pakistan and Bangladesh and in China (Singh *et al.,* 2021a), and has been the food basket for a large majority of human population in these countries (Singh *et al.,* 2021b). The cropping system is considered a lifeline for the food security and livelihoods of burgeoning South Asian population (Nawaz *et al.,* 2019). But, the major sustainability issue with RWCS in IGPs has been the burning of rice crop residues before establishing wheat

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during November (Singh *et al.,* 2020a,b; Sharma *et al*., 2020, Gupta *et al.,* 2021). In the north India, crop residue burning has become endemic and has caused ecological imbalance to the ecosystems (Sharma *et al*., 2021; Venkatramanan *et al*., 2021). It has been estimated that ~2.5 million farmers in north-west India burn the remaining stubble to prepare their fields for the subsequent wheat crop (Keil *et al*., 2021). The rice residue management (RRM) therefore, has become the major challenge in all rice growing areas, as loose and scattered residue impedes the tillage operations and often leads to delay in wheat sowing with wheat grain yield loss of 15-60 kg d^{-1} ha^{-1} (Pathak *et al*., 2013; Sidhu *et al*., 2007). Rice residue burning is not a viable option as it leaves high C footprints and lowers the amount of C added to soil organic C pool and C sustainability. RRM impacts ecosystems' sustainability due to change in energy use, C footprints and the net C budget of ecosystem (Singh *et al.,* 2021a). Over the years, several RRM technologies viz. surface retention of crop residue as with the use of happy seeder, *in situ* incorporation with mould board plough (MBP) and rotavator tillage (RT), and with super seeder, and residue removal with baler technology followed by zero tillage (ZT) have been advocated. As compared to the conventional tillage (CT) which is highly resource intensive (Singh *et al.,* 2019; Singh *et al*., 2021b), rice residue retention offers reduction in carbon (C) and energy footprints ~14.1 and 12.9 per cent, respectively (Singh *et al*., 2020a). Therefore, we compared different RRM technologies viz. residue retention, *in situ* incorporation and removal vis-à-vis CT at farmers field during *rabi* 2020-21 to study the yield potential and economics of different wheat establishment methods following RRM in north-western India (Punjab).

MATERIALS AND METHODS

Brief description of study area and soil characteristics: The study was conducted in the Bathinda district in the Indian Punjab. The geographical area of study area is 3,547 km^2, and is located in the north-western India between 29º332 to 30º362 N latitude and 74º382 to 75º462 E latitude. The climate of study area is typically a semi-arid, tropical, generally hot dry except during the rainy season (CGWB, 2013). Rainfall occurs due to south-west *monsoon* in the last week of June and extends upto second fortnight of September. Majority of soils in the study area are light in texture. Wheat (*Triticum aestivum* L.) is the major winter season crop grown in the region after rice (*Oryza sativa* L.) and cotton (*Gossypium hirsutum* L.).

Description of happy seeder method of wheat establishment: The happy seeder, an improved version of zero tillage machine simultaneously cuts and removes rice residue in front of tynes and spreads it over the surface (as mulch) and enables direct seeding of wheat in standing rice stubble (Sidhu *et al*., 2007). In alone happy seeder plots, wheat was sown in standing stubbles, while in mulcher + happy seeder plots, mulcher was used for the management of rice stubble before using happy seeder for wheat sowing. However, in SMS + happy seeder plots, SMS was used for chopping and spreading of loose rice stubble leftover after rice harvesting, and then wheat was sown with happy seeder.

Rice residue removal and wheat sowing with zero till machine: Zero till sowing of wheat was carried out by the farmers after rice residue removal from the field in the form of straw bales. Rice residue baling involves three consecutive operations viz. reaper for cutting of rice stubble, rake for making windrows of residue to facilitate its collection, followed by baler to convert loose residue in the form of rectangular bales. After baling, direct drilling of wheat in rows was done with ZT seed-cum-fertilizer drill.

Rice residue incorporation and wheat establishment: The rice residue incorporation is generally accomplished with the use of super seeder, RT or MBP tillage. Super seeder involves direct cutting and mixing of loose straw and stubble into the soils and simultaneous wheat sowing. Rotavator tillage involves direct *in situ* mixing of rice residues in the soil plough layer. After making seed bed, wheat seeding was done using conventional seed-cum-fertilizer drill in rows 17.5 cm apart. The MBP, on the other hand, could mix rice residues through deep tillage while simultaneous turning of surface soil layer. Prior to MBP tillage, mulcher was used for uniform chopping and spreading of residue remained in the field. After the rice residue is spread, the MBP tillage was performed, which was followed by an additional rotavator operation for fine mixing of residue into the soil. The fields were leveled using planker for making a fine seed

bed, and wheat was sown using conventional seed-cum-fertilizer drill in rows 17.5 cm apart.

Field preparation following conventional tillage (CT) and wheat sowing: After open field burning of rice straw, fields were intensively tilled by the farmers to prepare a fine seed bed. The CT method involves 2-3 operations of disc harrow, 3-4 plowings with cultivator, followed by 1-3 field leveling operations. After the tillage operations are over and a fine seed bed was prepared, wheat was sown with conventional seed-cum-fertilizer-drill in rows 17.5 cm apart. Brief description of agri-machinery used and farm operations performed under different RRM methods *vis-à-vis* CT method are given in Table 1.

Brief description of field demonstrations: A total of 290 field demonstrations viz. happy seeder (*n*=50), mulcher + happy seeder (*n*=50), SMS + happy seeder (*n*=30), super seeder (*n*=50), MBP (*n*=15), rotavator tillage (*n*=15) and baler + ZT (*n*=80) with respective conventional tillage (CT) covering a total area of ~182 ha. Wheat variety HD 3086 was sown in the first fortnight of November, 2020. The fertilizer management practices, weed control measures and insect-pest management were ensured as per the recommendations of Punjab Agricultural University, Ludhiana. Irrigations of (~75 mm each) were applied by the farmers at critical growth stages depending upon soil texture. Crop was harvested at physiological maturity in the 2nd week of April, 2021. For yield measurement, a net plot area of 4-6 m^2 was harvested manually, and grains from the above-ground biomass were removed using plot-thresher.

Economic analysis: The economic indices viz. average cost of cash inputs (ACCI), average gross returns (AGRs), average net returns (ANRs) and benefit cost (B-C) ratio were calculated for wheat sown in RRM and CT plots (Saini *et al.,* 2019). The ACCI included cost of inputs like seed, chemical fertilizers, pesticides and diesel, labour costs etc. The expenditure on sowing, harvesting and threshing etc. were considered for calculating ACCI (Eq.1). The AGRs and ANRs were worked out by considering cost of cultivation and minimum support price (MSP; US$ 27.5 per q; 1US$=70INR) and grain yield. The B-C ratio and economic efficiencies of wheat was calculated by using following equations.

$$\text{ACCI (US\$ ha}^{-1}\text{)} \quad \ldots(1)$$

Where, $C_{1,2,3,\ldots,}$ represents cost for different inputs and labour cost

$$\text{AGRs (US\$ ha}^{-1}\text{)} = \text{Grain yield x MSP} \quad \ldots (2)$$

$$\text{ANRs (US\$ ha}^{-1}\text{)} = \text{AGR-ACCI} \quad \ldots (3)$$

$$\text{Benefit-cost ratio} = \frac{\text{Average gross returns (US\$ ha}^{-1}\text{)}}{\text{Gorss cost US\$ ha}^{-1}} \quad \ldots(4)$$

The production efficiency of different treatments was calculated as a ratio of crop grain yield (kg ha^{-1}) and crop duration (days, d) (Saini *et al.,* 2019, Singh *et al.*, 2021c). The crop duration of 151 days was considered for estimating the production efficiency of rice and wheat (Eq. 5).

$$\text{Production efficiency (kg ha}^{-1}\text{ d}^{-1}\text{)} = \frac{\text{Grain yield}}{\text{Crop duration}} \quad \ldots (5)$$

The economic efficiency was determined by dividing net returns (ANRs, US$ ha^{-1}) under different fertilizer treatments by crop duration (d) (Eq. 6). The crop duration was kept same as for the estimation of production efficiency (Eq. 5).

$$\text{Economic efficiency (US\$ ha}^{-1}\text{ d}^{-1}\text{)} = \frac{\text{Average net returns (ANRs)}}{\text{Crop duration}} \quad \ldots (6)$$

RESULTS AND DISCUSSION

Seed rate, chemical fertilizers used and irrigations applied: The seed rate varied between 119.5 and 133.8 kg ha^{-1}. The lowest seed rate was used in the fields with wheat established following MBP tillage (119.5 kg ha^{-1}) and in CT plots (121.8 kg ha^{-1}), while the plots with surface retention of rice residue (viz. happy seeder, mulcher + happy seeder and SMS + happy seeder) was higher (132.0-133.8 kg ha^{-1}) (Table 1). The use of high seed rate in the fields with rice residue retained as surface mulch which exerts physical impedance for newly emerged wheat shoot offered by rice residue load of $\geq$7.5 Mg ha^{-1} reduces plant density (Sidhu *et al.,* 2007). The fertilizer-N application varied between 125.5 and 131.0 kg N ha^{-1} in different methods of wheat establishment following RRM. Fertilizer-N application rate was higher in the fields with surface retention of rice residue. The higher dose of fertilizer-N in happy seeder sown plots was ascribed to N

immobilization which is more prevalent in soils with low N content and it widens C: N ratio by promoting microbial population leading to temporary lock-up of N (Zhang *et al.,* 2015).

The fertilizer-P application rate varied between 25.1 and 27.8 kg P ha^{-1}, with relatively higher rate in the plots with surface retention of rice residue. The average number of irrigations applied to wheat varied between 4.4 and 5.3 (Table 1). These results revealed that in happy seeder sown wheat plots, the number of irrigations were decreased by ~10.4%, compared with the plots with *in situ* residue incorporation (viz. super seeder, MBP and the RT methods. However, in plots with residue removal (baler + zero tillage), the average number of irrigations applied to wheat was higher by ~15.2% than the surface retention of rice residue. As compared with the CT, the average number of irrigations applied to wheat was decreased by ~11.5% with surface retention of rice residue in happy seeder sown plots. These results corroborate earlier research highlighting that ZT and happy seeder method of wheat establishment has high water use efficiency (Sapkota *et al.,* 2017).

Weed infestation: The infestation of *Phalaris minor* was considerably lower in the plots with surface retention of rice residue and wheat establishment with happy seeder (Table 1). Among the three different methods of residue retention on the soil surface, the lowest *Phalaris minor* infestation was observed in plots where mulcher was used before using happy seeder for wheat sowing, compared with those without use of mulcher (alone happy seeder and SMS + happy seeder). It was important to observe that *Phalaris minor* infestation was considerably higher in the plots where rice residue was removed with baler or in the CT plots with residue burning. Brar and Walia (2007) reported that CT favored the germination of grassy weeds in wheat under rice-wheat cropping system as compared to ZT, while a reverse trend was observed for broad leaved weeds. The infestation of pink stem borer was higher in the plots where mulcher was used for scattering rice residue followed by the use of happy seeder for wheat sowing. However, in CT plots, the infestation of pink stem borer was ~10-times lower than the plots where mulcher was used before wheat sowing with happy seeder. Wheat under residue cover often encounters pink stem borer (*Sesamia inferens* Walker) attack (Beant-Singh *et al.,* 2014), causes formation of dead hearts and empty white heads at crop maturity (Deol, 2002).

Wheat grain yield: The wheat grain yield varied between 5.60 and 6.21 q ha^{-1} in plots with different RRM technologies, as compared with between 5.65 and 6.19 q ha^{-1} in CT plots (Figure 1). The plots with surface retention of rice residue had wheat grain yield varied between 6.10 and 6.13 q ha^{-1}, as compared with between 5.60 and 5.69 q ha^{-1} in plots with *in situ* crop residue incorporation, and the highest (6.21 q ha^{-1}) in wheat where rice residue was removed with baler technology. Wheat grain yield among different rice residue management technologies did not differ significantly (p<0.05) from that of the CT.

Economic indices: The ACC for wheat establishment following different RRM varied between 402.9 and 478.6 US$ ha^{-1}; the lowest in happy seeder sown wheat in standing stubble and the highest MBP plots with *in*

Table 1: Brief description of seed rate, chemical fertilizers applied, number of irrigations applied, weed infestation and pink stem borer infestation in wheat established methods following different rice residue management (RRM) technologies in north-western India

Particular	Happy seeder	Mulcher + happy seeder	SMS + happy seeder	Super seeder	MBP	Rotavator tillage	Baler + ZT	CT
Seed rate (kg ha^{-1})	133.8	133.5	132.0	125.5	119.5	125.3	125.5	121.8
Fertilizer-N (kg ha^{-1})	130.0	131.0	130.5	126.5	126.5	128.8	125.8	125.5
Fertilizer-P (kg ha^{-1})	27.8	27.1	26.9	25.3	25.9	25.4	25.1	26.4
Number of irrigations	4.6	4.4	4.8	5.2	5.0	5.2	5.3	5.2
Phalaris minor infestation (%)	10.1	8.7	12.4	34.2	32.6	34.0	46.4	48.7
Pink stem borer infestation (%)	2.2	8.3	3.5	6.3	2.7	4.9	3.2	0.8

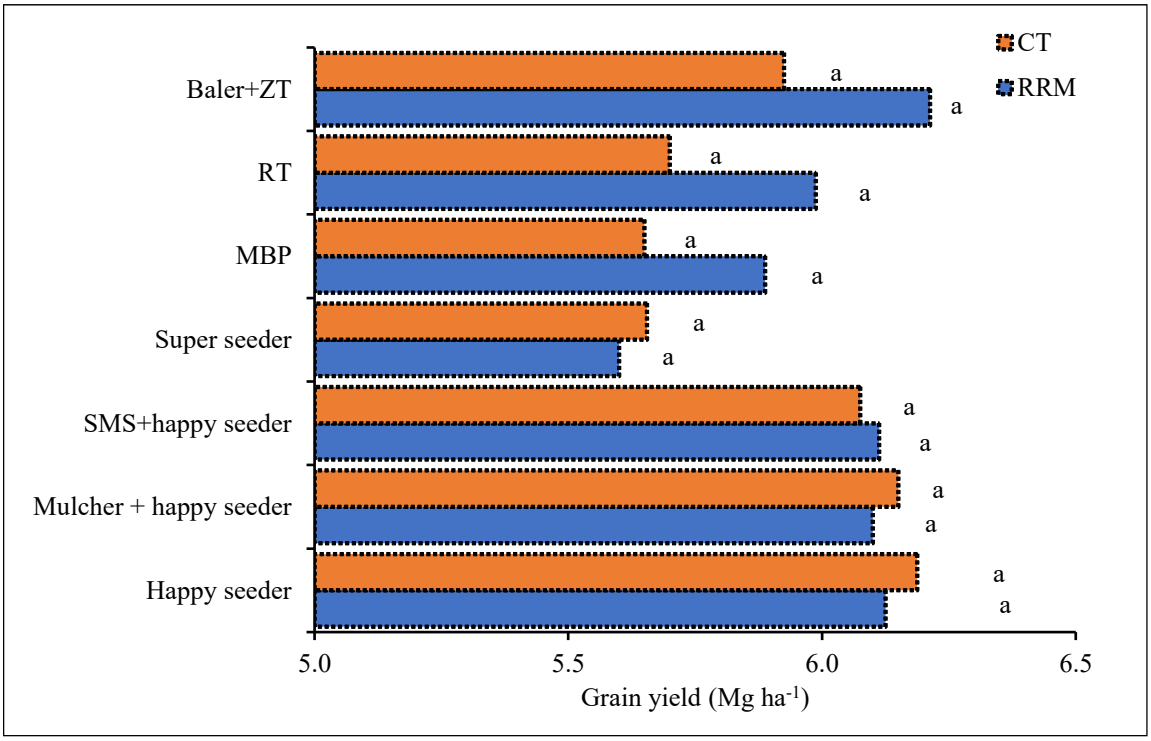

Figure 1: Wheat grain yield under different establishment methods *Bars indicate standard error from mean.* Mean values followed by same letter did not differ significantly (p<0.05)

situ residue incorporation (Table 2). Among the three *in situ* rice residue incorporation technologies, the highest ACC was associated with MBP followed by RT, while the lowest super seeder. It was important to observe that ACC for wheat establishment was nearly the same for happy seeder and super seeder methods of wheat establishment. The AGRs varied between 1540 and 1708 US$ ha^{-1} between different RRM technologies, as compared with between 1554 and 1702 US$ for CT plots. The ANRs varied between 1133 and 1282 US$ ha^{-1} for RRM technologies as compared with between 1093 and 1242 US$ ha^{-1}. These results revealed the highest B-C ratio of wheat establishment with happy seeder (B-C ratio = 4.18) with surface retention of rice residues, followed by super seeder sown wheat (B-C ratio = 3.78). As compared with the respective CT plots, only the wheat established following single sowing operation (either with happy seeder or super seeder) had the higher B-C ratios compared with their respective CT plots, while for all

Table 2: Economic indices viz. average cost of cultivation (ACC), average gross returns (AGRs), average net returns (ANRs) and the benefit-cost ratio (B-C ratio) of wheat under different establishment methods following rice residue management (RRM) in north-western India

Treatment†	ACC (US$ ha^{-1})		AGRs (US$ ha^{-1})		ANRs (US$ ha^{-1})		B-C ratio	
	RRM	CT	RRM	CT	RRM	CT	RRM	CT
Happy seeder	402.9	462.1	1684	1702	1282	1239	4.18	3.68
Mulcher + happy seeder	470.0	458.6	1678	1691	1208	1233	3.57	3.69
SMS + happy seeder	468.6	450.7	1681	1671	1212	1220	3.59	3.71
Super seeder	407.1	462.1	1540	1555	1133	1093	3.78	3.37
MBP	478.6	460.7	1619	1554	1140	1093	3.38	3.37
RT	476.4	460.7	1647	1568	1170	1107	3.46	3.40
Baler+ZT	467.9	458.6	1708	1629	1241	1171	3.65	3.55

†SMS=Straw management system, MBP=Mould board plough, RT=Rotavator tillage, ZT=Zero tillage

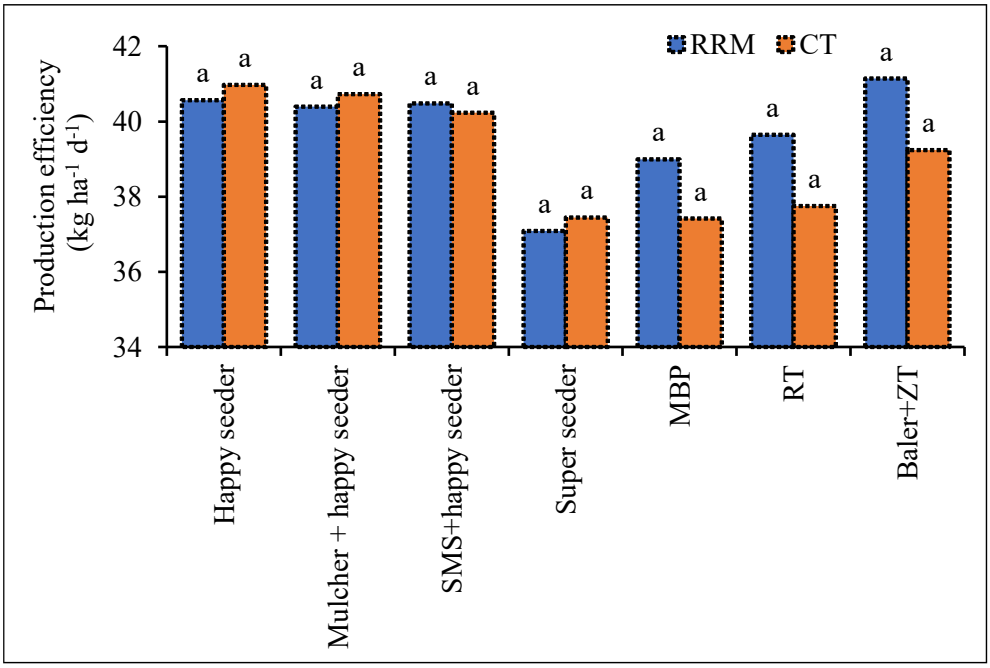

Figure 2: Economic efficiency (US$ ha^{-1} d^{-1}) of wheat under different establishment methods following rice residue management (RRM) in south-western Punjab, India. Mean values followed by same letter did not differ significantly (p<0.05)

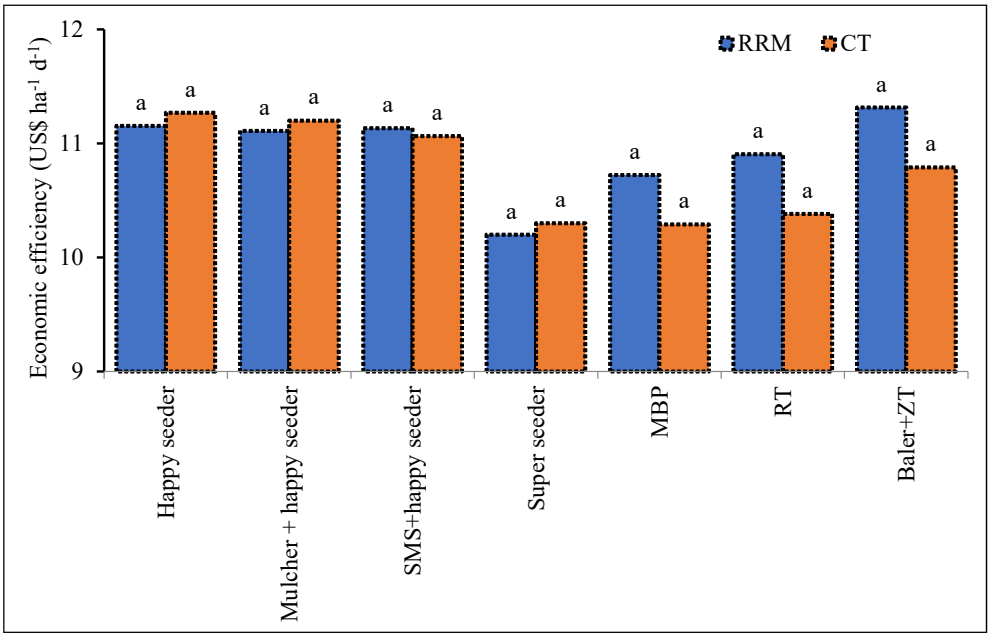

Figure 3: Production efficiency (kg ha^{-1} d^{-1}) of wheat under different establishment methods following rice residue management (RRM) in north-western India. Mean values followed by same letter did not differ significantly (p<0.05)

other RRM technologies the B-C ratio was higher for the CT plots.

***Economic efficiency and production efficiency*:** Figure 2 illustrates the economic efficiency of wheat establishment with different RRM technologies vis-à-vis CT. The economic efficiency of wheat varied between 10.2 and 11.3 US$ ha^{-1} d^{-1} for RRM plots, as compared to between 10.3 and 11.3 US$ ha^{-1} d^{-1}. These results revealed non-significant (p<0.05) difference in economic efficiency of wheat established with RRM, as compared to their respective CT plots. The production efficiency of wheat established with

different RRM methods varied between 37.1 and 41.1 kg ha^{-1} d^{-1} as compared with between 37.4 and 41.0 kg ha^{-1} d^{-1} (Figure 3). These results revealed non-significant difference in production efficiency for RRM plots as compared with their respective CT plots.

CONCLUSION

These results revealed non-significant differences in wheat grain yield amongst different rice residue management methods vis-à-vis conventional tillage (CT). The average net returns (ANRs) were higher (1133-1282 US$ ha^{-1}) for RRM technologies than the CT wheat (1093-1239 US$ ha^{-1}). The B-C ratio was higher for happy seeder (B-C ratio = 4.18) than the super seeder sown wheat (B-C ratio = 3.71). In happy seeder sown wheat plots, the number of irrigations were decreased by ~10%, compared with the plots with *in situ* residue incorporation (viz. super seeder, MBP and the RT methods.

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Research Article

Gendered Analysis of Constraints Faced by the Vegetable Growers of Uttarakhand

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ABSTRACT

Vegetable cultivation in hilly areas has been recognized as a profitable activity and it could be an alternative to subsistence farming in the hilly, marginal and rain fed agro-ecosystem. This paper aims to pinpoint the constraints the farmers face who are engaged in cultivation of vegetables. Major activities and operations like sowing/plantation, farm yard manure application, weeding, irrigation and harvesting were carried out by women farmers whereas male farmers were found to play a dominant role in decision making and they possess relatively more control over farm resources than women. To discover the most crucial constraints, Garret's technique of ranking is used. Suggestions for addressing the constraints faced by vegetable growers in hills are provided.

Keywords: Constraints, Garett ranking, Hills, Vegetable cultivation, Gender

INTRODUCTION

Vegetable cultivation in hilly areas has been identified as a financially rewarding practice, it could replace subsistence farming in the marginal, and rain fed hill agro-ecosystem. The characteristics and roles that men and women are socially assigned are referred to as "gender" (Chakravarty and Dhaka, 1995). The phrase "gender analysis" is often used to describe the study of the dynamics between and within households in an agricultural system (Feldstein and Poats, 1990). Gender analysis aids in the formulation of strategies to include both men and women in development initiatives (Sah *et al.*, 2007).

In India, specifically in hilly regions, the major phenomenon is that men are moving from rural areas to towns, cities, and even abroad, in search of employment and better opportunities, while leaving female counterparts behind to take care of the households, agriculture and allied activities. Despite their participation in several production activities and operations, women's position in agriculture as female labour is not recognized and they are seen as an invisible workforce (Singh and Vinay, 2013). Therefore, equipping women farmers with timely information is crucial to ensure constant development in agricultural production and raising their standard of living (Shailaja and Reddy, 2003).

Constraints are the factors that hinder the participation of vegetable growers at various stages of vegetable cultivation. During the cultivation of vegetables, vegetable growers face many problems. There remains a production disparity despite the promotion of numerous government organizations, and the availability of enhanced production techniques, hybrids, and protective measures (Kumar *et al.*, 2020). Analysis of various constraints related to vegetable production is essential for the formulation and implementation of any program related to extension (Pandit and Basak, 2013). The constraints that male vegetable growers face may be different from the constraints faced by female vegetable grower because of their social status in the community and other cultural factors.

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This study attempts to identify the constraints faced by vegetable growers of hills across gender and to identify the distribution pattern of male and female farmers in terms of their involvement in various aspects of vegetable production, their decision-making process, and their access to and control over resources. This study will also offer several suggestions for reducing gender disparities and enhancing the position of women in vegetable cultivation which is a remunerative industry in hills.

MATERIALS AND METHODS

The research was conducted in Uttarakhand, a mountainous state in the center of the Indian Himalayas. Using simple random sampling, villages from the Hawalbagh and Tarikhet blocks of district Almora and the Betalghat and Bhimtal blocks of district Nainital were chosen and 320 vegetable growers in total were chosen as respondents. A semi-structured interview schedule was used to gather the quantitative data. Data were categorized, and means, frequencies, and percentages were calculated. Garret's ranking technique (1969) was used to identify the most crucial element influencing the responses. The approach is efficient as it prioritizes the problems for decision-makers in identifying the significant problems (Debahash and Dubey, 2021).

RESULTS AND DISCUSSION

The results revealed that major activities and operations were carried out mainly by women i.e. production activities like sowing/planting, farmyard manure application, weeding, irrigation and harvesting were carried out by women farmers (Table 1).

For activities like nursery raising and packaging, both male and female farmers participated jointly whereas in activities like transporting and selling the produce or marketing, the male participation was higher than females. Similar findings by Sah *et al.* (2007) reported that in cultivation of potato crops, women predominantly applied FYM (53%), harvested potatoes (66%), did weeding (83%) and sorted and graded (52%) the produce. Manjari (2014) revealed that activities like procurement of inputs (82-83%), plant protection (58-99%) and selling of vegetables (60%) were mainly performed by male farmers. Fartyal and Rathore (2013) found that men were in charge of using plant protection techniques whereas women were involved in activities such as weeding, manure carrying and dispersing. In the activities like deciding on variety/ vegetable crop to be sown (66.87%), plantation / sowing time (65%) and selecting the place to sell the produce (56.87%), mostly men were making the decisions (Table 2).

Table 1: Distribution of farmers based on their involvement in different vegetable production activities

Activities	Men	Women	Jointly
Nursery raising	3.75%	37.81%	58.44%
Sowing/Plantation	8.44%	56.56%	35.00%
FYM application	7.50%	63.75%	28.75%
Weeding	4.06%	60.31%	35.62%
Chemical application	71.87%	21.87%	6.25%
Irrigation	10.94%	62.81%	26.25%
Harvesting	13.75%	48.75%	37.50%
Packaging	20.31%	31.87%	47.82%
Transport	67.81%	8.75%	23.44%
Selling the produce /Marketing	70.94%	19.06%	10.00%

Table 2 Distribution of farmers according to decision-making pattern in vegetable production

Activities	Men	Women	Jointly
Variety/vegetable crop to be sown	66.87%	26.88%	6.25%
Plantation/sowing time	65.00%	15.00%	20.00%
Harvesting time	16.87%	22.18%	60.94%
Where to sell	56.87%	20.31%	22.82%

However, decisions regarding harvesting time (60.94%) were made jointly which indicates that females have always been consulted for this activity. These findings are in close conformity with those of Pal and Haldar (2016) as they stated, in the agricultural sector men play a pivotal role in decisions made about production and women have very little influence on decision-making. Chouhan *et al.* (2016) in their study found that in rural areas due to certain socio-personal factors rural women were not able to make their decision regarding vegetable production process.

All the respondents revealed that both men and women had access to land, farm implements, manure and fertilizers, seeds and money earned by selling the

Table 3: Distribution of farmers according to access and control over production resources

Resources	Access	Control
Land	MW(100%)	M (92.81%), W (7.19%)
Farm implements	MW(100%)	M (41.25%), W (58.75%)
Chemicals/Fertilizers	M(80.94%), W(19.06%)	M(88.75%), W(11.25%)
Seed	MW(100%)	M (53.12%), W 46.88%)
Money earned by selling the produce	M (65%), W (35%)	M (87.81%), W (12.19%)

*M: Men, W: Women

produce. But it appears in the results that majority of the production resources and farm benefits were owned and controlled by the males in the households, though women had access to these as they were the actual workers. The main reason behind this could be the patriarchal dominance (Table 3).

It was recorded that women farmers had more access and control over small farm implements whereas male farmers owned the agricultural land, chemicals/ fertilizers, seed and money earned by selling the produce. However, the farm implements were the conventional small tools, which are manually operated. These results can be supported with the results stated by Paul and Meena (2016) that in both the plain and hilly region, male farmers (81.71%) had more access and control over the resources rather than females. Devkota (2005) also recorded that only men had significant control over money; women hardly ever participated in managing the revenue produced by large animals, cash crops, or grain crops. The major barrier to women participating equally in economic activity is their lack of control over economic resources.

Tables 4 and 5 indicate the preferences and order of difficulties experienced by male and female farmers who cultivate vegetables. It is evident from table 4 that for male farmers, lack of training and skills, high cost of input, lack of timely access to seeds and other inputs inadequate knowledge about training institutions and low prices of vegetables were the major constraints related to vegetable cultivation. Male vegetable growers

Table 4: Garret Ranking of constraints for male growers (N=160)

Constraints faced by male vegetable growers	Garret Score	Garret ranking
Lack of quality input material	50.21	7
High cost of input	64.70	2
Non-availability of seed and other input in time	56.75	3
Lack of time	50.71	6
Lack of irrigation source	39.26	17
Lack of training	70.37	1
Lack of knowledge about training institution	54.86	4
Difficulty in getting loan	47.96	12
Lack of financial institutions in area	48.49	9
Lack of knowledge about financial institution	43.48	14
More distance from market	42.75	16
Lack of demand in market	42.92	15
Low price of vegetable	54.83	5
Lack of knowledge about marketing linkage	48.37	10
Lack of storage facilities	49.56	8
Lack of knowledge about various schemes related to farming	44.65	13
Diseases	48.05	11

Table 5: Garret Ranking of constraints for female growers (N=160)

Constraints faced by male vegetable growers	Garret Score	Garret ranking
Lack of quality input material	53.61	5
High cost of input	55.30	4
Non-availability of seed and other input in time	40.31	17
Lack of time	69.74	1
Lack of irrigation source	62.99	2
Lack of training	51.34	6
Lack of knowledge about training institution	56.96	3
Difficulty in getting loan	47.81	11
Lack of financial institutions in area	47.16	12
Lack of knowledge about financial institution	43.48	14
More distance from market	42.75	16
Lack of demand in market	42.92	15
Low price of vegetable	50.25	8
Lack of knowledge about marketing linkage	50.43	7
Lack of storage facilities	48.26	10
Lack of knowledge about various schemes related to farming	48.68	9
Diseases	45.92	13

wanted to acquire these skills and training in vegetable cultivation but they were unable to do so. The reason could be that they are unaware of training institutions prevailing in their locality.

Since most settlements in rural areas are dispersed and located far from roads, the availability of seeds, seedlings, input supplies, fertilizers and other agricultural supplies is affected by the distance from markets and a lack of transportation infrastructure. Other than that, farmers do not visit state horticulture departments or blocks regularly. In addition, sometimes the inputs are not available even in the input centres timely when those are required. Kumar *et al.* (2019) found that the biggest challenges that vegetable growers encountered included rising costs for labour, seeds, and fertilizers as well as their unavailability when needed, and a lack of market intelligence, among other things. Farmers usually sow the seeds they produce on their own and sometimes they purchase poor-quality seeds and other inputs from local vendors that eventually result in lower productivity. One of the biggest challenges for farmers is the high cost of inputs, as the majority of them cannot afford to buy the number and quality of seeds needed to increase vegetable yield. Farmers prefer other crops that have minimum support prices in the market because the farmers generally get less market price for their produce, followed by price fluctuation, which results in less profit than other crops.

Female vegetable growers experienced lack of time, lack of irrigation sources, lack of knowledge about training institutions, high input costs and a shortage of high-quality raw materials as the main obstacles (Table 5). The reason could be that women in rural areas have a number of duties to perform from working in fields to fetching water, rearing the children to take care of the elderly members of the family, preparing food, and collecting fodder and firewood. Therefore, women farmers do not get much time to invest in farming due to the dual responsibilities of home and farm. Most of the hilly areas are still not equipped with irrigation sources. According to Bargali *et al.* (2015), in order to produce vegetables, rural women must deal with issues including a scarcity of irrigation water and a reliance on it, especially during the summer. Women and girls spend long hours and walk miles to fetch water for both domestic and productive use. These results are supported with the findings of Noack (2011) who states that many women find it difficult to engage in social and economic activities because of a lack of time. Females are usually

believed to be lacking in mobility, it affects their standard of living. Women in rural areas generally lack awareness or knowledge about various institutes that provide training related to agriculture or vegetable cultivation for that matter. Such kind of institutions are located away from rural areas, especially nearby the cities. Therefore, it is a difficult task for women to avail the services provided by the training institutes more frequently as mobility is a major concern.

CONCLUSION

There are certain ways to strengthen the participation of women farmers such as by removing social, institutional, and legal barriers that prevent women from taking part in decision-making, encouraging the involvement of female vegetable growers at every stage of leadership and decision-making and by providing training programmes to promote women's participation in decision-making. One of the main barriers to women's economic empowerment is women's unequal access to land and other resources. Because of prejudice and gender inequality, women have less resource access and management. Eliminating structural gender inequities and granting women equal access and ownership over economic assets are essential to empower them economically.

Lack of access to training and lack of awareness about training institutions are the prime constraints and to address these constraints, there is a need to organize more farmer centric awareness and capacity development programmes. More extension efforts, training programmes, and awareness campaigns, complemented with ICT tools usage along with mass media are needed. There are fewer numbers of training institutions in villages, and for that, some infrastructural developments and changes are required at village level.

Other constraints like lack of quality input material, high cost of input and non-availability of seed and other input in time can be addressed by establishing input centers at community level so that the farmers could avail these inputs on time. The establishment of a cooperative at local levels should be encouraged so that role of mediators can be diminished. Specific places in market can be provided to women farmers and their cooperatives so that a friendly infrastructure is built for promoting women's as sellers. Lack of irrigation source is a huge problem in hill agriculture as the resources are limited, and to overcome this problem, vegetable growers should be encouraged to use drip irrigation, sprinkler method as it saves time, money, and water. Addressing the constraints faced by the growers can provide guidelines to plan and execute the policies for the betterment of the farmers. Addressing the gendered constraints also needs gender transformative approaches through convergence of various departments so that it can bring a change in behavior and the 'normal order' of gender norms of the society and the intra-household dynamics.

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Research Article

A Study of Spiritual Intelligence and its Relationship with Locus of Control Among Youth

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ABSTRACT

The study assessed and compared the gender differences in spiritual intelligence among youth of Punjab and Uttarakhand. For this purpose, 360 youth aged between 20-22 years were taken. Research tools used were Spiritual intelligence scale by Dhar and Dhar (2010) and Levenson's scale for locus of control by Vohra (1999). Data was analyzed using descriptive statistics (frequency and percentage), Z test, t-test and Karl Pearson's Coefficient of Correlation. Result indicated that males and females of Punjab and Uttarakhand differ significantly in spiritual intelligence and correlation relation analysis showed that individuals with high spiritual intelligence believed that their accomplishments and failures were the product of their efforts and hard work, whereas youth with poor spiritual intelligence believed that their successes and failures were the result of external factors beyond their control.

Keywords: Chance control, Individual control and youth, Locus of control, Powerful others, Spiritual intelligence

INTRODUCTION

Human intelligence is a mental attribute that includes the ability to learn and use new information and skills (Sadiku *et al.,* 2020). In the previous century, intellectual and rational intelligence, also known as the intelligent quotient, became a hot topic for solving strategic and logical problems. Emotional intelligence, as defined by Goleman (1995), includes knowledge and control of one's own and others' feelings, as well as the ability to manage interpersonal relationships prudently and empathetically, and it has become as important as intelligence quotient. The spiritual intelligence was afterwards added to complete the picture of human intelligence. Spiritual intelligence is linked to the inner life of the mind and spirit, as well as to one's place in the world (Vaughan, 2002). Spiritual intelligence can be developed relatively independently and has the ability to discriminate with a moral sense in situations where humans have tempered rigid rules of understanding, compassion, and have the equivalent ability to observe when compassion and understanding have reached their limits. It is a framework for identifying and arranging the skills required for the adaptive application of spirituality. Spiritual intelligence seeks intrapersonal integration, or "the transformation of the personality from fragmentation to integration" (Emmons, 2000a).

The World Health Organization is also interested in looking beyond the physical, mental, and social aspects of health, and member countries are actively investigating the fourth dimension of health, spiritual well-being, and its impact on a person's overall health and happiness. In the 52nd World Health Assembly, the spiritual dimension of health was explored as an addition to the physical, mental, and social dimensions of health. 'Health is a dynamic condition of complete physical, mental, spiritual, and social well-being, not only the absence of disease or disability,' according to the proposal (WHO, 1999).

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Early adulthood, often known as "young adulthood," is the era following puberty. It has five distinct characteristics: identity exploration, instability, possibilities, self-focus, and feeling in the middle (Arnett, 2004). People are surrounded by countless opportunities and difficulties, all of which have a significant impact over the course of their lives. Spiritual intelligence can be used to improve the overall quality of a person's life and increase their well-being at this period. (Emmons, 2000b). In India, the youth have a sizable population. They assess perplexing situations that arise as a result of the changes they are witnessing. Youth are the future's hope and leaders, it is critical that they develop aptitude, behaviour, and action in accordance with democratic values. Youth's innovative minds, enthusiasm, and vitality are the country's current demographic strength (Som *et al.,* 2018)

The word "locus of control" refers to a person's belief system about the repercussions of his or her actions, which is based on convictions that shape an individual's attitude toward success or failure. (Taylor, 2020) Locus of control is an important personality trait that has been linked to a variety of factors, including an individual's mental health Spiritual intelligence can perk up person's belief system and have tendency to change attitude towards life.

MATERIALS AND METHODS

Criteria of selection

Sample of 180 youth were taken from youth of Punjab Agricultural University Ludhiana and 180 youth were from Govind Ballabh Pant University of Agriculture and Technology aged between 20 to 22 years.

Research instruments

Spiritual intelligence: Spiritual intelligence was assessed by using Spiritual Intelligence Scale (Dhar and Dhar, 2010).

Locus of control: The locus of control was assessed by using Levenson's scale for locus of control by Vohra (1999).

RESULTS AND DISCUSSION

A look into gender-wise locale differences in the distribution of respondents across various dimensions and levels of spiritual intelligence revealed that 33.67 per cent of females of Punjab and 40 per cent of females of Uttarakhand were at the low level of benevolence with no significant difference. 28.56 per cent and 45.56 per cent of females from Punjab and Uttarakhand were found at the average level of benevolence, and at high level, females from Punjab females (34.44%) outnumbered Uttarakhand females (14.44%) with no significant difference. On the other hand, male respondents of Punjab and Uttarakhand showed a similar result as female respondents where Punjab males (38.89%) superseded Uttarakhand males (17.78) at the high level of benevolence with no significant difference.

The equal number of female respondents (58.89%) from Punjab and Uttarakhand were found at the average level of modesty followed by high level where 24.44 per cent and 22.22 per cent of females from Punjab and Uttarakhand were found, whereas, males of Uttarakhand (50.00 per cent) were found more than males of Punjab (23.23 per cent) with a significant difference ($Z= 2.05$; $p\leq0.5$) followed by average level (Punjab males: 46.67 per cent and Uttarakhand males: 31.11 per cent) and high level (Punjab males: 30 per cent and Uttarakhand males 18.89%) of modesty.

For the third dimension of spiritual intelligence i.e. conviction, more than half population of females of Uttarakhand and Punjab were at average level (Punjab female: 66.67% and Uttarakhand female: 61.11%) followed by high level and low level with no significant difference. A similar trend was found with the male population of both the state also where more than half population fell at average level (Punjab male: 68.89% and Uttarakhand male: 65.56%) with no significant difference.

More than half of the female respondents of Punjab (55.56%) and Uttarakhand (57.78%) were found at the average level of compassion. 26.67 and 17.78 per cent of females from Punjab and 7.78 and 34.44 per cent of females from Uttarakhand were accumulated at high and low level respectively with no significant difference. On the other side, equal number of males (70%) from both the state were found at average level of compassion.

In the dimension of magnanimity, females from Uttarakhand (67.78%) were found more than females

Table 1: Gender wise locale differences in distribution of the respondents across various dimensions and levels of spiritual intelligence (n=360)

Dimensions of Spiritual Intelligence		Female (n_1= 180)					Male (n_2= 180)				
		Punjab (n_{1a}=90)		Uttarakhand (n_{1b}=90)		Z-value	Punjab (n_{2a}=90)		Uttarakhand (n_{2b}=90)		Z-value
		f	%	f	%		f	%	f	%	
Benevolence	Low	33	36.67	36	40.00	0.28	33	36.67	34	37.78	0.09
	Average	26	28.89	41	45.56	1.36	22	24.44	40	44.44	1.56
	High	31	34.44	13	14.44	1.34	35	38.89	16	17.78	1.50
Modesty	Low	15	16.67	17	18.89	0.16	21	23.33	45	50.00	2.05**
	Average	53	58.89	53	58.89	0.00	42	46.67	28	31.11	1.30
	High	22	24.44	20	22.22	0.17	27	30.00	17	18.89	0.82
Conviction	Low	12	13.33	13	14.44	0.08	13	14.44	15	16.67	0.16
	Average	60	66.67	55	61.11	0.62	62	68.89	59	65.56	0.39
	High	18	20.00	22	24.44	0.34	15	16.67	16	17.78	0.08
Compassion	Low	16	17.78	31	34.44	1.20	14	15.56	13	14.44	0.08
	Average	50	55.56	52	57.78	0.23	63	70.00	63	70.00	0.00
	High	24	26.67	7	7.78	1.05	13	14.44	14	15.56	0.08
Magnanimity	Low	22	24.44	14	15.56	0.64	15	16.67	8	8.89	0.51
	Average	46	51.11	61	67.78	1.75*	40	44.44	53	58.89	1.38
	High	22	24.44	15	16.67	0.57	35	38.89	29	32.22	0.55
Optimism	Low	12	13.33	10	11.11	0.16	17	18.89	13	14.44	0.32
	Average	58	64.44	50	55.56	0.94	55	61.11	51	56.67	0.46
	High	20	22.22	30	33.33	0.85	18	20.00	26	28.89	0.67
Overall Spiritual intelligence	Low	18	20.00	27	30.00	0.75	13	14.44	37	41.11	1.74*
	Average	43	47.78	48	53.33	0.53	49	54.44	34	37.78	1.50
	High	29	32.22	15	16.67	1.10	28	31.11	19	21.11	0.76

*p≤0.10; **p≤0.05; ***p≤0.01

of Punjab at average level (51.11%) with a significant difference (Z=1.75; p≤0.10) whereas, at low and high level no significant difference was found. 44.44% of males from Punjab and 58.89% of males of Uttarakhand was found at average level, whereas, a less proportion of the respondents occupied low level of magnanimity (Punjab males: 16.67% and Uttarakhand males 8.89%). Most of the females from Punjab (64.44%) and Uttarakhand (55.56%) accumulates under average level of optimism followed by high level where 22.22 per cent of females from Punjab and 33.33 per cent of females from Uttarakhand were accumulated and only 13.33 percent of females from Punjab and 11.11 per cent females from Uttarakhand were found at low level. A similar trend was found in male population also where 61.11 per cent males from Punjab and 56.67 per cent males from Uttarakhand were found at average level followed by high and low level.

In total spiritual intelligence, most of the females from Punjab (47.78%) and Uttarakhand (53.33%) were at average level, whereas, 32.22 per cent and 16.67 per cent females from Punjab and Uttarakhand were found at high level. 20 per cent and 30 per cent of females from and Punjab and Uttarakhand fell at low level of spiritual intelligence. On the other side, a significant difference (Z=1.74; p≤0.10) was found at low level of spiritual intelligence where males from Uttarakhand (41.11%) were found more than males of Punjab (14.44%) and 54.44 per cent of males from Punjab and 37.78 per cent of males from Uttarakhand were

Table 2: Gender wise locale differences in mean scores of the respondents across various dimensions of spiritual intelligence (n=360)

Dimensions of Spiritual Intelligence	Female (n_1=180)					Male (n_2=180)				
	Punjab (n_{1a}=90)		Uttarakhand (n_{1b}=90)		t- value	Punjab (n_{2a}=90)		Uttarakhand (n_{2b}=90)		t- value
	Mean	SD±	Mean	SD±		Mean	SD±	mean	SD±	
Benevolence	65.86	12.35	62.57	10.07	1.96**	66.74	12.1	61.18	12.36	3.05***
Modesty	57.61	8.06	56.24	7.87	1.15	57.50	8.35	49.79	12.81	4.79***
Conviction	32.81	4.65	32.91	4.63	0.14	32.93	3.81	32.97	4.53	0.05
Compassion	36.53	5.40	33.99	4.72	3.37***	36.41	4.25	37.11	4.94	1.02
Magnanimity	11.51	2.56	11.48	2.13	0.09	12.17	2.21	12.43	1.91	0.87
Optimism	8.08	1.64	8.43	1.48	1.52	8.00	1.55	8.58	1.44	2.59***
Overall Spiritual intelligence	212.4	27.37	205.62	22.54	1.81*	213.7	22.7	202.06	24.34	3.33***

*p≤0.10; **p≤0.05; ***p≤0.01

at average level of spiritual intelligence. Only 21.11 per cent males from Uttarakhand and 31.11 per cent of males from Punjab were found at high level.

Inline to this result, a study by Eriksen, 1999 concluded that among the three ethnic groups a significant difference was found where Hindu-Mauritians ethnic group scored highest in spiritual intelligence. Thus, it can be concluded that with the difference in culture and ethnicity spiritual intelligence also varies.

The perusal of data presented in Table 2 revealed that females from Punjab showed higher mean scores with a significant difference in benevolence (t value: 1.96; p≤0.5), compassion (t value: 3.37; p≤0.1), and overall spiritual intelligence (t value: 1.81; p≤0.10) than females of Uttarakhand. As a result, it could be concluded that females from Punjab were more benevolent, compassionate and had more overall spiritual intelligence than females of Uttarakhand. For modesty, conviction, magnanimity and optimism no significant difference was found in both the state of females. On the other side, a similar result was found for males of both the state except for the optimism, where males from Uttarakhand (8.58) have higher mean scores than males from Punjab (8.00) with a significant difference (t value: 2.59; p≤0.1) and for modesty, males from Punjab (57.50) showed higher mean scores than males from Uttarakhand (49.79) with a significant difference (t value: 4.79; p≤0.1). It implies that males of Uttarakhand were more optimistic and males of Punjab were more benevolent, modest and had more spiritual intelligence.

Research by Shanto (2016) explored and understand the local cultural background and depicted a relationship between ethnic identity and spiritual intelligence, as well as an ethnic difference in spiritual intelligence. A similar finding was also revealed by Trimble (2000) who found a link between ethnic identity and spirituality.

Table 3 highlighted the correlation analysis of various dimensions of spiritual intelligence and locus of control among female respondents of Punjab and Uttarakhand. A significant negative correlation was found between the dimensions of spiritual intelligence except conviction r= -0.194 (benevolence r=-0.584; p≤0.01, modesty r=-0.474; p≤0.01, compassion r=-0.494; p≤0.01, magnanimity r=-0.502; p≤0.01, optimism r=-0.314; p≤0.01), overall spiritual intelligence r=-0.600; p≤0.01 and powerful others among Punjab females, Similarly, females of Uttarakhand, also showed a significant negative correlation with powerful others and dimensions of spiritual intelligence and overall spiritual intelligence (r=-0.333; p≤0.01) except compassion (r=-0.140) which implies that females of Punjab and Uttarakhand whose more locus of control was powerful others, they had low spiritual intelligence.

In the same way, females of Punjab displayed significant negative correlation with chance control and dimensions of spiritual intelligence and overall spiritual intelligence (r=-0.505; p≤0.01) except optimism (r=-0.180),whereas, in Uttarakhand females, chance control showed a negative relation with all dimensions of spiritual intelligence (benevolence r=-0.070, modesty

Table 3: Correlation analysis of various dimensions of spiritual intelligence and locus of control among female respondents of Punjab and Uttarakhand

Dimensions of spiritual intelligence	Females (n_1=180)					
	Punjab (n_{1a}=90)			Uttarakhand (n_{1b}=90)		
	Dimensions of Locus of control					
	Powerful others	Chance control	Individual control	Powerful others	Chance control	Individual control
Benevolence	-.584**	-.447**	.876**	-.246*	-.070	.395**
Modesty	-.474**	-.440**	.614**	-.214*	-.108	.403**
Conviction	-.194	-.276**	.380**	-.376**	-.098	.430**
Compassion	-.494**	-.371**	.746**	-.140	-.191	.368**
Magnanimity	-.502**	-.453**	.718**	-.181	-.122	.436**
Optimism	-.314**	-.180	.300**	-.381**	-.204	.179
Overall Spiritual intelligence	-.600**	-.505**	.873**	-.333**	-.154	.536**

*p≤0.05; **p≤0.01

Table 4: Correlation analysis of various dimensions of spiritual intelligence and locus of control among male respondents of Punjab and Uttarakhand

Dimensions of spiritual intelligence	Males (n_1=180)					
	Punjab (n_{1a}=180)			Uttarakhand (n_{1b}=180)		
	Dimensions of Locus of control					
	Powerful others	Chance control	Individual control	Powerful others	Chance control	Individual control
Benevolence	-.542**	-.125	.499**	-.333**	-.207*	.568**
Modesty	-.258*	-.249*	.345**	-.331**	-.305**	.657**
Conviction	-.290**	-.112	.212*	-.152	-.357**	.062
Compassion	-.356**	-.226*	.399**	-.117	-.077	.165
Magnanimity	-.391**	-.287**	.331**	-.229*	-.043	.263*
Optimism	-.243*	-.199	.083	-.158	-.234*	.094
Overall Spiritual intelligence	-.554**	-.261*	.541**	-.366**	-.232*	.682**

*p≤0.05; **p≤0.01

r=-0.108, conviction r=-0.098, compassion r=-0.191, magnamity r=-0.122, optimism r=-0.204) and overall spiritual intelligence (r=-0.154). Thus, females who had high chance control of locus of control were low in spiritual intelligence.

On contrary to this, females of Punjab and Uttarakhand (except optimism r= 0.179) showed a significant positive correlation with individual control and dimensions of spiritual intelligence and overall spiritual intelligence (r=0.536; p≤0.01). This means females of Punjab and Uttarakhand whose more locus of control was individual control had more spiritual intelligence.

Thus, it could be concluded that youth with high spiritual intelligence believed that their successes or failures are the result of the effort and hard work they made, whereas, youth with low spiritual intelligence have perception that their success or failures are the consequences from external factor which are beyond their control.

Data presented in the Table 4 depicted correlation analysis of various dimensions spiritual intelligence and locus of control among male respondents of Punjab and Uttarakhand. In respect to Punjab males, dimensions of spiritual intelligence i.e. benevolence (r=-0.542; p≤0.01), modesty (r=-0.258; p≤0.05), conviction

(r=-0.290; p≤0.01), compassion (r=-0.356; p≤0.01), magnanimity (r=-0.391; p≤0.01), optimism (r=-0.243; p≤0.05) and overall spiritual intelligence (r=-0.554; p≤0.01) had a significant negative correlation with powerful others. Similarly, Uttarakhand males, showed a significant negative relation with powerful control and benevolence (r=-0.333; p≤0.01), modesty (r=-0.331; p≤0.01), magnanimity (r=-0.229; p≤0.05) and overall spiritual intelligence (r=-0.366; p≤0.01). Leftover dimensions i.e. conviction (r=-0.152), compassion (r=-0.117) and optimism (r=-0.158) also showed a negative correlation with chance control. Thus, result can be deducted as males of Punjab and Uttarakhand who had high powerful others locus of control their spiritual intelligence tended to be low or vice versa.

Chance control showed a negative relation between all the dimensions of spiritual intelligence and overall spiritual intelligence (r=-0.261; p≤0.01). Modesty (r=-0.249; p≤0.05), compassion (r=-0.226; p≤0.05), magnanimity (r=-0.287; p≤0.01) showed a significant negative correlation with chance control, whereas, benevolence (r=-0.125), conviction (r=-0.112), and optimism (r=-0.199) also showed negative correlation without significant relation. Similarly, Uttarakhand males, also showed a negative significant relation between chance control and dimensions of spiritual intelligence (benevolence, modesty, conviction, optimism) and overall spiritual intelligence. On the other side, males from Punjab showed a significant correlation in individual control and all the dimensions of spiritual intelligence except optimism (r=.083) which wasn't significant but had positive relation. Like-wise males of Uttarakhand, also showed significant positive relation between dimensions of spiritual intelligence except conviction (r=0.062) and compassion (r=0.165) which were not significant but had positive correlation.

The result can be concluded as spiritual intelligence has relationship with internal and external locus of control. Youth who scored low on spiritual intelligence supposed that fate, luck and circumstances have control over the events that influence their lives, whereas, youth with high spiritual intelligence are more likely to take responsibility for their actions.

CONCLUSION

Locus of control relates to the extend to which people believe they have influence over events that impact them, while spiritual intelligence refers to the ability to interact with problems of meaning and worth in order to solve them. Spiritual intelligence is a significant factor that influences personal development. This study contributes to the understanding of the relationship between spiritual intelligence and internal and external locus of control. Youth with high spiritual intelligence believed that their triumphs and failures were the product of their hard work and effort, whereas youth with low spiritual intelligence believed that their successes and failures were the result of external factors beyond their control. Making balance and performing well in the face of stress and turmoil is more crucial in the education sector for the students' overall growth.

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Research Article

Genetic Characterization and Association Analysis of Carrot (*Daucus carota* L.) Germplasm for Crop Enhancement and Sustainable Agriculture

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ABSTRACT

In the year 2021 and 2022, fifty-two elite carrot lines were tested using an augmented block design in the Vegetable Experimental Farm, Division of Vegetable Science, SKUAST-Kashmir, Shalimar, India. Data was collected on plant height (cm), leaf length (cm), leaf width (cm), petiole length (cm), root length (cm), root diameter (cm), average root weight (g), days to first root harvest, days to last root harvest, and root yield per hectare hectare^{-1} (q). The phenotypic and genotypic variances and the coefficients of variation for phenotypic, genotypic, and environmental factors were determined using the mean values. In addition, bsH and GAM for each trait were computed. Notably, significant variations were observed across all the measured characteristics. Root yield per hectare was found positively correlated with plant height, leaf length, leaf width, root length, root diameter, and average weight of roots. The coefficient of variation was low for all the traits, ranging from 0.054 to 0.383 during the *rabi* season 2021 and 0.053 to 0.381 during the *rabi* season 2022, respectively. PCV was slightly greater than GCV, and there was a higher heritability along with a substantial GAM. Additionally, the genotypic correlation coefficients were higher than their phenotypic counterparts, indicating that additive genetic factors played a significant role on the observed genetic associations, while environmental effects had minimal impact. In conclusion, the genotypes examined in this study exhibited valuable traits, suggesting that they should be included in breeding programs aiming at developing high-yielding superior carrot varieties suitable for crop enhancement and sustainable agriculture.

Keywords: Elite lines, Phenotypic and genotypic variances, Correlation, Heritability, Genetic Advance, Additive genes, Crop enhancement, Sustainable agriculture

INTRODUCTION

The carrot (*Daucus carota* L.) is a prominent cool-season vegetable crop belonging to the Apiaceae family. It holds immense agricultural significance and is extensively cultivated across the world. Carrot is a cool-season crop with flexible sowing times depending on the climate zone. It can be sown in temperate regions during the spring, while in subtropical areas, the ideal sowing time is in the autumn or winter. The earliest cultivated carrots' geographical origin and precise time frame remain uncertain. However, according to the research by Savage (Savage *et al.,* 1994), Asia Minor and the inner Asiatic regions are considered potential centers of origin for cultivated carrots. Afghanistan is believed to be the primary center of carrot diversity, suggesting that this region played a crucial role in the early domestication and development of different carrot

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varieties. Subsequently, Turkey is recognized as the second center of carrot diversity, signifying its historical importance in the cultivation and evolution of carrots (Stolarczyk and Janick, 2011).

In spite of the considerable amount of research focused on enhancing carrot growth and utilizing heterosis to its fullest potential, the root yield per hectare of carrots in temperate regions still falls short compared to what can be achieved in tropical areas. This situation underscores the necessity for a persistent and ongoing process of choosing carrot varieties with greater root yield per hectare.

Enhancing the genetics of a crop relies on the abundance of genetic variation inherent to the crop species. Sufficient variability offers a range of choices from which to select for improvement and potential hybridization. Assessing the correlations between genotypes has proven to be a valuable method for understanding the connections among different agricultural traits within genetically diverse populations, leading to more effective advancements in crop enhancement (Bello *et al.,* 2006). Binodh *et al.* (2008) highlighted the significance of comprehending the associations between characteristics, as this knowledge accelerates selecting desirable traits for rapid and efficient crop improvement.

The concept of heritability is based on the idea that individuals who are more closely related are likely to share more similarities compared to those who are more distantly related (Falconer and Mackay, 1996). Broad-sense heritability captures the proportion of phenotypic variation due to genetic values that may include effects due to dominance and epistasis. On the other hand, narrow-sense heritability captures only that proportion of genetic variation that is due to additive genetic values (VA). Estimating heritability is valuable for breeders, as it helps them allocate resources effectively for selecting desired traits and achieving maximum genetic improvement with limited time and resources (Smalley *et al.,* 2004). Various methods exist for calculating heritability, such as broad-sense estimates conducted on individual plants, single plots, or the mean of various entries (Nyquist, 1991). Smalley *et al.* (2004) reported that parent-offspring regression analysis has been used to determine the heritability of both plants and animals.

Genetic advance illustrates the extent of progress achieved in a particular trait when subjected to specific selection pressures. A high genetic advance, especially in conjunction with high heritability estimates, creates an optimal scenario for selection. Additionally, it suggests that the characteristic contains additive genes, and choosing such features could result in consistent crop improvements. Thus, considering heritability estimates along with genetic advance is more reliable and significant than analysing the parameters separately (Nwangburuka and Denton, 2012).

In the face of growing competition for carrot cultivation, a consistent enhancement of carrot traits is essential. This can be accomplished by effectively choosing appropriate parent materials with substantial genetic diversity. The primary aim of the current study was to assess the genetic diversity, genetic associations, heritability, and anticipated genetic advance in elite carrot lines. Additionally, the study aimed to determine appropriate selection criteria for guiding future breeding efforts.

MATERIALS AND METHODS

The current study was carried out at Vegetable Experimental Farm, Division of Vegetable Science, SKUAST-Kashmir, Shalimar, India during *rabi* season, 2021 and 2022. A collection of 52 superior carrot lines was procured from various sources: Division of Vegetable Science, SKUAST-K; different regions within Jammu and Kashmir (local germplasm); ICAR-NBPGR in Pusa, New Delhi; and the Nordic Genetic Resource Centre in Sweden. The origin of these inbred lines is detailed in Table 1 and Figure 1. The seeds of these elite lines were sown using an Augmented Block Design, with a spacing of 45 cm between ridges and 15 cm between individual plants on ridges. As per the recommendations provided by SKUAST-K, conventional agricultural practices were followed for field upkeep and harvesting.

Data was taken for various parameters, including plant height (cm), leaf length (cm), leaf width (cm), petiole length (cm), root length (cm), root diameter (cm), average weight of roots (g), days to first root harvest, days to last root harvest, and root yield per hectare per hectare (q).

Plant height was measured using a meter scale, starting from the crown end of the root up to the tip

Table 1: Name of the elite carrot lines along with their sources

S. No.	Genotypes	Source
1.	SKAU-C-1	Ganderbal district, J&K
2.	SKAU-C-2	Ganderbal district, J&K
3.	SKAU-C-3	Ganderbal district, J&K
4.	SKAU-C-4	Baramulla district, J&K
5.	SKAU-C-5	Ganderbal district, J&K
6.	SKAU-C-6	Ganderbal district, J&K
7.	SKAU-C-7	Ganderbal district, J&K
8.	SKAU-C-8	Ganderbal district, J&K
9.	SKAU-C-9	Pulwama district, J&K
10.	SKAU-C-10	Pulwama district, J&K
11.	SKAU-C-11	Shopian district, J&K
12.	SKAU-C-12	Budgam district, J&K
13.	SKAU-C-13	ICAR-NBPGR, Pusa, New Delhi
14.	SKAU-C-14	ICAR-NBPGR, Pusa, New Delhi
15.	SKAU-C-15	ICAR-NBPGR, Pusa, New Delhi
16.	SKAU-C-16	ICAR-NBPGR, Pusa, New Delhi
17.	SKAU-C-17	SKUAST-K
18.	SKAU-C-18	SKUAST-K
19.	SKAU-C-19	SKUAST-K
20.	SKAU-C-20	SKUAST-K
21.	SKAU-C-21	SKUAST-K
22.	SKAU-C-22	SKUAST-K
23.	SKAU-C-23	SKUAST-K
24.	SKAU-C-24	SKUAST-K
25.	SKAU-C-25	IIVR, Varanasi, UP
26.	SKAU-C-26	SKUAST-K
27.	SKAU-C-27	SKUAST-K
28.	SKAU-C-28	SKUAST-K
29.	SKAU-C-29	SKUAST-K
30.	SKAU-C-30	SKUAST-K
31.	SKAU-C-31	SKUAST-K
32.	SKAU-C-32	SKUAST-K
33.	SKAU-C-33	SKUAST-K
34.	SKAU-C-34	SKUAST-K
35.	SKAU-C-35	SKUAST-K
36.	SKAU-C-36	SKUAST-K
37.	SKAU-C-37	SKUAST-K
38.	SKAU-C-38	SKUAST-K
39.	SKAU-C-39	SKUAST-K
40.	SKAU-C-40	SKUAST-K
41.	SKAU-C-41	SKUAST-K
42.	SKAU-C-42	SKUAST-K
43.	SKAU-C-43	SKUAST-K
44.	SKAU-C-44	SKUAST-K
45.	SKAU-C-45	SKUAST-K
46.	SKAU-C-46	SKUAST-K
47.	SKAU-C-47	Nordic Genetic Resource Centre, Sweden
48.	SKAU-C-48	Nordic Genetic Resource Centre, Sweden
49.	SKAU-C-49	Nordic Genetic Resource Centre, Sweden
50.	SKAU-C-50	Nordic Genetic Resource Centre, Sweden
51.	CHECK-1 (Chamman)	SKUAST-K
52.	CHECK-2 (Shalimar Carrot-1)	SKUAST-K

of the leaf. To measure leaf length, a meter scale was employed, spanning from the leaf's base to its tip. A meter scale was also used for leaf width, petiole length, and root length. The root diameter was measured at the middle portion of the root using a vernier caliper. Calculating the average root weight involved the following formula:

Average root weight = Total root weight of 5 sampled roots/total no. of sampled roots.

Days to the first and last root harvest were determined by calculating the duration between the date of sowing and the date of the initial and final harvest of marketable roots in the chosen plants. The root yield per hectare per hectare was computed by multiplying the average fruit yield per plant (grams) with the total number of plants per hectare and then converting the result to quintals per hectare.

Using the SPAD (Statistical Package for Augmented Design) software, which was developed by IASRI, New Delhi, the collected data from both the years (2021 and 2022) was subjected to Analysis of Variance (ANOVA). Significant means were compared using the least significant difference at $P \leq 0.05$ and $P \leq 0.01$ significance levels. Prior to conducting ANOVA, the data underwent transformation. Phenotypic ($\delta^2 p$) and genotypic ($\delta^2 g$) variances were calculated following the method outlined in (Ogunniyan

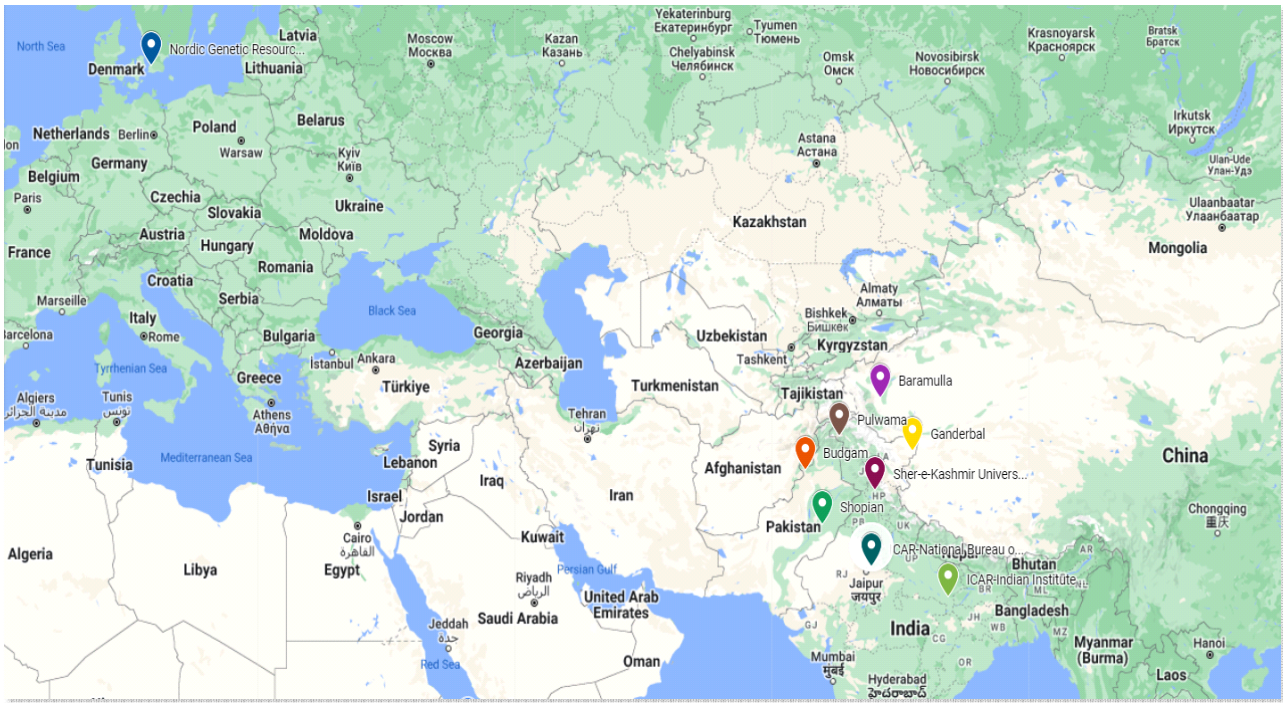

Figure 1: Location of the sources of fifty-two diverse elite carrot lines

and Olakojo, 2014). $\delta^2g = MSp - MSe/r$, $\delta^2p = MSg/r$, and $\delta^2e = MSe/r$, Where *MSp, MSg,* and *MSe* are the mean squares of phenotypes, genotypes, and error, respectively, and "r" represents the number of replications.

To facilitate genetic analysis, the mean values were employed to determine the phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) following the approach outlined by Singh and Chaudhury (Hill *et al.,* 1978): GCV (%) = $\sqrt{\delta^2g}/x \times 100$, and PCV (%) = $\sqrt{\delta^2p}/x \times 100$. Here, δ^2g represents the genotypic variance, δ^2p represents the phenotypic variance, and x denotes the sample mean. The estimation of the broad sense heritability (bsh^2) for each trait followed the procedure detailed by Falconer (Falconer and Mackay 1996): Broad-sense heritability (bsH^2) = δ^2g / δ^2p, *w*here δ^2g represents the genotypic variance and δ^2p stands for the phenotypic variance. The calculation of the expected genetic advance percent of the mean was conducted in line with the method presented by Shukla et al. (Shukla *et al.,* 2006): Expected Genetic Advance (%) = $(k.\ \delta^2g)/\mu \times 100$, where k represents the standardized selection differential constant (2.06) at a 5% selection intensity, δ^2g is the phenotypic standard deviation, and h^2 signifies the broad sense heritability.

RESULTS

Analysis of Variance (ANOVA) for various quantitative traits in the elite lines of carrot: The analysis of variance results, as presented in Tables 2, 3, 4, and 5, indicated the presence of statistically significant variations in all the studied characteristics. The Block effect (unadjusted), i.e., the Block ignoring Treatments was found highly significant for all the traits. However, the adjusted Block effects, i.e., the Block eliminating Treatments, exhibited minimal and non-significant values for all the traits. The treatment effects, whether adjusted, i.e., Treatment (eliminating Blocks) or unadjusted, i.e., Treatment (ignoring Blocks), showed high significance across all the traits. Additionally, the effects attributed to the reference checks and the applied treatments were also found to be statistically significant. Furthermore, the mean sum of squares resulting from the treatment versus check comparison was significant for all traits.

Variation in the quantitative traits of elite lines of carrot: Tables 6 and 7 present a comprehensive summary of key statistical parameters for ten different characteristics of carrot lines for the years 2021 and 2022. These parameters include mean values, range, minimum and maximum values, standard deviation,

Table 2: Analysis of Variance with respect to Mean Sum of Squares (MSS) for various quantitative traits in carrot (*Daucus* spp.) during the *Rabi* season 2021 (Treatment Adjusted)

S. No.	Source of variation	d.f	Mean Sum of Squares									
			Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Petiole length (cm)	Root length (cm)	Root diameter (mm)	Average root weight(g)	Days to first root harvest	Days to last root harvest	Root yield hectare^{-1} (q)
1.	Block (ignoring Treatments)	4	82.90 **	33.14 **	14.17 **	52.66 **	35.94 **	2.39 **	1759.18 **	105.89 **	102.80 **	30541.28 **
2.	Treatment (eliminating Blocks)	51	46.48 **	22.67 **	8.52 **	17.41 **	13.76 **	0.58 **	467.60 **	23.37 **	21.55 **	8118.04 **
3.	Treatment: Check	1	135.06 **	82.08 **	6.97 **	6.56 **	6.40 **	0.62 **	2560.00 **	243.54 **	211.14 **	44444.44 **
4.	Treatment: Test and Test vs. Check	50	44.71 **	21.48 **	8.55 **	17.62 **	13.91 **	0.57 **	425.75 **	18.97 **	17.76 **	7391.51 **
5.	Residuals	4	3.3e^{-28}	1.0e^{-28}	6.7e-^{29}	4.0e^{-29}	5.4e^{-29}	1.9e^{-29}	4.3e^{-27}	4.1e^{-27}	3.5e^{-29}	5.2e^{-26}

**Significant at 1% probability level

Table 3: Analysis of Variance with respect to Mean Sum of Squares (MSS) for various quantitative traits in carrot (*Daucus* spp.) during the *Rabi* season 2021 (Block Adjusted)

S. No.	Source of variation	d.f	Mean Sum of Squares									
			Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Petiole length (cm)	Root length (cm)	Root diameter (mm)	Average root weight(g)	Days to first root harvest	Days to last root harvest	Root yield hectare^{-1} (q)
1.	Treatment (ignoring Blocks)	51	52.98 **	25.27 **	9.63 **	21.54 **	16.58 **	0.76 **	605.57 **	31.68 **	29.62 **	4838.44 **
2.	Treatment: Check	1	135.06 **	82.08 **	6.97 **	6.56 **	6.40 **	0.62 **	2560.00 **	243.54 **	211.14 **	985.06 **
3.	Treatment: Test vs. Check	1	54.84 **	15.30 **	12.69 **	12.20 **	11.98 **	5.14 **	9.01 **	18.16 **	19.59 **	37776.17 **
4.	Treatment: Test	49	51.27 **	24.31 **	9.62 **	22.03 **	16.88 **	0.68 **	577.86 **	27.63 **	26.12 **	4244.89 **
5.	Block (eliminating Treatments)	4	8.1e^{-29}	1.6e^{-28}	4.3e^{-29}	4.7e^{-29}	8.9e^{-30}	2.8e^{-29}	1.6e^{-27}	3.5e^{-27}	1.8e^{-30}	2.9e^{-26}
6.	Residuals	4	6.0e^{-29}	1.6e^{-28}	7.9e^{-29}	3.1e^{-29}	2.2e^{-29}	3.3e^{-29}	3.4e^{-28}	4.7e^{-27}	7.2e^{-29}	4.7e^{-26}

**Significant at 1% probability level

Table 4: Analysis of Variance with respect to Mean Sum of Squares (MSS) for various quantitative traits in carrot (*Daucus* spp.) during the *Rabi* season 2022 (Treatment Adjusted)

S. No.	Source of variation	d.f	Mean Sum of Squares									
			Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Petiole length (cm)	Root length (cm)	Root diameter (mm)	Average root weight(g)	Days to first root harvest	Days to last root harvest	Root yield hectare^{-1} (q)
1.	Block (ignoring Treatments)	4	66.94 **	39.01 **	7.37 **	65.03 **	38.82 **	0.96 **	1759.18 **	108.29 **	106.71 **	26351.27 **
2.	Treatment (eliminating Blocks)	51	43.94 **	19.34 **	8.98 **	17.82 **	16.22 **	0.35 **	467.60 **	18.71 **	17.54 **	9886.15 **
3.	Treatment: Check	1	242.56 **	82.08 **	6.97 **	42.44 **	6.40 **	0.62 **	2560.00 **	5.26 **	13.46 **	945.22 **
4.	Treatment: Test and Test vs. Check	50	39.97 **	18.09 **	9.02 **	17.33 **	16.42 **	0.34 **	425.75 **	18.98 **	17.62 **	10064.97 **
5.	Residuals	4	2.1e^{-27}	2.5e^{-29}	2.7e^{-29}	2.6e^{-28}	7.1e^{-29}	3.9e^{-30}	3.7e^{-28}	7.5e^{-28}	6.4e^{-28}	9.2e^{-27}

**Significant at 1% probability level

Table 5: Analysis of Variance with respect to Mean Sum of Squares (MSS) for various quantitative traits in carrot (*Daucus* spp.) during the *Rabi* season 2022 (Block Adjusted)

S. No.	Source of variation	d.f	Mean Sum of Squares									
			Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Petiole length (cm)	Root length (cm)	Root diameter (mm)	Average root weight(g)	Days to first root harvest	Days to last root harvest	Root yield hectare^{-1} (q)
1.	Treatment (ignoring Blocks)	51	49.19 **	22.40 **	9.56 **	22.92 **	19.27 **	0.42 **	605.57 **	27.21 **	25.91 **	11952.92 **
2.	Treatment: Check	1	242.56 **	82.08 **	6.97 **	42.44 **	6.40 **	0.62 **	2560.00 **	5.26 **	13.46 **	945.22 **
3.	Treatment: Test vs. Check	1	7.92 **	0.06 **	0.02 **	9.37 **	32.15 **	0.01 **	9.01 **	28.15 **	29.67 **	140833.33 **
4.	Treatment: Test	49	46.08 **	21.64 **	9.81 **	22.80 **	19.27 **	0.43 **	577.86 **	27.64 **	26.09 **	9547.35 **
5.	Block (eliminating Treatments)	4	1.4e^{-27}	2.0e^{-29}	1.0e^{-29}	3.3e^{-28}	1.7e^{-29}	1.3e^{-30}	2.6e^{-28}	8.0e^{-28}	6.4e^{-28}	4.5e^{-26}
6.	Residuals	4	1.3e^{-27}	7.1e^{-29}	5.2e^{-30}	3.5e^{-28}	8.6e^{-30}	2.2e^{-30}	1.5e^{-27}	7.4e^{-28}	5.9e^{-28}	2.3e^{-26}

**Significant at 1% probability level

Table 6: Mean values, range, minimum, maximum, standard deviation, standard error of mean, variance, coefficient of variation, and coefficient of dispersion of various quantitative traits in carrot (Daucus spp.) during the *Rabi* season 2021

S.No.	Trait	Mean	Range	Minimum	Maximum	Standard Deviation (SD)	Standard Error of Mean (SEM)	Variance (σ^2)	Coefficient of Variation (COV)	Coefficient of Dispersion (COD)
1.	Plant Height (cm)	40.44	34.10	23.82	57.92	7.07	0.98	50.04	0.175	0.145
2.	Leaf length (cm)	21.24	24.34	8.27	32.61	4.87	0.68	23.75	0.229	0.176
3.	Leaf width (cm)	14.48	13.50	7.53	21.03	3.05	0.42	9.33	0.211	0.156
4.	Petiole length (cm)	18.85	20.60	9.33	29.93	4.61	0.64	21.25	0.244	0.194
5.	Root length (cm)	21.67	17.62	13.03	30.65	4.04	0.56	16.30	0.186	0.139
6.	Root diameter (cm)	3.48	3.45	1.73	5.18	0.82	0.11	0.68	0.237	0.173
7.	Average root weight (g)	62.00	82.00	15.33	97.33	23.78	3.30	565.27	0.383	0.298
8.	Days to first root harvest	88.98	20.55	78.12	98.67	5.25	0.73	27.58	0.059	0.052
9.	Days to last root harvest	95.26	19.87	84.80	104.67	5.10	0.71	26.01	0.054	0.047
10.	Root yield hectare^{-1} (q)	258.33	341.67	63.89	405.56	99.07	13.74	9814.05	0.383	0.298

* C.D ($P \leq 0.05$)

Table 7: Mean values, range, minimum, maximum, standard deviation, standard error of mean, variance, coefficient of variation, and coefficient of dispersion of various quantitative traits in carrot (Daucus spp.) during the Rabi season 2022

S.No.	Trait	Mean	Range	Minimum	Maximum	Standard Deviation (SD)	Standard Error of Mean (SEM)	Variance (σ^2)	Coefficient of Variation (COV)	Coefficient of Dispersion (COD)
1.	Plant height (cm)	40.35	31.22	26.51	57.73	6.73	0.93	45.26	0.167	0.140
2.	Leaf length (cm)	21.29	22.03	9.71	31.74	4.59	0.64	21.11	0.216	0.174
3.	Leaf width (cm)	14.48	14.16	7.67	21.83	3.07	0.43	9.45	0.212	0.155
4.	Petiole length (cm)	18.71	20.60	10.58	31.18	4.70	0.65	22.11	0.251	0.201
5.	Root length (cm)	22.16	18.85	12.30	31.15	4.32	0.60	18.68	0.195	0.159
6.	Root diameter (cm)	3.40	2.48	2.23	4.71	0.65	0.09	0.42	0.191	0.163
7.	Average root weight (g)	62.33	82.00	15.67	97.67	23.78	3.30	565.28	0.381	0.297
8.	Days to first root harvest	88.63	22.21	76.12	98.33	5.17	0.72	26.70	0.058	0.044
9.	Days to last root harvest	95.02	21.53	82.80	104.33	5.02	0.70	25.25	0.053	0.040
10.	Root yield hectare^{-1} (q)	259.72	341.66	65.28	406.94	99.07	13.74	9813.96	0.381	0.297

* C.D ($P \leq 0.05$)

standard error, variance, coefficient of variation, and coefficient of dispersion.

The mean values for plant height (cm), leaf length (cm), leaf width (cm), petiole length (cm), root length (cm), root diameter (cm), average weight of roots (g), days to first root harvest, days to last root harvest, and root yield per hectare per hectare (q) were 40.44 and 40.35; 21.24 and 21.29; 14.48 and 14.48; 18.85 and 18.71; 21.67 and 22.16; 3.48 and 3.40; 62.00 and 62.33; 88.98 and 88.63; 95.26 and 95.02; and 258.33 and 259.72 for the years 2021 and 2022, respectively. The coefficient of variation was low for all the traits, ranging from 0.054 (days to last root harvest) to 0.383 (root yield) during the *Rabi* season 2021 and 0.053 (days to last root harvest) to 0.381 (root yield) during the *Rabi* season 2022, respectively. Additionally, standard errors were consistently low across all the traits except for root yield per hectare indicating that the sample means are closely distributed around the population mean and are the representative of the whole population (Figure 2 and 3). Singh *et al.* (2019) and Kumar *et al.* (2022) documented comparable findings.

Association analysis of various quantitative traits in the 52 elite lines of carrot: Correlation coefficients between pairs of traits are shown in Tables 8 and 9. All the characters that had a significant phenotypic association with each other also showed significant genotypic relationships except for plant height and root length and root diameter in both the seasons; petiole length and root length, petiole length and days to first and last root harvest during the *Rabi* season 2021; plant height and leaf weight, leaf length and days to first and last root harvest, leaf weight and petiole length, petiole length and root length and root diameter, root diameter and days to first and last root harvest during the *rabi* season 2022.

The traits that did not exhibit a significant relationship with each other were plant height with average root weight, days to first root harvest, days to last root harvest and root yield per hectare, leaf length with petiole length, average root weight with days to first and last root harvest, root yield per hectare with days to first and last root harvest in both the seasons; leaf weight with petiole length, petiole length with root diameter; root diameter with days to first and last root harvest, during the *rabi* season 2021; petiole length with

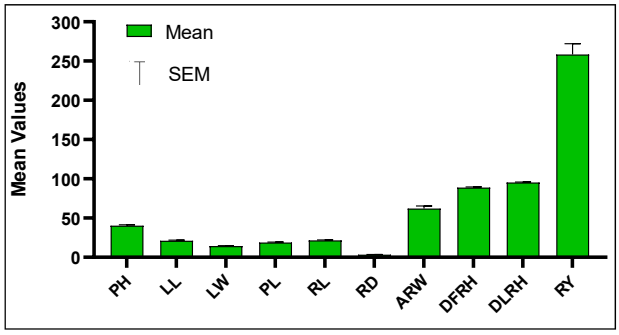

Figure 2: Mean Value along with Standard Error of Mean of plant height (cm), leaf length (cm), leaf width (cm), petiole length (cm), root length (cm), root diameter (cm), average weight of roots (g), days to first root harvest, days to last root harvest, and root yield per hectare per hectare (q) for the year 2021.

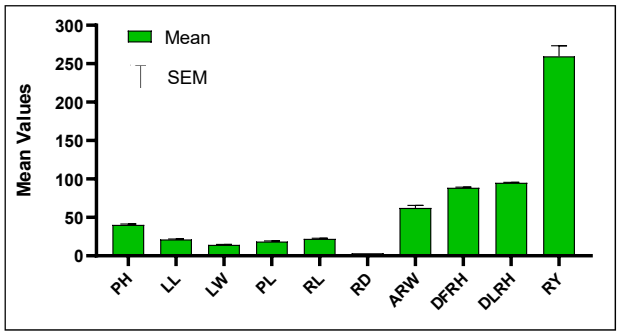

Figure 3: Mean value along with Standard Error of Mean of plant height (cm), leaf length (cm), leaf width (cm), petiole length (cm), root length (cm), root diameter (cm), average weight of roots (g), days to first root harvest, days to last root harvest, and root yield per hectare per hectare (q) for the year 2022.

days to first and last root harvest, root length with days to first and last root harvest, during the *rabi* season 2022.

Plant height and leaf length were positively correlated with all the parameters except for the days to first root harvest and days to last root harvest. Except for petiole length, days to first root harvest, and days to last root harvest, leaf weight exhibited a positive correlation with all variables. Petiole length showed a positive correlation with all the traits except for leaf weight, root length, root diameter, average root weight and root yield per hectare. Root length and root diameter showed a positive correlation with all the traits except for petiole length, days to first root harvest and days to last root harvest. Average root weight showed a positive correlation with all the characteristics except for petiole length, days to first root harvest and days

Table 8: Phenotypic and genotypic Correlation Coefficients among different quantitative traits in carrot (*Daucus* spp.) during the *Rabi* season 2021

Character	Attribute	LL	LW	PL	RL	RD	ARW	DFRH	DLRH	RY
PH	P	0.753 **	0.333 **	0.721 **	0.183 *	0.249 **	0.075	-0.046	-0.052	0.077
	G	0.762 **	0.341 *	0.729 **	**0.186**	**0.297**	0.077	-0.055	-0.060	0.077
LL	P		0.564 **	0.111	0.506 **	0.453 **	0.397 **	-0.295 **	-0.291 **	0.395 **
	G		0.570 **	0.112	0.514 **	0.473 **	0.398 **	-0.313 *	-0.312 *	0.398 **
LW	P			-0.077	0.729 **	0.398 **	0.438 **	-0.245 **	-0.246 **	0.437 **
	G			-0.079	0.738 **	0.442 **	0.441 **	-0.264 *	-0.264 *	0.441 **
PL	P				-0.255 **	-0.094	-0.300 **	0.231 **	0.219 **	-0.301 **
	G				**-0.257**	-0.045	-0.302 *	**0.247**	**0.238**	-0.302 *
RL	P					0.430 **	0.319 **	-0.338 **	-0.342 **	0.319 **
	G					0.455 **	0.321 *	-0.360 **	-0.368 **	0.321 *
RD	P						0.548 **	-0.042	-0.043	0.547 **
	G						0.556 **	-0.107	-0.106	0.556 **
ARW	P							-0.103	-0.102	0.997 **
	G							-0.113	-0.107	1.000 **
DFRH	P								0.866 **	-0.106
	G								0.998 **	-0.113
DLRH	P									-0.098
	G									-0.107

Table 9: Phenotypic and genotypic Correlation Coefficients among different quantitative traits in carrot (*Daucus* spp.) during the *Rabi* season 2022

Character	Attribute	LL	LW	PL	RL	RD	ARW	DFRH	DLRH	RY
PH	P	0.706 **	0.189 *	0.722 **	0.165 *	0.159 *	0.013	-0.115	-0.092	0.075
	G	0.716 **	**0.192**	0.731 **	**0.166**	**0.161**	0.013	-0.118	-0.103	0.076
LL	P		0.522 **	0.046	0.495 **	0.460 **	0.368 **	-0.187 *	-0.187 *	0.424 **
	G		0.527 **	0.047	0.501 **	0.465 **	0.370 **	**-0.197**	**-0.201**	0.426 **
LW	P			-0.239 **	0.610 **	0.327 **	0.411 **	-0.311 **	-0.322 **	0.493 **
	G			**-0.241**	0.615 **	0.331 *	0.413 **	-0.328 *	-0.343 **	0.496 **
PL	P				-0.251 **	-0.222 **	-0.342 **	0.026	0.047	-0.305 **
	G				**-0.252**	**-0.224**	-0.343 *	0.024	0.049	-0.307 *
RL	P					0.283 **	0.368 **	-0.111	-0.110	0.461 **
	G					0.286 *	0.371 **	-0.117	-0.125	0.465 **
RD	P						0.333 **	-0.183 *	-0.177 *	0.481 **
	G						0.336 *	**-0.200**	**-0.195**	0.484 **
ARW	P							-0.060	-0.044	0.789 **
	G							-0.060	-0.049	0.792 **
DFRH	P								0.879 **	-0.030
	G								0.997 **	-0.033
DLRH	P									-0.035
	G									-0.039

to last root harvest. Days to first root harvest showed a negative correlation with all the traits except for petiole length and days to last root harvest. Days to last root harvest showed a negative correlation with all the characteristics except for petiole length and days to first root harvest. Root yield per hectare showed a positive correlation with all the traits except for petiole length, days to first root harvest and days to last root harvest.

Genetic Characterization of various quantitative traits in the 52 elite lines of carrot: Tables 10 and 11 provide information regarding phenotypic, genotypic, and environmental variances, along with their respective coefficients of variation for both seasons. Likewise, Tables 12 and 13 display data on heritability, genetic advance, and genetic advance as a percent of the mean for both seasons.

The genotypic variances are almost identical to their phenotypic variances, with slightly higher phenotypic coefficients of variation, resulting in very low or negligible environmental variances (Figure 4 and 5). The coefficients of variation for phenotype and genotype were notably high for several traits, including leaf length, leaf width, petiole length, root diameter, average root weight, and root yield per hectare. Plant height and root length exhibited coefficients of medium variation, while days to first root harvest and days to last root harvest had low coefficients of variation.

Broad-sense heritability ranged from 80.93% (days to last root harvest) to 99.68% (average root weight) during the *Rabi* season 2021 and 80.39% (days to last root harvest) to 99.52% (average root weight) during the *Rabi* season 2022, respectively. The genetic advance as a percent of mean (GAM) ranged from 9.55% (days to last root harvest) to 78.83% (average root weight) during the *Rabi* season 2021 and 9.39% (days to last root harvest) to 78.32% (average root weight) during the *rabi* season 2022, respectively (Figure 6 and 7).

DISCUSSION

Analysis of variance (ANOVA) for various quantitative traits in the elite lines of carrot: The analysis of variance results indicated the presence of statistically significant variations in all the studied characteristics. The Block effect (unadjusted), i.e., the

Table 10: Variability of various quantitative traits in carrot (*Daucus* spp.) during the *Rabi* season 2021

S.No.	Trait	σ^2p	σ^2g	σ^2e	PCV	PCV Category	GCV	GCV Category	ECV	ECV Category
1.	Plant Height (cm)	50.86	49.62	1.245	17.63	Medium	17.42	Medium	2.76	Low
2.	Leaf length (cm)	23.91	23.68	0.229	23.02	High	22.91	High	2.25	Low
3.	Leaf width (cm)	9.43	9.28	0.155	21.21	High	21.04	High	2.72	Low
4.	Petiole length (cm)	21.42	21.16	0.256	24.55	High	24.40	High	2.68	Low
5.	Root length (cm)	16.52	16.19	0.324	18.76	Medium	18.57	Medium	2.63	Low
6.	Root diameter (cm)	0.69	0.68	0.007	23.77	High	23.64	High	2.47	Low
7.	Average root weight (g)	566.51	564.68	1.825	38.39	High	38.33	High	2.18	Low
8.	Days to first root harvest	31.54	25.61	5.930	6.31	Low	5.69	Low	2.74	Low
9.	Days to last root harvest	29.80	24.12	5.684	5.73	Low	5.16	Low	2.50	Low
10.	Root yield hectare^{-1} (q)	9848.33	9796.75	51.575	38.42	High	38.31	High	2.78	Low

***** σ^2p = Phenotypic Variance; σ^2g = Genotypic Variance; σ^2e = Environmental Variance; PCV = Phenotypic Coefficient of Variation (%); GCV = Genotypic Coefficient of Variation (%); and ECV = Environmental Coefficient of Variation (%).

Table 11: Variability of various quantitative traits in carrot (*Daucus* spp.) during the *Rabi* season 2022

S.No.	Trait	σ^2p	σ^2g	σ^2e	PCV	PCV Category	GCV	GCV Category	ECV	ECV Category
1.	Plant Height (cm)	46.11	44.84	1.270	16.83	Medium	16.59	Medium	2.79	Low
2.	Leaf length (cm)	21.28	21.02	0.258	21.66	High	21.53	High	2.39	Low
3.	Leaf width (cm)	9.52	9.41	0.110	21.31	High	21.19	High	2.29	Low
4.	Petiole length (cm)	22.24	22.06	0.186	25.21	High	25.10	High	2.31	Low
5.	Root length (cm)	18.85	18.60	0.257	19.59	Medium	19.46	Medium	2.29	Low
6.	Root diameter (cm)	0.42	0.42	0.007	19.16	Medium	19.01	Medium	2.41	Low
7.	Average root weight (g)	567.07	564.38	2.695	38.20	High	38.11	High	2.63	Low
8.	Days to first root harvest	30.07	25.01	5.059	6.19	Low	5.64	Low	2.54	Low
9.	Days to last root harvest	29.06	23.35	5.706	5.67	Low	5.09	Low	2.51	Low
10.	Root yield hectare^{-1} (q)	9847.58	9797.08	50.498	38.21	High	38.11	High	2.74	Low

***** σ^2p = Phenotypic Variance; σ^2g = Genotypic Variance; σ^2e = Environmental Variance; PCV = Phenotypic Coefficient of Variation (%); GCV = Genotypic Coefficient of Variation (%); and ECV = Environmental Coefficient of Variation (%).

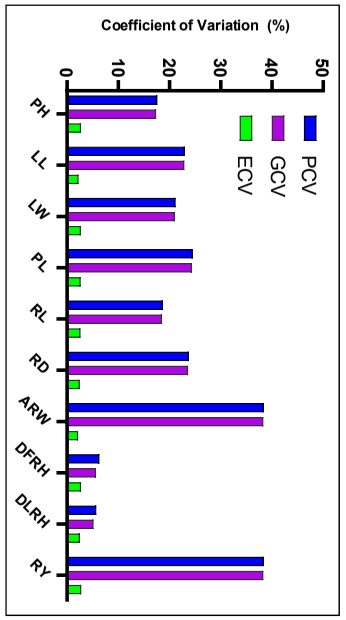

Figure 4: Coefficients of variation of plant height (cm), leaf length (cm), leaf width (cm), petiole length (cm), root length (cm), root diameter (cm), average weight of roots (g), days to first root harvest, days to last root harvest, and root yield per hectare (q) for the year 2021.

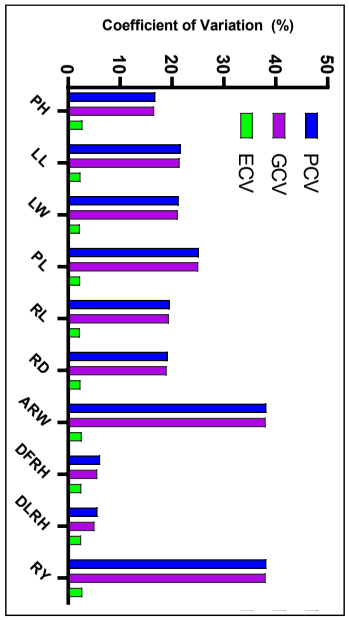

Figure 5: Coefficients of variation of plant height (cm), leaf length (cm), leaf width (cm), petiole length (cm), root length (cm), root diameter (cm), average weight of roots (g), days to first root harvest, days to last root harvest, and root yield per hectare per hectare (q) for the year 2022.

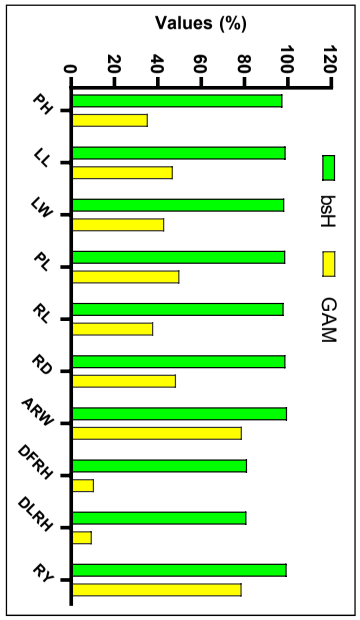

Figure 6: Broad sense heritability (bsH), and genetic advance as a percent of mean (GAM) of plant height (cm), leaf length (cm), leaf width (cm), petiole length (cm), root length (cm), root diameter (cm), average weight of roots (g), days to first root harvest, days to last root harvest, and root yield per hectare per hectare (q) for the year 2021.

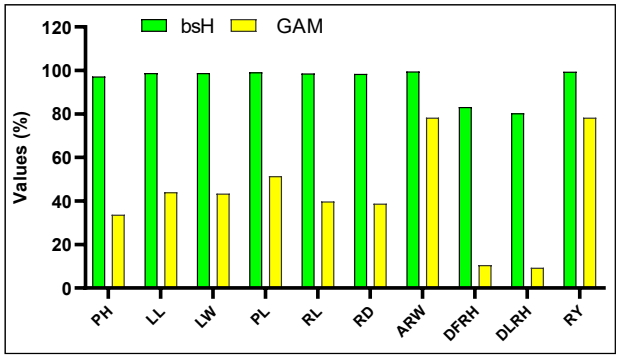

Figure 7: Broad sense heritability (bsH), and genetic advance as a percent of mean (GAM) of plant height (cm), leaf length (cm), leaf width (cm), petiole length (cm), root length (cm), root diameter (cm), average weight of roots (g), days to first root harvest, days to last root harvest, and root yield per hectare per hectare (q) for the year 2022.

Block ignoring Treatments was found highly significant for all the traits. However, the adjusted Block effects, i.e., the Block eliminating Treatments, exhibited minimal and non-significant values for all the traits suggesting a high degree of uniformity among the evaluation blocks, and greater precision of treatment effect estimates. The treatment effects, whether adjusted, i.e., Treatment (eliminating Blocks) or unadjusted, i.e., Treatment (ignoring Blocks), showed high significance across all the traits indicating that the applied treatments were heterogeneous. Furthermore, the mean sum of squares resulting from the treatment versus check comparison was significant for all traits, indicating that the test entries differed significantly from the reference checks. Similar results were reported by Kaur *et al.* (2005) and Teli *et al.* (2017).

Table 12: Broad sense heritability (bsH), genetic advance (GA), and genetic advance as percentage of mean (GAM) of various quantitative traits in carrot (*Daucus* spp.) during the *Rabi* season 2021

S.No.	Trait	Broad Sense Heritability (%)	bsH Category	Genetic Advance (GA)	Genetic Advance as per cent of Mean (GAM) %	GAM Category
1.	Plant Height (cm)	97.55	High	14.33	35.44	High
2.	Leaf length (cm)	99.04	High	9.98	46.97	High
3.	Leaf width (cm)	98.36	High	6.22	42.98	High
4.	Petiole length (cm)	98.81	High	9.42	49.96	High
5.	Root length (cm)	98.04	High	8.21	37.88	High
6.	Root diameter (cm)	98.92	High	1.69	48.43	High
7.	Average root weight (g)	99.68	High	48.87	78.83	High
8.	Days to first root harvest	81.20	High	9.39	10.56	Medium
9.	Days to last root harvest	80.93	High	9.10	9.55	Low
10.	Root yield hectare^{-1}(q)	99.48	High	203.36	78.72	High

Table 13: Broad sense heritability (bsH), genetic advance (GA), and genetic advance as percentage of mean (GAM) of various quantitative traits in carrot (*Daucus* spp.) during the *Rabi* season 2022

S.No.	Trait	Broad Sense Heritability (%)	bsH Category	Genetic Advance (GA)	Genetic Advance as per cent of Mean (GAM) %	GAM Category
1.	Plant Height (cm)	97.25	High	13.60	33.71	High
2.	Leaf length (cm)	98.79	High	9.39	44.08	High
3.	Leaf width (cm)	98.85	High	6.28	43.40	High
4.	Petiole length (cm)	99.16	High	9.63	51.49	High
5.	Root length (cm)	98.64	High	8.82	39.82	High
6.	Root diameter (cm)	98.42	High	1.32	38.85	High
7.	Average root weight (g)	99.52	High	48.82	78.32	High
8.	Days to first root harvest	83.18	High	9.40	10.60	Medium
9.	Days to last root harvest	80.36	High	8.92	9.39	Low
10.	Root yield hectare^{-1} (q)	99.49	High	203.38	78.31	High

Variation in the quantitative traits of elite lines of carrot: The coefficients of variation (CVs) calculated for the 10 agronomic characteristics of the carrot lines revealed the presence of significant variation in all of these attributes. Notably, the CVs were consistently low across all traits, indicating a high degree of uniformity among these inbred lines. This low CV can be attributed to the inbreeding process, which has led to the fixation of recessive genes and increased genetic homogeneity within the lines. Additionally, since these lines were developed with a focus on similar characteristics, this similarity likely contributed to the minimal differences observed among the lines for these traits. Furthermore, the collective variations in the standard error for each trait showed the distinctiveness of each line. The low standard errors observed across the traits suggest that the lines share a nearly identical pattern of gene actions. Consequently, this indicates the potential for selective breeding among this array of inbred lines to enhance their traits further. Singh *et al.* (2019); Kumar *et al.* (2022), and Rana *et al.* (2022) documented comparable findings.

Association analysis of various quantitative traits in the 52 elite lines of carrot: Plant height, leaf length, leaf width, root length, root diameter, average root weight and root yield showed a positive correlation. Additionally, root yield per hectare was found positively correlated with plant height, leaf length, leaf width, root length, root diameter, and average weight of roots. This suggests that when evaluating these traits, one can indirectly assess and select for root yield. Priya and Santhi (2015) and Poleshi *et al.* (2018) also found that root length, weight, and diameter were significantly and positively correlated with root yield.

Genetic characterization of various quantitative traits in the 52 elite lines of carrot: The genotypic variances are almost the same as their phenotypic variances, with slightly higher phenotypic coefficients of variation, indicating a very low or negligible role of environment in the expression of the traits under observation.

Traits, including leaf length, leaf width, petiole length, root diameter, average root weight, and root yield per hectare, recorded high phenotypic and genotypic coefficients of variation, indicating that genotypes had a broad genetic base for these characters. High coefficients of variation of phenotype and genotype for yield parameters (average root weight and root yield per hectare) encourages the use of yield parameters in selecting suitable parents for breeding or further improvement. Traits such as leaf length, leaf width, petiole length, root diameter, plant height and root length may be considered where there is need to support the yield parameters because their coefficients of variation were relatively substantial.

This was in conformity with the findings of Kaur *et al.* (2005), Priya and Santhi (2015), Teli *et al.* (2017) and Rana *et al.* (2022).

Heritability represents the proportion of phenotypic variance ascribed to genetic variance. In this particular study, it was observed that heritability was notably high, surpassing 80%, for all the traits under investigation. This high heritability signifies that environmental factors have a minimal impact on these traits, which can be effectively transmitted to the progeny, and a significant role of the genetic constitution in the expression of these traits, i.e., the variation observed is mainly under genetic control. The offspring of these lines will be exactly like their parents because there are no visible environmental effects on the expression of these characters. All the genes responsible for these traits are homozygous dominant in nature. Consequently, any of these traits can effectively serve as selection criteria due to their strong genetic base, and the selection based on phenotypic expression could be relied upon.

Teli *et al.* (2017), Chaitra *et al.* (2018), Singh *et al.* (2019), and Kumar *et al.* (2022), have also reported high heritability for different yield controlling traits in carrot.

High heritability and high genetic advance as percent of mean (GAM) was observed for all the traits except for days to first root harvest and days to last root harvest, which showed high heritability coupled with moderate and low genetic advance as percent of mean, respectively, indicating the presence of additive genes in all these traits and suggested reliable improvement through the selection of these traits.

The moderate and relatively low genetic advance as a percent of mean observed for days to first root harvest and days to last root harvest may be

compensated by their high heritability. Since high heritability does not always indicate a high genetic gain, heritability is recommended to be considered in association with genetic advance as a percent of mean. A high estimate of heritability along with high genetic gain (percent of mean) is more reliable than heritability alone for predicting the effect of selection (Johnson *et al.,* 1955). Akshaya (Akshaya *et al.,* 2022) also found that high heritability may not always be associated with large genetic advance.

CONCLUSION

The Phenotypic Coefficient of Variation (PCV) was slightly greater than the Genotypic Coefficient of Variation (GCV), and there was a higher heritability along with a substantial Genetic Advance as a percent of mean (GAM). Additionally, the genotypic correlation coefficients were higher than their phenotypic counterparts, indicating that additive genetic factors played a significant role on the observed genetic associations, while environmental effects had minimal impact. In conclusion, the genotypes examined in this study exhibited valuable traits, suggesting that they should be included in the breeding programs aiming at developing superior carrot varieties suitable for crop enhancement and sustainable agriculture.

The root yield stands as a crucial factor determining the economic viability of the hybrid or variety. Consequently, this trait should be given the utmost importance in any breeding initiative. The combination of substantial heritability and a high genetic advance as a percentage of the mean value for this trait indicates that there is a promising opportunity to identify and select high-yielding cultivars from the current pool of specimens suitable for temperate regions.

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Contribution of authors: All the authors have contributed equally.

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Research Article

Mapping the Training Needs: A Skill Gap Analysis of KVK-Extension Professionals in Haryana and Punjab

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ABSTRACT

Well-trained human resource is the backbone for the success of any extension organization. Due to the rapid changes in technology, it is necessary to update and upgrade human resource skills. Thus, this study attempted to identify the training needs of KVK Subject Matter Specialist in Haryana and Punjab. A structured questionnaire was built into an online survey and sent to SMS of 41 KVKs. Responses about general profile and training needs were received from 54.4 per cent of SMS in Haryana and 47 per cent in Punjab. These responses were collected on 3-point Likert scale. Besides descriptive statistics, Weighted Sum Method was used for training need assessment. The majority of SMS in both the states were males, had Ph.D. as their qualification. The use of ICT (0.58) in Haryana and training on managerial skills (0.59) in Punjab were the top extension-related training needs. Among Fisheries related training needs, Better Management Practices ranked first, with a score of 0.33, in Haryana and 0.24, in Punjab. The SMS with specialization other than fisheries had less interest in related training needs, stressing upon the need of allotting fisheries SMS in districts with high potential for fisheries. It is recommended to design the training as per the identified needs of SMS so that the KVK system in the country becomes more robust and client-oriented.

Keywords: Training need assessment, KVK, SMS, Haryana, Punjab

INTRODUCTION

The development of the sector cannot be achieved without an efficient and effective extension system (Koyenikan, 2008). The extension contributes to improving the welfare of farmers/fishers as extension advisory services and programs forge to strengthen the farmer's capacity to innovate by providing access to knowledge and information. The extension is crucial to support sustainable agriculture, which moves from production to a broader set of sustainability (Sallam, 1994). The quality of human resources in an agricultural extension organization determines its success or failure (Ghosh and Vijayaragavan, 2003). To be a successful extension staff, one must be competent in technical matters and areas of management, programming communication, human relations, and leadership (Graham 2009; Gonzalez, 1982). The effectiveness of extension services is also highly dependent on the ability of competent extension workers as the whole extension process is dependent on them to transfer information from extension organizations to the clients (Ali *et al.*, 2012).

The Subject Matter Specialist (SMS) is a resource person in Krishi Vigyan Kendras (KVKs) for agricultural knowledge management and information/ experience sharing with the farming community. SMSs of the KVKs must be competent to perform such multi-dimensional tasks and improve their work effectiveness, making the Indian frontline extension system more visible, vibrant, demand-driven and client-

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oriented. The capacity building of KVK professionals is crucial to increase the visibility and vibrancy of the KVK system (Patil and Kokate, 2011). Tshering *et al.* (2007) observed that the lack of technical competency by extension agents resulted in the problems of extension non-performance and ineffective delivery of services. Thus, it is necessary to identify the training needs of KVK-SMSs so that they lead to better performance delivery of extension services for sustainable rural development. This study assessed the extension and fisheries-related training needs of KVK-SMSs of Haryana and Punjab.

MATERIALS AND METHODS

The study was conducted in all the 22 KVKs of Punjab and 19 KVKs of Haryana. KVKs of Haryana come under ATARI- Jodhpur and KVKs of Punjab come under ATARI-Ludhiana. All the KVK SMS in position in these two states, were the target respondents (205). A structured questionnaire was used. The questionnaire was built into an online survey using a customised Google Form with questions about general profile, time spent, sources of information and training needs.

The online form was sent to all the KVK SMS in Haryana and Punjab through respective ATARIs and host institutes. Of the 205 SMSs, responses received were 48 (54.4%) in Haryana and 55 (47%) in Punjab. Repeated follow-up with respective Heads of KVKs and Director of Extension of Host institutes helped to obtain responses covering all the KVKs in both states. Thus, at least one response from each KVK was ensured and responses from these questionnaires were tabulated and analysed further to arrive at meaningful conclusions. The responses were collected on 3 – point Likert scale. Percentage analysis, which is a descriptive, analytical tool was mainly used in the analysis. The training needs were calculated by Weighted Sum Method for each of the thematic area identified.

WSM Score = ((Number of MP ×3) + (Number of P ×2) + (Number of LP ×1)) / (Total Number of MP+P+LP)

where (MP) Mostly Preferred, (P) Preferred and (LP) Least Preferred. The scores were then normalized.

The relationship of the general profile and perceived training needs of the SMS were determined using the Spearman rank co-efficient of correlation.

$$r = 1 - \frac{\sigma \sum d2}{n(n2 - 1)}$$

where, r = coefficient of correlation

d = differences of ranks between paired samples

n = no. of pairs of observations

Mann Whitney U test was used to test whether there was a significant difference in training need of SMS between the two states.

RESULTS AND DISCUSSION

KVKs have a multidisciplinary expert team, SMS, who work in participative mode with different farming communities. The general profile of KVK-SMS of Haryana and Punjab is given in Table 1.

Table 1: Profile of KVK-SMS

	Haryana n= 48 (%)	**Punjab n=55 (%)**
Gender		
Male	39 (82. 98)	33 (60)
Female	8 (17.02)	22(40)
Educational qualification		
Masters	11 (22.92)	10 (18.18)
Ph.D.	37 (77.80)	45(81.82)
Experience (years)	10.63	10.07
Fisheries as Specialization (years)	1(2.08)	1(1.81)

In Haryana, 82.98 per cent and in Punjab 60 per cent of SMSs were males. Sinha *et al.* (2021) and Padmaja and Prabhakar (2011) reported that majority of SMS were males. About 78 percent SMSs in Haryana and 82 per cent in Punjab had Ph.D. as their educational qualification. Dey *et al.* (2023) reported that in West Bengal, the majority (57%) of the SMS were Ph.D. holders. The average experience of KVK-SMS of both states was about 10 years. Of the 48 responses in Haryana, only 2.08 per cent SMS and out of 55 responses from Punjab 1.81 per cent SMS had fisheries as their specialization. Bashir *et al.* (2016) in Tamil Nadu and Kerala reported that about 5 per cent of the SMS working in KVK's of two states had specialization in fisheries. Sinha *et al.* (2021) also reported that only 3.25 per cent of SMS in Bihar and Jharkhand had fisheries as specialization. This implies that KVKs are short of fisheries professionals.

Skill development programs attended by KVK-SMS: SMS must be competent enough to perform the multidimensional tasks effectively. Thus, attending skill development programs becomes crucial. Extension programmes must adapt to modern agricultural trends and aid farmers by improving their management and decision-making skills (Singh *et al.*, 2018; Singh *et al.,* 2020). The number of skill development programs attended by SMS of Haryana and Punjab during 2019-2022 are given below in the Figure 1

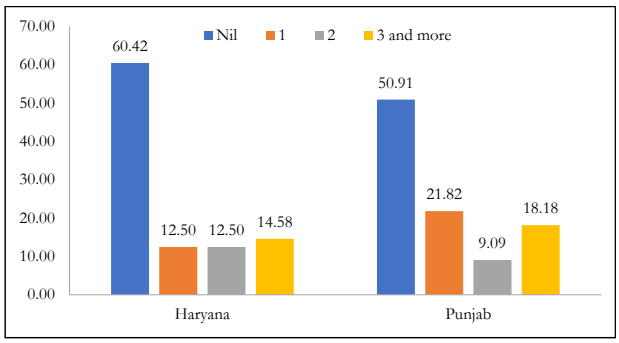


Figure 1: Number of Skill Development programs attended by KVK SMS

Majority of SMS in both states (60.42% in Haryana and 50.91% in Punjab) did not attend any skill development/training program during 2019-20 to 2021-22. Only 18.18 per cent of SMS in Punjab and 14.58 per cent in Haryana attended more than three skill development programs. Thus, more programs can be designed for the training of KVK-SMS based on the need. Nongtdu *et al.* (2012) suggested that necessary steps should be taken to identify the unfelt needs of the extension personnel to strengthen their knowledge, skills and attitude required for performing their job efficiently.

Time spent on different activities: The time allocation of SMS across various activities can greatly influence how productive they are and how well they fulfill their roles. Generally, the amount of time KVK SMS dedicate to their duties can differ depending on the specific tasks they're assigned and the requirements of their job descriptions.

In Haryana, KVK SMS spent 19.61 percent of time on conducting training for farmers, rural youth and women, 18.98 per cent on conducting extension activities such as Kisan Mela, exhibition, field visits etc. However, in Punjab, KVK SMS spent 20.48 per cent of time on conducting training for farmers, rural youth and women, and 19.71 per cent of time on regular administrative work (including file work, reporting & non-core activities).

Thus, in Haryana, SMS spent 68.89 per cent of time and in Punjab 67.43 per cent of time on extension work and resource generation activities. About 16 percent of time of SMS in Haryana and 20 per cent of time of SMS in Punjab was spent on administrative works. So, it could be concluded that SMS have adequate time for extension related activities and were not burdened with administrative works.

Sources of Information: SMS source their information from multiple sources and give varying importance to the primacy of each source.

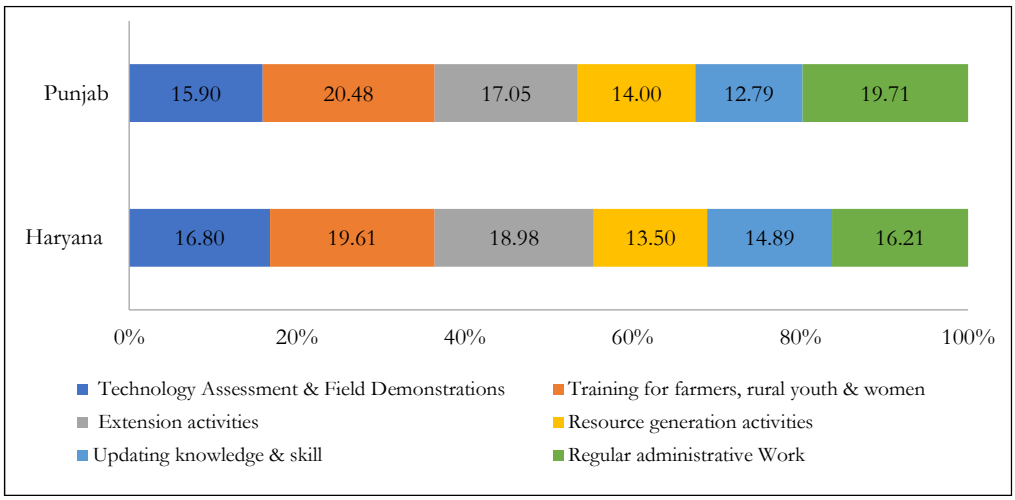


Figure 2: Percentage of time spent by SMSs on different activities

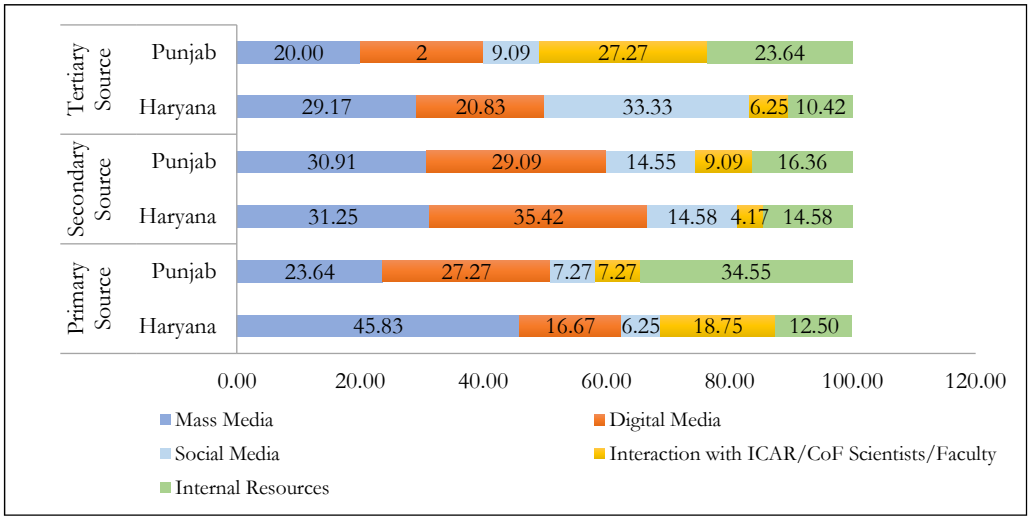


Figure 3: Sources of information for SMS

It is evident from the Figure 3 that SMS use various sources to avail information. Mass media (45.83%) was the first most important primary source of information. Digital media i.e., e-books/web portals/ internet (35.42%) was the most important secondary source of information. Social media i.e., Facebook/ YouTube/ WhatsApp (33.33%) was the most important tertiary source of information. The majority of the KVK scientists in South India used WhatsApp for seeking and dissemination of information, followed by Facebook (James *et al.,* 2022).

In Punjab, internal resources i.e., interaction/ meetings/ publications/ circulars (34.55%) were the first most important primary source of information, which is a good indication. Mass media i.e., newspaper/ magazine/ books/ radio/ T.V. (30.91%) was the most secondary source of information. Interaction with ICAR/CoF scientists/ faculty (27%) was the most important tertiary source of information.

Training need assessment of KVK-SMS: SMS must be competent to perform extension related activities efficiently and effectively. They must have multidimensional skills to improve knowledge and skills of farmers. Thus, there is a need to identify the training needs of SMS as per the contemporary issues in the world. The extension and fisheries related training needs have been assessed.

Extension related training needs: The extension related training needs of KVK SMSs and their weighted scores are given in Table 2

It is evident from the Table 2 that the use of ICT / social media for development (0.58) and success story documentation / preparing extension literature (0.57) were the top extension related training needs of KVK-SMS in Haryana. Managerial skills / team work with score of 0.59 ranked top extension related training needs of KVK-SMS in Punjab followed by use of GIS tools for agriculture development with score of 0.55. Patil and Kokate (2011) indicated 78.42 per cent of SMS working in KVKs need training. Top training needs of SMS were observed towards agricultural engineering (82.71%), agricultural finance, marketing and exports (82.08%) and Integrated Nutrient Management (80.83%). The results indicated that 80.33 per cent of SMS were interested in trainings on Extension Education and 75.06 per cent were interested in training on Animal, Dairy, Veterinary and Fisheries. Augustine (2020) found that SMS mostly needed training in promotion of rural youth activities followed by organisation of farm and farm women for agricultural production programmes.

It is evident from Table 3, that Better Management Practices / Good Aquaculture Practices ranked first in both the states. In Haryana, top fisheries related training needs were Best Management Practices (0.33), followed by recent technologies in aquaculture (0.31) and fish nutrition and feed technology (0.30) .Whereas, in Punjab, top fisheries related training needs were Best Management Practices (0.24), recent technologies in aquaculture (0.24) followed by conservation of fisheries resources (0.23). Thus, in both states demands with

Table 2: Extension related training needs

Extension related training needs	Haryana (n=48)		Punjab (n=55)	
	Scores	Rank	Scores	Rank
Managerial Skills	0.51	7	0.59	1
Use of GIS Tools for Agriculture Development	0.54	4	0.55	2
Success Story Documentation / Preparing Extension Literature	0.57	2	0.54	3
Data Analysis	0.40	12	0.54	3
Project Management	0.50	8	0.51	4
Market-let Extension	0.49	9	0.51	4
Entrepreneurship Development	0.55	3	0.51	4
Use of ICT / social media for Development	0.58	1	0.51	4
Making Videos on Technologies	0.48	10	0.46	5
Participatory Technology Development	0.48	10	0.45	6
Formation of FPOs	0.53	5	0.43	7
Market Information System	0.46	11	0.42	8
Gender Issues	0.52	6	0.42	8
Internet Radio	0.33	13	0.36	9

Table 3: Fisheries related training needs

Fisheries Related Training needs	Haryana		Punjab	
	Score	Rank	Score	Rank
Better Management Practices	0.33	1	0.24	1
Recent Technologies in Aquaculture	0.31	2	0.24	1
Conservation of Fisheries Resources	0.26	6	0.23	2
Ornamental Fish Rearing	0.25	7	0.20	3
Fish Nutrition and Feed Technology	0.30	3	0.19	4
Fish Health Management	0.29	4	0.19	4
Fish Breeding and Seed Production / Seed Rearing	0.25	7	0.18	5
Fisheries Marketing / Value Addition	0.28	5	0.17	6

regard to fisheries related training needs were very low. This indicates that SMS with specialization other than fisheries have less interest in such trainings and stresses upon the need of allotting fisheries SMS in districts with high potential for fisheries. Scores of Haryana were better than that of Punjab indicating SMS of Punjab have less interest in fisheries. Dey *et al.* (2023) reported SMSs have shown keen interest to get maximum training in the areas of Entrepreneurship Development, Success Story Documentation, Best Management Practices whereas, Training on Ornamental Fish Rearing/Aquarium Management, Gender dimension and mainstreaming and Conservation of Fisheries Resources were relatively least preferred.

From the Figure 4, it is clear that there is there is very weak correlation between extension related training needs with age, gender, education, specialization present working condition and infrastructure. Similarly, there is a weak correlation between fisheries related training needs with age, gender, education, specialization present working condition and infrastructure. Thus, these variables need not to be considered while planning the training programs for capacity development of KVK SMS. These results are contrary to findings of Kalita (1992) which revealed significant correlation between age, service experience and training needs.

Results Mann Whitney U statistics showed that there was no significant difference between two states in terms of extension and fisheries related training needs. Thus, similar types of training programs can be designed for the SMS of both the states

Figure 4: Correlation of extension and fisheries related training needs with general profile of SMS

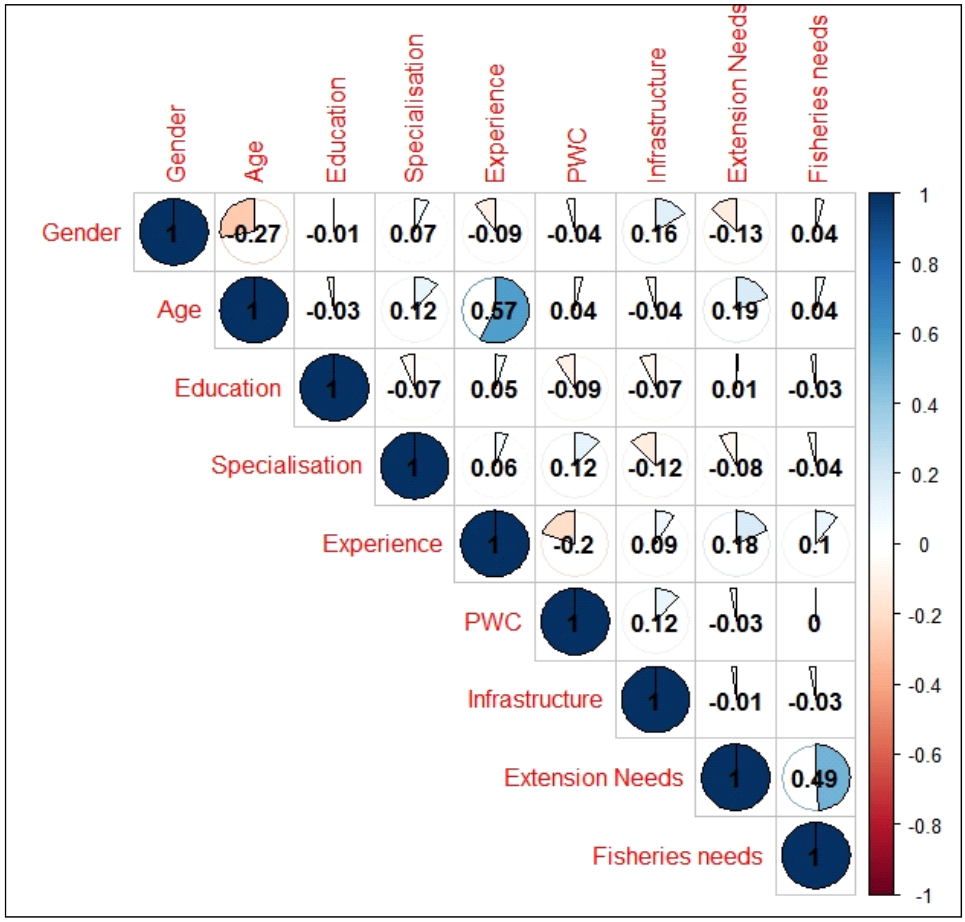
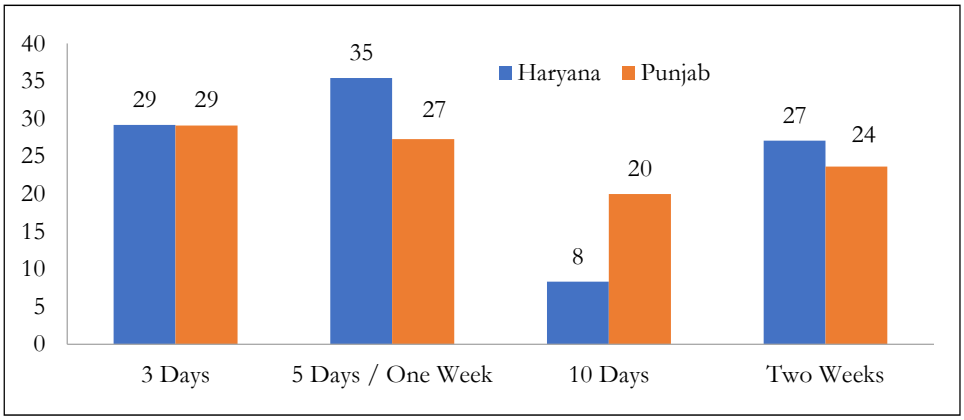


Figure 5: Duration of training program preferred by KVK SMS



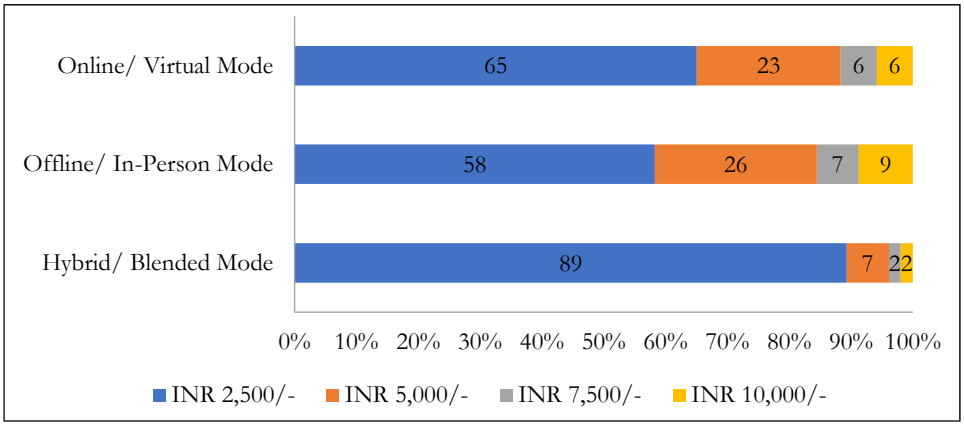
Duration of training program preferred by KVK SMS: SMS were asked about their preferred duration of training program. Figure 5 represents that 35 per cent of SMS preferred training programs of 5 days / one week duration in Haryana where as 29 per cent of SMS in both states preferred training programs of 3 days duration. Thus, training programs can be designed accordingly for the prioritized areas of training.

Fee structure for a one- week customised training program: Figure 6 indicated that majority of the SMS (65%) were willing to pay Rs 2500/- for attending online/ virtual training program. Whereas, 58 per cent respondents were willing to pay Rs 2500/- for In-person training and 89 per cent were willing to pay Rs 2500/- for Hybrid/ Blended mode. Thus, it indicates SMS don't want to spend more of skill development training irrespective of the mode of training.

CONCLUSION

Skilled SMS are the valuable assets to the KVKs and they must be competent enough, as the success of any

Figure 6: Fee structure preferred by KVK SMS (n=103)



organization depends upon the quality of its human resource. KVK SMS train farmers and rural youth about modern agricultural technologies and practices. Thus, they need to update new skills regularly to strength their crucial role in agrarian development. KVKs can prove to be an important tool for fisheries development in areas with high potential for fisheries. Training needs assessment should be done on a regular basis due to rapid changes in technology. The training needs of KVK SMS should be identified and need-based training modules need to be designed, which will lead to robust and client oriented KVK system in the country.

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Research Article

Sustainability of Scientific Piggery Venture as a Livelihood Security Option among the Tribal Farmers of Jorhat District, Assam, India

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ABSTRACT

Pig rearing occupies an important place among the tribal people and have the potential for upliftment of the socio economic status of the rural society. In this study two blocks of Jorhat district, Assam, India were selected namely Dhekargarah and Ujani Majuli Development Block with tribal population of 95 and 98 per cent, respectively where piggery being the predominant livestock activity. From two development block 5 villages were selected and from each village 10 farm families were included in this study. In every selected village, one farm family was as nucleus pig breeder farmer and the rest nine as breeder cum fattener farmers. Each farm family was supported for establishment of semi-scientific pigsty, improved pig germplasm and feed and medicine. The breeder pig farmers were provided 10 females and 2 male pure breed Hampshire piglets. The fattener farmers were provided 4 females and 1 male pure breed Hampshire piglets. One year onward beside technical support no inputs support was provided. From this study it was found that, scientific/semi-scientific pig farming, better breeds accompanied with proper feed and health management was the key to higher profit than traditional method of rearing. From one year onward when no input was provided, since the major cost was feed so, for sustainability of the farm the farmers replaced three forth portion of commercial feed with various cheap, seasonal, nutritional and locally available ingredients. It was recorded that, the farmers could make more profit than that of the previous year feeding with commercial feed. Such intervention can be a role model and can adopt as a tool for piggery development, improving livelihood and ensuring security.

Keywords: Pig, Piggery sector, Tribal people, Scientific intervention, Livelihood security

INTRODUCTION

Pig rearing is a profitable and viable occupation of weaker section of the rural society, especially among the tribal masses of India. This monogastric omnivorous species is considered as the most efficient food converting animal among the livestock (Deka, 2016; Mpofu and Makuza, 2003), and therefore, they plays an important role in upliftment of the socio-economic status of the weaker sections of the rural society, particularly in the North-Eastern Region (NER) of the country. The NER has a substantial pig population constituting around 33.66 per cent of the country's pig population. Assam possesses 16,36,022 numbers pigs of which are 613,668 crossbred and 10,22,354 are of local varieties (19th Livestock Census, 2012). The small scale pig sector has seemingly greater potential to reduce poverty (Lanada *et al.*, 2005). Pig

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rearing occupies an important position in farming system as it is closely interlinked with the other agricultural operation performed by the tribal people for livelihood. Pigs can be raised for their entire lifetime in enclosure as they do not contribute to loss of grazing lands (Mpofu and Makuza, 2003). Families usually keep an average of 1-2 indigenous for fattening with zero to minimum inputs in terms of family labour and feeding (Kumaresan *et al.*, 2007; Moanaro *et al.,* 2011). Although, the traditional system has been followed generation after generation, further improvement is required to augment the productivity and to bridge the wide gap between the demand and availability of pork. Several reports highlighted that the main purpose of keeping pigs was to obtain emergency cash and/or meeting the home consumption. It appeared as potential source of animal proteins and avenues for additional income and employment that can improve the livelihood in a sustainable manner (Petrus *et al.,* 2011). In spite of several opportunities in pig based entrepreneur, the pig farmers faces several challenges due to lack of quality germplasm, health care service and above all the high feed cost. In pig farming 75-80 per cent of the production cost attribute to the feed. To overcome this for sustainable pig farming an alternate feeding schedule need to be followed. An in-depth scientific intervention is needed for further improvement in existing production system for transforming the subsistence production to a profitable enterprise.

MATERIALS AND METHODS

Jorhat is located in the central part of Brahmaputra valley of Assam with total geographical area of 2,851 Sq KM which is equivalent to 3.63 per cent of the state land mass. The district lies between latitude 20^0 10' N and longitude 93^0 37' E to 93^0 57' E. On the north side of the district, the river Brahmaputra forms the largest riverine island of the world- 'Majuli'. Majuli, spreading over 924.6 km² with a population of about 1.50 lakh. According to the 2011 census Jorhat district has a population of 10,91,295 per cent. The district has SC and ST population of 7.61 and 12.09 per cent respectively of the total population. However, Dhekargarah and Ujani Majuli Development Block has a tribal population of 95 and 98 per cent, respectively and piggery is the predominant livestock activity.

From each development blocks, five villages were selected for piggery intervention with 10 farm families. Thus, altogether 100 farm families were covered. Within each village, one farm family was selected as nucleus pig breeder farmer and the rest nine as breeder cum fattener farmers. The breeder pig farmers were provided 10 females and 2 male pure breed Hampshire piglets. The fattener farmers were provided 4 females and 1 male pure breed Hampshire piglets. Thus a total of 570 piglets were provided to these 100 farmers.

***SWOT analysis*:** Dhakargarah and Ujani Majuli Development Block fall under the same agro ecological situations (AES-I), therefore, the SWOT analysis in these two blocks were worked out together.

Selection of Farmers: Based on the experience in piggery rearing, economic status of the selected farmers, age of the farmer, land holding, educational qualification, working hands in the household and suggestion from local committees, one breeder and nine fattener farmers were selected in each of the village.

Provisioning Infrastructure (pigsty): The floor area of the sty for breeding unit was 432 sq feet. Each breeding units had two chambers of 192 sq feet each. An alleyway in the middle was provided for easy management of the pigs. Two run areas were also constructed on the two sides of the sty with bamboo poles each measuring 192 sq feet. The housing was constructed with 5 inch plastered wall to the height of 3.3 feet with RCC columns and floor beams. The floor was brick soled with 2 inch RCC topping. Proper feeding and drinking and drainage system was provided. The farmers contributed the CI sheet or thatched roofing of the stys. Some farmers also created the water supply facilities on their own. The floor area

of the fattening units was 392 sq feet with two chambers. Other construction designs were similar to the breeding units.

Supply of pure breed piglets: For higher productivity Hampshire piglets were obtained from the All India Coordinated Research Project on Pig and National Agricultural Innovative Project, AAU, Khanapara. 2-4 months old piglets were brought in two batches from AAU Khanapara and were distributed.

Feed supplementation: To support the farmers for the first nonproductive year, a provision for feed was included in the project. Feed support was supplementary in nature and was at a rate of 1 kg feed/day/ pig for 365 days. The feed supplied to the farmers were high quality granular formulations available commercially. After 1 year the farmer supported feed requirement with their own.

Medicine supplementation: The piglets were pre-vaccinated against this disease before handing over to the farmers. The booster dose and subsequent doses were given to each of the piglets. The beneficiaries were given medical support at a rate of Rs 1.00 per pig/day for 365 days.

Skill up gradation on piggery husbandry: More than 20 trainings were imparted to the beneficiary and non-beneficiary farmers of the ten villages.

Local Para-vet personnel creation: 25 young persons from the ten villages were given 15 days training at KVK, Jorhat covering all aspects pig husbandry and were groomed at the village level with practical experiences to become para-vet personnel.

Data collection: For this study data were collected after 1 and 2 year of initiation of the project from 5 breeding units and 10 fattening units.

RESULT AND DISCUSSION

The SWOT analysis is presented in Table 1. It was done using various participatory tools like- matrix ranking, problem tree analysis, stakeholder analysis, focus group discussion etc.

Performance analysis of breeding and fattener units: The overall performance of the breeding and fattener units is encouraging. With the integration of improved breed and scientific management practices the productivity of the units increase considerable as compared to the traditional method of pig rearing.

Table 1: SWOT analysis of Dhakargarah and Ujani Majuli Development Block for animal Sector

Strength	Weakness
1. Exceptional traditional knowledge in pig rearing	1. Lack of skill and knowledge in scientific pig rearing
2. Highly experienced pig rearing farmers	2. Low adoption of recommended practices
3. Good marketing linkages	3. Low financial capabilities, lower access to credit institutions
4. Ingenious feeding strategies	4. High cost of quality pig feed
	5. Non availability of improved breeds
	6. Lack of nearby animal health centers
Opportunity	**Threat**
1. Short supply of pork in the nearby districts.	1. Exploitation by money lenders and middlemen
2. Dhakargarah block is well connected to the district H.Q and other districts of the sate	2. Outbreak of swine fever.
3. Possibility Integration of pig and poultry production with agriculture fishery and horticulture	

The early and high fecundity, better piglet growth and higher selling price of the piglets of the improved breed are rays of hope for the farmers. A comparison made between traditional and scientific rearing of pigs in 5 villages under the project is presented in Table 2.

Economic of breeding units as compared to traditional system (with 12 pigs): The comparison of average net profit earned by farmers after one year of the project period under traditional and semi-scientific pig farming is shown in Table 3. As obvious from the table, the low cost of production under traditional system was mainly due to lesser use of commercial concentrate feed and supplementation of bulk of the feed from household wastes and natural vegetations. However, inferior breed and sluggish growth of the pigs in traditional rearing system ultimately reduced the net profit. On the other hand, in scientific/semi-scientific pig farming, better breeds accompanied with proper feed and health management was the key to higher profit. However, profit in a scientific piggery based mainly on commercial feed formulations was not very remarkable either as seen in Table-3. It was very interesting to note that how some very intuitive farmers were able to cut down on feed cost in their breeder and fattener units when the feed support from the project was withdrawn on the second year (Column 4, Table 3). They followed a very ingenious strategy to cut the feed cost by reducing the commercial concentrates and incorporating some locally available cheap food materials and at the same time more or less maintaining the basic dietary requirement of the pigs. They reduced concentrated commercial feed to 0.5 kg/pig/day instead of the average requirement of 2 kg concentrates/pig/day. This alone reduced the feed cost by Rs 12,592.50/ pig/annum (considering price of commercial

Table 2: Comparison of production in traditional and improve management

Characteristics	Traditional rearing system	Scientific rearing system
Sty type	Makeshift, unscientific	Semi–Scientific
Breed	Local, nondescript	Hampshire
Age at first farrowing	9-10 months	7-8 months
Fecundity	1st farrowing- 5-6 nos 2nd farrowing- 8-10 nos	6-7 nos 12-14 nos
Weight of piglets at birth	0.7-0.8 kg	0.95-1.05 kg
Body weight gain of piglet (up to three months)	End of 1st month- 2.5 kg End of 2nd month- 5.0 kg End of 3rd month- 9.0 kg	4.510.016.0
Average selling price of piglets (at 2 months)	Rs 1300-1500	Rs 2500-3000
Weight at sexual maturity (female)	35-40 kg	50-60 kg
Weight of castrated male at marketing stage (8 months)	50-55 kg	70-80 kg

Table 3: Economics of breeding units as compared to traditional system (with 12 pigs)

Heads of expenditure and return	Traditional system	Semi-Scientific system	
		1st year (with input support from the project)	2nd year (No input support from the project)
Cost of sty (Rs)	5000.00	Rs 30,000.00	0.00
Cost of piglets (Rs)	12 x 1400 = 16,800	12 x 2200 = 26,400	0.00
Feed cost (Rs)	i. Concentrate = 12,558.00[a] ii. Household wastes = 0.0	i. Concentrate = 1,00,740.00[b] ii. Household wastes = 0.0	i. Concentrate feed = 50,232.00[c] ii. Discarded potato from cold storage= 2,000.00[d] iii. Household wastes = 00.00 iv. Purchase out of abandoned vegetable plots = 1,000.00[e] v. Lathyrus = 5,000.00[f] vi. Oil cake = 4,000.00[g] vii. Colocacia = 0.00[h] Total cost = Rs 62,232
Labour cost (Rs)	180 man days = 36000	180 man days = 36000	180 man days = 36000
Cost of medicine (Rs)	1000 (lumpsum)	2000 (Lumpsum)	2000 (Lumpsum)
Insurance cost (Rs)	-	-	4000
Gross Expenditure (Rs)	Rs 71,358	Rs 1,95,140 (actual expenditure was Rs 98000, since concentrate feed was provided from the project)	Rs 1,04,232
No of piglets produced in two years	60	90	108
Piglet mortality (5%)	58 (surviving piglets)	85	102
Selling price of piglets (Rs)	60 x 1400 = 84,000	85 x 2500= 2,12,500	102 x 2500 = 2,55,000
Selling price of castrated male (@ Rs 180/kg)	1 no x 70 kg = 12,600	1no x 100 kg = 18,000	3no x 120 kg = 48,000
Gross Income (Rs)	96,600	2,30,500	3,03,000
Net Income (Rs)	25,242.00	35,360.00 (actual net profit was 1,48,600 as the concentrate feeds was provided from the project)	1,98,768.00

[a] 0.25 kg concentrate/pig/six months x Rs 23/kg x 12 pigs
[b] 1 kg feed /pig/ 1 year x Rs 23/kg x 12 pigs
[c] 1 kg feed x six months x Rs 23/kg x 12 pigs
[d] 1 kg x 6months x 14no pigs = 2548 kg)

concentrate feed at Rs 23/kg). To compensate for the total feed requirement, they collected some free or inexpensive feedstuff available locally. They collected discarded potatoes from nearby cold storage by only paying the transportation cost. They also purchased 'end of the season' vegetable plots (which farmers did not harvest any more due to drastic fall in price) of radish, cabbage, brinjal etc. from local farmers at throw-away prices. Thus, large quantities of vegetables were available for the pigs at least for two months. Lathyrus is another crop grown and consumed extensively by the tribal farmers; but, due to lack of market the lathyrus is sold locally at Rs 10-15/kg. Lathyrus is known to possess 26 per cent of high quality protein and some farmers mixed the lathyrus in the pig feed as a source of cheap protein. Similarly, mustard oil cake is readily and cheaply available in the area and hence it was also mixed in the feed as a source of energy. Besides these, kitchen wastes, residues of fermented rice beer (which every tribal household make at home) and wild colocassia was extensively used as pig feed. Thus, these groups of farmers were able to drastically reduce the feed cost and could sustain the breeder and fattener units even after the support period which is in consonance with the findings of (Lemke *et al.,* 2006; Kumaresan *et al.,* 2009; Moanaro *et al.,* 2011).

Marketing and horizontal spread: The quick sale of the piglets and the profit earned by the breeder farmers makes them even more determined to start similar piggery venture of their own. Many nearby

farmers bring their local pigs to cross with the purebred Hampshire bores of the breeding units to upgrade their own pig stock. The breeder farmers thus earn additional profit through servicing. They charge Rs 200-500 for each service. Many farmers have procured good quality piglets from these breeding units to open new farms or to replace their low productive pigs. Thus, the horizontal spread of the good quality piglet under the project is quite encouraging. Due to the forward market linkage established by KVK, Jorhat many of the piglets from these farmers are also been sold to farmers from the nearby districts.

CONCLUSION

Form this study it can be concluded that, for sustainable piggery farming, scientific intervention to the existing traditional way of rearing pig as well as adopting various cheap, seasonal, nutritional and locally available feed ingredients to reduce the high feed cost can play a imperative role in socioeconomic upliftment of the tribal people with livelihood security.

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Research Article

Farmers Perception and Satisfaction on Technology Dissemination Methods of State Departments of Agriculture in Southern India

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ABSTRACT

Farmer's perception about any technologies is priceless resource to agricultural policy makers for designing policies in order to reduce vulnerabilities of farmers. Therefore, the present study was conducted to ascertain the farmers perception and satisfaction on Technology Dissemination methods of State Departments of Agriculture (SDA) in Southern India. The study was conducted in two highly diversified south Indian states, namely Kerala and Andhra Pradesh with a total of 100 respondents, comprising 50 respondents from each of the states Kerala and Andhra Pradesh through simple random sampling method. The results revealed that, more than half of the respondents (56%) expressed moderately favourable perception towards technology dissemination methods of SDA followed by highly favourable (22%) and less favourable (22%) perception with equal proportions with respect to Kerala farmers. In case of 'Andhra Pradesh farmers' distribution, exactly half of the respondents (50%) expressed moderately favourable perception followed by highly favourable (30%) and less favourable (20%) perception. Farmers level of satisfaction towards technology dissemination methods of SDA revealed that, more than half of the Kerala farmers (56%) expressed moderate satisfaction over technology dissemination methods of SDA followed by higher satisfaction (26%) and low satisfaction (18%) respectively whereas exactly half of the Andhra Pradesh farmers (50%) expressed moderate satisfaction over technology dissemination methods of SDA followed by higher satisfaction (26%) and low satisfaction (24%) respectively. The comparative analysis of perception and satisfaction among the Kerala and Andhra Pradesh farmers showed that, there was significant difference between farmers. Hence, to improve farmers' perception and satisfaction, it is important for State Departments to understand their specific needs, engage in participatory approaches, provide tailored support, and ensure effective communication channels to deliver timely and relevant information.

Keywords: Agriculture, Evaluation, Public Extension System, Programmes, Services

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INTRODUCTION

Agricultural extension has multiple goals, including transferring knowledge from global, national, and local researchers to farmers, helping them clarify their own goals and assessing their opportunities, educating them about decision making processes, and promoting desirable agricultural development (Ravikishore *et al.,* 2022). Agricultural information dissemination has significant impact on economic growth and development of many nations (Zhang *et al.,* 2016). Highly developed and organised flow of agricultural information is capable of enhancing productivity and better market price for farmers, increase farmers knowledge and facilitate agricultural activities in rural areas (Msoffe and Ngulube, 2016). The development and dissemination of new technology or information is an important factor determining the future of agriculture. Increase in agriculture production would have to be necessarily obtained by appropriate agricultural technology and its speedy transfer to the farmers through efficient Technology Dissemination Methods (Damba *et al.,* 2020).

Technology Dissemination is a part of State Department of Agriculture (SDA), concerned with transmitting information and knowledge of important agricultural technology from research to farmer. These departments aim to bridge the gap between scientific advancements and on-ground farming practices, providing farmers with access to modern agricultural techniques, improved seeds, machinery, and other necessary resources (Ravikishore *et al.,* 2023). One of the reasons that the government is highly involved in rendering extension services, is to ensure that farmers receive the support which will enable them to produce adequate and quality produce, and thus enabling the country to be food secure. Agricultural extension professionals of State Department of Agriculture (SDA) are personnel who are responsible for meeting the goals of extension system. The effectiveness of the technology alone does not bring the desired change in the rural areas and partly depends on the capability of the extension workers to properly transferring the technologies to the local populace (Asayehegn *et al.,* 2012). The effectiveness of extension services is highly dependent on the ability of extension workers who are competent because the entire extension process is dependent on them to transfer information from extension organizations to the farmers (Ravikishore and Seema, 2017). Therefore, effective public extension services play an important role in agricultural sustainability and food security of a country (Maake and Antwi, 2022).

The perception and satisfaction of farmers regarding the technology dissemination methods employed by State Departments of Agriculture can vary depending on various factors such as the effectiveness of the methods, the relevance of the technologies, the accessibility of information, and the overall support provided to farmers. Perception as defined by Van den Ban and Hawkins (2000) is the process by which information or stimuli is received and transformed into psychological awareness. Perceptions indicate the users view of a technology/ method/initiative, which is formed based on his or her previous experiences. (Sivakumar and Sulaiman, 2015). Assessing farmers' perceptions is an important means to evaluate farmers knowledge level on a particular issue, as perception refers to an individual's current appraisal of an object or program. Farmer's satisfaction is considered to be an important indicator of sustainability which has become the leading target of scientific research and policy agenda (Ridaura *et al.,* 2002). Client satisfaction evaluations can address the reliability and responsiveness of services or the willingness of providers to meet clients' needs. Evaluating the satisfaction rate of farmers is highly important for a number of reasons. First, the farmers are the intended beneficiaries of the program and thus, they should have the right to judge its performance. Second, as end users, the farmers have personal experiences with the program that are not shared by nonusers. Third, the sustainability of the program ultimately depends on the willingness of the farmers to continue participating in it, which is a reflection of their satisfaction (Elias *et al.,* 2013).

Farmers are more likely to be satisfied with technology dissemination methods if the technologies being promoted are relevant to their specific needs and circumstances. The perception of the system's effectiveness is higher when the technologies disseminated align with the local agro-climatic conditions, cropping patterns, and farming practices. In the contemporary scenario, various technology dissemination methods are being implemented by State

Departments of Agriculture in Kerala and Andhra Pradesh. The success or failure of the technology dissemination methods depends upon how far its clients perceived and satisfied the same. The present study was therefore, systematically planned and conducted to know the perception and satisfaction of the farmers about technology dissemination methods of State Departments of Agriculture.

MATERIALS AND METHODS

State Departments of Agriculture (SDA) were selected purposively as an organization for the present study due to the prime role, responsibility and immense importance given to them in providing agricultural extension services to the farmers at grassroots level. In light of this, a survey was conducted using pre tested and structured questionnaire among the farmers of Kerala and Andhra Pradesh of Southern India with a total of 100 respondents to rate the statements about Perception and Satisfaction on Technology Dissemination Methods of SDA. Farmers were selected through stratified random sampling where in the Kerala state was classified into 5 zones, from each zone 10 farmers were selected randomly with the sample size of 50 respondents. In case of Andhra Pradesh, the state was classified into two regions, namely: Rayalaseema and Coastal Andhra regions, from each region 25 extension personnel were selected randomly with the sample size of 50 respondents. Thus, the total sample size comprises 100 respondents.

Perception is mental organization and interpretation of sensory information. It is the opinion expressed by the respondents. Understanding the process of human perception is crucial to understanding human behaviour (Argade *et al.,* 2015). Perception in this case was operationalized as the farmer's opinion towards various technology dissemination methods implemented by State Department of Agriculture in Southern India. Perception is the subjective process of acquiring, interpreting, and organizing sensory information. But there was no standardized scale available for measuring the perception. Hence, to measure the perception of farmers, a scale developed by Preethi *et al.* (2014) and followed by Namitha and Kumar (2016) with some modification was used. Scale consists of twelve statements which were measured in a five-point continuum namely, Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree. Based on the total scores the respondents were classified into 3 categories using quartiles, as measure of check**.** The minimum (12) and maximum (60) possible scores range was considered to derive the quartiles for categorization.

Farmers' satisfaction is a concept that applies the theory of customer satisfaction to agricultural and rural policies and the supply of rural public goods. Customer satisfaction is a concept in marketing and is generally considered to be a mental or emotional reaction to the quality of a product or service (Kassem *et al.,* 2021). Farmers' satisfaction in this study was conceptualized as the effective reaction of a farmer towards the use of technology dissemination methods of State Department of Agriculture (SDA). Farmer Satisfaction was measured by using the scale developed by Maoba (2016) with slight modification. The scale consists of six statements and was suitably modified in order to make all the six statements positive so as to make it easy for the respondents to answer. Thus, the six statements expressing different dimensions of farmers' satisfaction were administered to the respondents and their responses were recorded on a five-point continuum namely, Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree. The possible score ranged from a minimum of 6 to a maximum of 30. Based on the total score, the respondents were classified into three categories namely, higher satisfaction, moderate satisfaction and low satisfaction using quartiles as measure of check.

RESULTS AND DISCUSSION

The distribution of farmers based on their perception are furnished below. A careful observation of the Table 1 reveals the distribution of the respondents based on their perception towards Technology Dissemination Methods of State Department of Agriculture in the States of Kerala and Andhra Pradesh. Examining the 'Kerala farmers' distribution, it could be evident from the table that, more than half of the respondents (56%) expressed moderately favourable perception towards technology dissemination methods of SDA followed by highly favourable (22%) and less favourable (22%) perception towards technology dissemination methods of SDA with equal proportions. This might be because, the number of visits, demonstrations, meetings conducted to farmers by the extension personnel had

Table 1: Distribution of respondents based on farmers' perception towards Technology Dissemination Methods of State Department of Agriculture (n=100)

Category	Kerala farmers (n_1=50)		Andhra Pradesh farmers (n_2=50)	
	Number	Percentage	Number	Percentage
Less favourable (<Quartile$_1$)	11	22	10	20
Moderately favourable (Q_1-Q_3)	28	56	25	50
Highly favourable (>Quartile$_3$)	11	22	15	30
	Quartile$_1$-49		Quartile$_1$-51.25	
	Quartile$_3$ -56		Quartile$_3$ - 58	

moderately influenced their knowledge and merely created awareness on advanced agricultural methods. Hence, majority of the farmers expressed moderately favourable perception towards technology dissemination methods of SDA. The finding of this study was supported by the Namitha and Kumar (2016) who found that Perception of farmers on Innovations in Technology Dissemination methods implemented by different agricultural institutions in Kannur, Kerala was calculated and it shows that majority of the respondents had medium level (62.5%) of perception.

With respect to 'Andhra Pradesh farmers' distribution, exactly half of the respondents (50%) expressed moderately favourable perception towards technology dissemination methods of SDA followed by highly favourable (30%) and less favourable (20%) perception towards technology dissemination methods of SDA. This might be because, the response or solution received for their problems from the extension personnel was fairly good enough to give permanent solution to their problems. Hence, majority of the farmers expressed moderately to highly favourable perception towards technology dissemination methods of SDA. The finding of this study was supported by the Sarker and Itohara (2009) who conducted the study on Farmers' Perception about the Extension Services and Extension Workers and revealed that the majority (62%) of the farmers had a good perception about the effectiveness of agricultural extension services in their livelihood improvement.

The parametric standard normal deviate test was used to test the significance difference of two sample proportion which means whether the proportion of the Kerala sample is in agreement with Andhra Pradesh sample proportion or not with respect to perception. The results in this regard are presented in Table 2.

Table 2: Comparative analysis of perception among Kerala and Andhra Pradesh farmers (n=100)

Category	Kerala (n_1=100)	Andhra Pradesh (n_2=100)	'z' value
Low (<15)	22	12	2.1111*
High (15 and above)	28	38	

* Significant at 5% level

A Perusal of Table 2 reveals the comparative analysis of perception among Kerala and Andhra Pradesh farmers towards Technology Dissemination Methods of SDA. It was analyzed with standard normal deviate test, which could be used to test for the significant difference of two sample proportions. We can see that, 'z' value was more than the table value at 0.05 per cent level of significance. Hence, it was inferred that there was significant difference among Kerala and Andhra Pradesh sample proportions with respect to farmers' perception towards Technology Dissemination Methods. This was because the technology dissemination methods and schemes implemented by SDA was different from Kerala to Andhra Pradesh. The knowledge and comprehension that have been received from SDA on the agricultural technologies was highly location specific and need specific. Hence, the farmers' perception towards technology dissemination methods of SDA depends on the performance effectiveness of extension personnel where we have already observed significant difference.

A perusal of the Table 3 reveals the distribution of the respondents based on their level of satisfaction towards Technology Dissemination Methods of State Department of Agriculture in the States of Kerala and Andhra Pradesh. Examining the 'Kerala farmers' distribution, it could be evident from the table that

Table 3: Distribution of respondents based on farmers' satisfaction towards Technology Dissemination Methods of State Department of Agriculture (n=100)

Category	Kerala Farmers (n_1=50)		Andhra Pradesh Farmers (n_2=50)	
	Number	Percentage	Number	Percentage
Low satisfaction (<Quartile$_1$)	9	18	13	26
Moderate satisfaction (Q_1-Q_3)	28	56	25	50
Higher satisfaction (>Quartile$_3$)	13	26	12	24
	Quartile$_1$-13.25		Quartile$_1$- 13	
	Quartile$_3$ -17		Quartile$_3$ – 16	

more than half of the respondents (56%) expressed moderate satisfaction over technology dissemination methods of SDA followed by higher satisfaction (26%) and low satisfaction (18%) respectively. This might be because, the response or solution received for their problems from the extension personnel was not good enough to give permanent solution to their problems.

With respect to 'Andhra Pradesh farmers' distribution, exactly half of the respondents (50%) expressed moderate satisfaction over technology dissemination methods of SDA followed by higher satisfaction (26%) and no satisfaction (24%) respectively. This might be because, the factors like unavailability of extension personnel, inaccessibility to the agricultural office and high caste based political disparity on the farming community have resulted in dissatisfaction towards State Department of Agriculture (SDA). The finding of this study was supported by the Elias *et al.* (2015) who conducted the study on Farmers' Satisfaction with Agricultural Extension Service and Its Influencing Factors: A Case Study in North West Ethiopia and revealed that about 55 percentage of the farmers were satisfied with the extension services.

The parametric standard normal deviate test wad used to test the significant difference of two sample proportion which means whether the proportion of the Kerala sample is in agreement with Andhra Pradesh sample proportion or not with respect to level of satisfaction. The results in this regard are presented in Table 4.

Table 4: Comparative analysis of level of satisfaction among Kerala and Andhra Pradesh farmers (n=100)

Category	Kerala (n_1=100)	Andhra Pradesh (n_2=100)	'z' value
Low (<15)	16	19	2.8843**
High (15 and above)	34	31	

** Significant at 1% level

It was analysed with standard normal deviate test, which could be used to test for the significant difference of two sample proportions. We can see that, 'z' value was more than the table value at 0.01 per cent level of significance. Hence, it was inferred that there was significant difference among Kerala and Andhra Pradesh sample proportions with respect to level of satisfaction towards Technology Dissemination Methods of SDA. This was because the farmers in Andhra were not satisfied with the job involvement of extension personnel in addressing their current and emerging issues. Where as in Kerala the availability of extension personnel to the farming community was regular enough to address the challenging issues of farmers.

CONCLUSION

Farmers perception on Technology Dissemination Methods of SDA reveals that more than half of the Kerala farmers expressed moderately favourable perception towards technology dissemination methods of SDA both in Kerala and Andhra Pradesh states. Farmers satisfaction on Technology Dissemination Methods of SDA reveals that more than half of the Kerala and Andhra Pradesh farmers expressed moderate satisfaction over technology dissemination methods. The comparative analysis of perception and satisfaction among the Kerala and Andhra Pradesh farmers showed that, there was significant difference between farmers. Based on the findings it can be concluded that, still there is a room to improve the farmers perception and satisfaction on technology dissemination methods. It's important to note that farmers' perception and satisfaction can vary widely,

as each farmer has unique needs, preferences, and experiences. Thus, from a policy perspective, the findings suggest a need to develop demand-driven extension service instead of the existing supply-driven one. Such service should be aiming to enhance the rewards from farming in order to maintain participation and farmers' satisfaction, which influence the sustainability of the extension program.

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Research Article

Problems Faced by Litchi Growers Regarding Integrated Pest Management Practices in Punjab

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ABSTRACT

Current study was carried out during 2021-2022, with the aim of estimating the problems faced by the Litchi growers regarding Integrated Pest Management (IPM) practices in Pathankot and Gurdaspur district of Punjab. From each district two blocks were selected having maximum number of litchi growers. A list of litchi growers' were procured from the department of horticulture and from procured list 25 respondents were selected randomly from each blocks to make a sample size of 100 respondents. Problems of the farmers were analyzed by using Mean Percent Score (MPS). Findings of the study showed that the main problems due to which the farmers do not practice IPM practices are complexity of IPM practices, these practices are more time and energy consuming Inadequacy of equipment's used in IPM, Lack of favourable government policies and support, Powerful influence of pesticide industry.

Keywords: Integrated pest management, Pesticides, Litchi, Practices, Mean percent score

INTRODUCTION

The Punjab state has 5.03 M ha. Geographical area out of which 4.23 M ha is under cultivation. Agriculture is a way of life. About 75 per cent of its population depends directly in agriculture. It has shaped the thought, outlook, culture and economic life of our people. Therefore, it will continue to control all strategies for planned socio-economic development of the state. since the advent of green revolution, the state has made rapid strides in agricultural production. Presently, area under Horticultural crops in Punjab State is 380750 ha. out of which 86670 ha. is under Fruits, 273250 ha. is under Vegetables, 2100 is under Flowers and 18730 ha. is under Spices and Aromatic crops (Anonymous, 2022c). Litchi (*Litchi chinensis Sonn*) is an important subtropical evergreen fruit crop belongs to family Sapindaceae. It is known as queen of the fruit due to its attractive deep pink/red colors and flavored juicy aril. It has high nutritive value and refreshing taste. Litchi is consumed as fresh fruit, pulp and various processed products like squash, RTS, wine etc. (Singh *et al*., 2012). Litchi appears to be native of the area, near Southern province of China and northern Vietnam from where it was introduced into India during the 18th century in the North East region (Tripura) and over the period of time to eastern states and percolated in the northern states (Rai *et al.,* 2000).

Litchi cultivation has gained momentum in Punjab after the end of 20th century. Presently, Punjab occupies an area of about 3142 ha with the production of 51504 MT and productivity of 16.4 MT/ha. The major litchi growing districts of Punjab are Pathankot, Hoshiarpur and Gurdaspur and these districts are contributing nearly 57.4, 14.3 and 13.9 per cent respectively of the total area in the state. The crop is also grown in some pockets of Rupnagar, SBS Nagar, Union territory of Chandigarh, Patiala and Mohali districts. Litchi productivity is the highest at the national level among the other litchi growing states. Dehradun and Calcuttia are the leading cultivars of litchi in these zones (Singh *et al.,* 2022). A number of insects and mite pests are damaging the litchi plants and fruits in the state. Among the various pests, leaf curl mite, fruit borer (especially *Blastobasis* sp.), leaf roller (*Tortrix epicyrta*) and bark eating

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caterpillar are very serious. For control of diseases and pest in crops many chemicals are used, which are harmful (Anonymous, 2021). Environmental pollution is just one of the linked negative outcomes of the careless and imprudent use of chemical pesticides in agriculture, ecological imbalances, pesticides residues in food, fruits and vegetables, fodder, soil and water, pest resurgence, human and animal health hazards, destruction of bio-control agents, development of resistance in pests etc. Therefore, Govt. of India has adopted Integrated Pest Management (IPM) as cardinal principle and main plank of plant protection in the overall Crop Production Programme since 1985 (Anonymous, 2022).

Crop yield benefits greatly from plant protection. One of the key components of managing pests and diseases is adopting plant protection recommendations. Despite this, farmers are not fully implementing the guidelines, so it is crucial to consistently utilise plant protection methods to control pests and diseases. Integrated Pest Management and Integrated Disease Management are included in plant protection. Considering that the study was conducted with the intention of learning about the obstacles that farmers face in adoption of the Integrated Pest Management practices in Punjab. IPM practices use comprehensive and current information on the life cycle of pests and their interactions with the environment (Ofuoku, 2009).

The promotion of IPM requires identifying the major components of IPM for the purpose of policy-making and practical planning with the participation of farmers. Despite extensive efforts for the training of farmers in recent decades, many farmers are still unaware to a great extent of the IPM as a pest control approach in their current pest control practices (Ashraf, 2012). IPM has been introduced as a sustainable approach for preventing, monitoring and controlling pests. It tries to integrate natural, chemical and biological techniques to combat pests. This approach through a package of tactics minimizes economic and environmental costs and improves safety and effectiveness. They have suggested increasing this knowledge. Some have argued that plant pathology clinics established during the last five year have been effective in improving agricultural products and suggest them as an appropriate approach for technical knowledge diffusion and extension regarding pest control in farms (Asgarinya, 2010). Keeping in view the above scenario, there were not much study related to IPM practices followed by farmers or the problems faced by farmers about IPM practices, the present will throw some light on the problems being faced by farmers in practicing IPM practices.

MATERIALS AND METHODS

The present study was conducted during the year 2021-2022 in Gurdaspur and Pathankot of Punjab. From each district two blocks were selected having maximum number of litchi growers. A list of litchi growers' were procured from the department of horticulture and from procured list 25 respondents were selected randomly from each blocks to make a sample size of 100 respondents. Data was collected from farmers on specially structured pre-tested interview scheduled. Mean percent score method was used to analyze the problems faced by the respondents regarding IPM practices in Punjab.

$$\text{Mean percent score (MPS)} = \frac{\text{Observed score}}{\text{Total score}} \times 100$$

RESULTS AND DISCUSSION

The age of the respondents was classified into three categories by using cumulative cube root method and these were categorized as young, middle and old age as given in Table 1. The average age of the respondents was 57.49 (±13.24). The results revealed that maximum respondents were of old age that were more than 50 years of age i.e., 65 per cent. This might be due to the fact that younger generation is moving towards education and prefer govt. job thus leading to these results. The Average education of the respondents was 11.14 (±2.62). Most of the litchi growers were educated and very few of them were having low educational qualification. Education plays an important role in better understanding the things and in farming education is also important to do the farming in a innovative way. It is evident from the result that maximum number of the respondents belonged to nuclear family i.e., 72 per cent and 28 per cent from joint family. Average family size of the respondents was 5.45 (±2.31). The results are in contradiction with Sangavi *et al.* (2020).

Table 1: Socio-economic profile of the respondents (n=100)

Particular	Mean±SD
Average age in years (years)	57.49±13.24
Categorization of age in years (% respondents)	
Young <35	08 (08.00)
Middle 35-50	27 (27.00)
Old >50	65 (65.00)
Average education (years)	11.14±2.62
Categorization of education in years (% respondents)	
Primary	06 (06.00)
Middle	26 (26.00)
Matric	20 (20.00)
High school	27 (27.00)
Graduate	18 (18.00)
Postgraduate	03 (03.00)
Average family size (members)	5.45±2.31
Family type	
Nuclear	72(72.00)
Joint	28(28.00)
Categorization of family size (% respondents)	
Small (2-5 members)	44(44.00)
Medium (5-8 members)	35(35.00)

The result presented in Table 2 represented the occupation of the respondents and results showed that about 20 per cent of the respondents were engaged in only agriculture for their livelihood, 43 per cent were dependent on agriculture + government jobs, 27 per cent of respondents were having agriculture + private job and only 10 per cent were those who were having their own business + agricultural occupation with it. Agriculture + government job was the major occupation of the litchi growers as farming and govt. job provide better livelihood support.

Table 2: Distribution of the respondents according to their occupation

Parameters / Categories	Frequency (%)
Occupation of the respondents	
Only agriculture	20(20.00)
Agriculture + government job	43(43.00)
Agriculture + private job	27(27.00)
Agriculture + business	10(10.00)

The average mass media exposure of the respondents was 1.74 (±1.86). The data in the Table 3. reveals that more than half of the respondents were having low mass media exposure i.e.; 78 per cent of the respondents were either having no mass media exposure or were just using one or two mass media to gather information regarding IPM. About 17 per cent of the respondents were having medium level of mass media exposure and only five percent of the respondents were having high level of mass media exposure.

Table 3: Distribution of the respondents according to their mass media exposure (n=100)

Average mass media exposure: 1.74(±1.86)

Categories	Frequency (%)
Low (0-3)	78 (78.00)
Medium (3-6)	17 (17.00)
High (6 or above)	05 (05.00)

Mean percent score method was used to analyze the problems faced by the respondents regarding IPM practices in Punjab (Table 4). Ranks were assigned to the problems. Result revealed that the main problems due to which the farmers do not practice IPM practices were complexity of IPM practices, these practices are more time and energy consuming, Inadequacy of equipment's used in IPM, Lack of favourable government policies and support, Powerful influence of pesticide industry, Shortage of funding for IPM, especially large-term funding, Costs of IPM are much more apparent than benefits. Some other problems are lack of proper knowledge, lack of proper training facilities and labour scarcity for farm operations. To overcome from these problems there is need to provide better knowledge to the farming community and also to conduct training programme so that IPM practices can be used by farmers in a better and scientific manners. Same results were also founded by Jayasooriya and Aheeyar (2015).

CONCLUSION

It is concluded on the basis of major findings of the study that, respondents above the age group of 50 years are more involved in Litchi growing. Educated level of the farmers was good in the study area. Respondents were unaware about benefits of the IPM

Table 4: Problems faced by Litchi growers regarding Integrated Pest Management practices

Problems	Level of seriousness			Total score	MPS	Rank
	MS	NS	S			
Lack of proper knowledge	75	13	15	266	88.66	II
Lack of training facilities	77	5	16	257	85	IV
Labour scarcity for farm operations	78	2	20	258	86	III
Complex IPM practices	100	0	0	300	100	I
More time and energy consuming practices	100	0	0	300	100	I
Inadequacy of equipment's used in IPM	100	0	0	300	100	I
Lack of favorable government policies and support	100	0	0	300	100	I
Powerful influence of pesticide industry	100	0	0	300	100	I
Shortage of funding for IPM, especially large-term funding	100	0	0	300	100	I
Costs of IPM are much more apparent than benefits	100	0	0	300	100	I

*multiple response

due to lack of proper knowledge and awareness and due to lack of training facilities and extension contacts. Another reason was that there was more influence of pesticide companies due to which farmers use pesticides instead of IPM practices. There was need of more training programs and awareness campaigns related to IPM for farmers.

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Research Article

Knowledge of the Recommended Package of Practices by the Almond Growers of Pampore Area of Kashmir Valley

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ABSTRACT

The present study was conducted in the Pampore block of the Kashmir valley. The area is specifically known for production of worlds most precious spice viz. Saffron. Owing to its Karewa lands, the area is known to produce top quality almonds both bitter and sweet ones. The study was undertaken in this area to get the first-hand information regarding the production technology adopted by the almond growers of the different villages falling in Pampore area in order to enable the policy makers to develop strategies for the transfer for technology wherever there exists any such scope for the same. The study was carried out in five randomly selected villages of Horticulture block Pampore of district Pulwama of J&K (UT). A sample of 120 almond growers was taken for collecting the primary data with the help of a well-structured interview schedule. The study reveals that majority of the respondents were literate with middle age (16-30 years) having family size of 6-10 members, possessing a land holding of above 2 hectares. Majority of the respondents were dependent on agriculture for their livelihood with farming experience of 16-30 years, annual income upto Rs 2 lakhs, medium sources of information and scientific orientation and majority of the respondents had medium extension contacts. Majority of the respondents (46.67) per cent had medium level adoption regarding the recommended package of practices.

Keywords: Adoption, Almond growers, Income, Interview schedule, Karewa lands, Scientific orientation

INTRODUCTION

Almonds (*Prunus amygdalus*) are native to Mediterranean region and considered as one of the oldest tree nut in the world, it is closely related to peach and have probably evolved from the same ancestral species in South-Central Asia. From there it spread along the shores of the Mediterranean in Northern Africa and Southern Europe by Egyptians, Greeks and Romans. It was bought to California in the 17th century by Spanish where the industry progressed and production increased several folds due to cultivation of superior varieties accompanied by prudent scientific production and protection technologies making California, the world leader in almond production. In India it was first introduced to Kashmir during 16th century by Persian settlers but in spite of its great potential in the region, the crop could not be developed on commercial scale as that of apple. Almond (*Prunus amygdalus*) belongs to family Rosaceae a drupe, consisting of an outer hull and a hard shell with the seed, which is not a true nut. There are two main types of almonds. One variety (*Prunus amygdalus var. dulcis*) produces sweet almonds, which are edible, and may be eaten raw or roasted or pressed for the almond oil (Bender and Bender, 2005). The other variety (*Prunus amygdalus var. amara*) produces bitter almonds, which are used for almond oil.

The world almond production for the year 2017 stands at 2,239 thousand metric tonnes, with United States being the leading producer. In united states the

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production amounted to approximately 10 lakh tonnes with area 4 lakh hectares in that marketing year followed by Spain 2.5 lakh tonnes having area under almond 6.3 lakh hectares and Iran having production of 1.1 lakh tonnes and area 50 thousand hectares approximately. (Anonymous, 2017a).

The India's almond production for the year 2016-17 stands at 7.94 thousand metric tonnes. Out of this, 7 thousand metric tonnes are being produced alone in Kashmir valley, which accounts for 88 per cent of the total almond production in India and rest 0.94 metric tonnes are being produced in Himachal Pradesh, accounting for 11 per cent of the total almond production in India. In Jammu and Kashmir, almond is cultivated over an area of 5.11 thousand hectares with production of 7 thousand metric tonnes. However, the world average production of a professionally maintained almond tree is 23-30 kg/ tree which are higher than the almond production in Jammu and Kashmir (Rao, 2017). Pulwama is the leading producer of almonds and is having maximum area 4688 hectares under almond in the state of Jammu and Kashmir with a production of 4180 metric tonnes followed by Budgam having area under almond 1467 hectares and production 1486 metric tonnes. In Baramulla area under almond is 258 hectares and production is 553 metric tonnes. In district Pulwama block Pampore has the maximum area under almond 1435 hectares with production 574 metric tonnes. The area and production of Himachal Pradesh for the year 2017 stands at 6.58 thousand hectares and 7 thousand metric tonnes respectively. (Anonymous, 2017b).

MATERIALS AND METHODS

Agro-climatic conditions: District Pulwama lies Mid to High altitude Temperate Agro Climatic Zone. Pulwama is located at 33^0 54'N latitude, 70^0.53'E longitude and 5273meter altitude with average annual rainfall of 658mm. Majority of the area has clay soils and very limited area has sandy loam soils. Net sown area is 32.381 thousand ha with net irrigated area 21.319, gross irrigated area is 38.858, rainfed area 20.453 with a cropping intensity of 176 per cent.

Cropping pattern of District: Besides, Pampore being known for the world's famous cash crop i.e. saffron, the Cropping pattern of this karewa land is dominated by horticulture as it is economically preferable especially apple and almond fruit Crops.

Selection of horticulture block: In district Pulwama, almond is cultivated in 5 blocks and block Pampore has been purposively selected having maximum area under almond.

Selection of horticulture block

Name of block	Area (ha)	Production (tonnes)
Pulwama	344	310
Tral	229	206
Pampore	1486	1338
Rajpora	18	16
Kakapora	317	386

Source: Chief Horticulture Office, Pulwama (2018)

Selection of villages: Block Pampore comprises 23 villages. Out of 23 villages, almond is being cultivated only in 19 villages. Among 19 villages only 5 villages namely 1. Chandharoo 2. Maij 3. Dusoo 4. Konibal 5. Ludhoo got selected randomly.

Selection of almond growers: The study was carried in selected 5 villages in block Pampore of Pulwama district. A comprehensive list of farmers engaged in almond cultivation from each village was framed in consultation with the office of Horticulture Development Officer of the concerned Horticulture Block. Respondents were selected using proportionate sampling technique (taking area as auxiliary information) and ultimate unit of sampling (farmer) were selected randomly taking the total sample size of 120 respondents.

Table 1: Selection of Almond orchardists from selected villages

District	Block	Villages	No. of orchardists	Orchardists to be selected
Pulwama	Pampore	Dusoo	168	27
		Chandhara	231	37
		Maij	98	15
		Konibal	133	21
		Ludhoo	129	20
Total		05	759	120

Source: Horticulture Development Office, Pampore Pulwama

Formula for proportionate allocation method:

$n_1 = N_1/N \times n$

n_1= Total sample from the village

n =Sample size (120)

N_1=Total number of respondents from the concerned village.

N=Total number of respondents from the 5 villages.

Data collection: The researcher personally collected the data by interviewing the respondents using well-structured interview schedule. The questions were simple and brief, asked in local language i.e. Kashmiri. All the selected respondents were personally interviewed by the researcher and the data was recorded directly on the schedule, which enabled the author to get first-hand information and gave an opportunity to observe their reactions. The respondents were at ease and expressed their opinion freely, fairly and frankly as friendly atmosphere was maintained during the interview.

Compilation of data and working out of scores: Scores were given to responses collected from respondents and then accordingly tabulated. Suitable statistical tools were used and findings emerged out of the data analysis were interpreted based on the study objectives and accordingly discussed and necessary inferences, conclusions were drawn.

RESULTS AND DISCUSSION

Age: The data presented in the Table 2 revealed that more than half of the respondents i.e. 50.83 per cent belonged to middle age category, whereas 36.67 per cent belonged to old age category and only 12.50 per cent belonged to young age category. Most of them were middle aged, with more experience, but younger farmers being more innovative counteract it. It might be because of the reason that farmers of middle age are enthusiastic having more responsibility and are more efficient than the younger and older ones. These results are in line with Ashok (2011).

Education: With regard to education, it is evident from the Table 2 that 26.67 per cent of the respondents studied upto middle level, while 25.00 per cent and 25.83 per cent of respondents have education upto high school and graduation & above level respectively followed by illiterate 20.83 per cent and primary level of education 1.67 per cent. The possible reasons for

Measurement of variables

Variables	Empirical Measurement
Dependent variables	
Knowledge	Out of 21 questions framed, only 16 questions were retained for measuring the level of knowledge of recommended almond cultivation practices after pre-testing of the schedule.
Adoption	Level of adoption has been measured by framing questions based on package of practices regarding almond cultivation given by SKUAST-K.
Independent variables	
Age	Chronological age of the respondent
Education	Number of years of formal schooling
Occupation	Measured with involvement of respondents in various occupations.
Annual Income	Total annual income from agriculture and allied activities.
Family size	Number of members in family
Experience in almond cultivation	Number of years completed by the respondent in almond farming at the time of interview.
Land holding	Total land possessed by the farmer in kanals
Source of information	Measured with the degree to which the respondents utilized various information sources.
Scientific orientation	Measured with scale developed by Raja (1998) with suitable modifications.
Extension contacts	It has been measured by the frequency of contact of farmers with various extension personals.

Table 2: Socio-economic profile of almond growers (N=120)

Variable	Category	Respondents	
		Frequency	Percentage
Age	Young (23-44 years)	15	12.50
	Middle (45-66 years)	61	50.83
	Old (above 66 years)	44	36.67
Education	Illiterate	25	20.83
	Primary level	02	01.67
	Middle level	32	26.67
	High level	30	25.00
	Graduate and above	31	25.83
Occupation	Only Agriculture	54	45.00
	Agriculture + Business	29	24.16
	Agriculture + Services	37	30.84
Annual income	Annual income group I (up to 2 lakhs)	45	37.50
	Annual income group II (2-4 lakhs)	40	33.33
	Annual income group III (above 4 lakhs)	35	29.17
Family size	(up to 5 members)	19	15.83
	(6-10 members)	70	58.33
	(above10 members)	31	25.84
Experience in Almond cultivation	Up to 15 years	29	24.17
	16-30 years	54	45.00
	Above 30 years	37	30.83
Land holding	Small (up to 1 hectare)	37	30.83
	Medium (2 hectares)	41	34.17
	Large (more than 2 hectares)	42	35.00
Source of information	Low (below mean- S.D)	40	33.33
	Medium (between mean ±S.D)	55	45.84
	High (above mean ±S.D)	25	20.83
Scientific orientation	Low (below mean ± S.D)	51	42.50
	Medium (between mean ± S.D)	47	39.50
	High (above mean ± S.D)	12	10.00
Extension contacts	Low (below mean ± S.D)	33	27.50
	Medium (between mean ±S.D)	64	53.33
	High (above mean ±S.D)	23	19.17

more educated sample from the total sample could be the importance of education in one's life, easy availability and access to education facilities in the area. The findings also get support from Moulasab (2004).

Occupation: The data presented in the Table 2 revealed that majority 45.00 per cent of the respondents had agriculture as their main occupation followed by 30.84 per cent who were involved in agriculture as well as Govt. services and rest of the sample size 24.16 per cent were having agriculture as well as business as their occupation. Hence, the agriculture was seen as an important occupation in the study area. The results are in line with the findings of Raghuprasad (2018).

Annual income: Table 2 revealed that majority 37.50 per cent of the respondents were having annual income upto 2 lakhs, 33.33 per cent had annual income of 2-

4 lakhs and 29.17 per cent of the respondents were having annual income of above 4 lakhs per annum. The data in Table 2 show significant relation with the results from Table 1 which reveals why majority of the farmers had low annual income upto (2 lakhs) as majority of farmers had only agriculture as their main occupation. The findings are similar to the findings reported by Gupta *at al.* (2018).

Family size: A close look at Table 2 shows that majority 58.33 per cent of the respondents belonged to family group of 6-10 members followed by 25.84 per cent which belong to family group of above 10 members and only 15.83 per cent of the respondent were having upto 5 members of family. The reason for falling majority of respondents in medium category is due to the fact that in modern days people prefer to live with families having medium and nuclear family size to maintain their economic status and livelihood, also the emergence of government policies which emphasizes on having small families also might be one of the reasons. This is in conformity with the findings of earlier studies by Khalache and Khaire (2014).

Experience in almond cultivation: The data pertaining to experience in almond cultivation in the Table 2 showed that majority 45.00 per cent of the respondents had an experience of 16-30 years, 30.83 per cent had above 30 years and 24.17 per cent had experience upto 15 years. This might be due to the reason that farming experience mainly depends upon age of the farmer. Since majority of the respondents belonged to middle age category, having medium level of farming experience. The results are in line with the findings of Devi (2012).

Land holding: From the Table 2, it was revealed that 35.00 per cent of the respondents were having land holding of 2 hectares, 34.16 per cent had holdings of more than 2 hectares and 30.83 per cent had holding of 1 hectare of land. The study area greatly has the plain land and in such lands large land holdings are common. Similar findings were reported by Sidram (2008).

Sources of information: The data presented in the Table 2 revealed that majority of the respondents 45.84 per cent belonged to medium level of information sources category followed by 33.33 per cent who had low level of sources of information and 20.83 per cent of respondents had high level of sources of information. Thus, it may be concluded that majority of the farmers had medium information source utilization followed by low and high. The reason behind this fact may be that majority of respondents belonged to middle level of education, which affects the overal information seeking behaviour of almond growers. The results of this finding are in line with the previous study conducted by Motiwale (2017).

Scientific orientation: With regard to scientific orientation the data presented in the Table 2 showed that, 42.50 per cent of the respondents had low level of scientific orientation. Whereas, 39.50 per cent and 10.00 per cent had medium and high level of scientific orientation respectively. This might be due to, that majority of respondents were middle aged with medium level of education. The results are in accordance with the findings of Sriramana (2014).

Extension contacts: It is evident from data given in Table 2 that more than half of the respondents 53.33 per cent belonged to medium level extension contacts, whereas 27.50 per cent of the respondents had low level extension contact and 19.17 per cent had high level of extension contact.

This might be due to reason that majority of respondents might have medium extension participation as the Agriculture/Horticulture departments, KVK'S were not far from the villages resulting in medium extension contacts. The above findings were in accordance with the findings of study conducted by Raja (2018).

It is evident from the Table 3 that majority 46.67 per cent of the growers had medium level of knowledge, 35.00 per cent had low level and 18.33 per cent of the respondents had high level of knowledge on the specialized designed scale. The mean and standard deviation score for knowledge were 28.05 and 5.775 respectively.

The possible reason for having majority of respondents in medium level of knowledge category might be that, as every individual tries to acquire knowledge regarding different operations related to his crop like fertilizer application, pesticide application, adoption of improved varieties, spacing, harvesting time, pruning etc. to get assured yield. The above

Table 3: Overall knowledge level of almond growers (N=120)

Variable	Categories	Respondents	
		Frequency	Percentage
Knowledge	Low (below mean - S.d) (< 22.275)	42	35.00
	Medium (btwn mean +S.d) (22.276+28.051)	56	46.67
	High (above mean +S.d) (>28.052)	22	18.33

Mean: 28.05 S. d.: 5.775

findings are in confirmation of the results of the study conducted by the Suman (2014).

In order to study the nature of relationship between the selected independent variables of Almond growers and their knowledge level, Pearson's correlation analysis was followed using standard statistical package. Table 4 reveals that the age was negatively and significantly correlated, education, occupation, experience, extension contacts, sources of information and scientific orientation were positively and significantly related with the knowledge level of the respondents. However, annual income, family size and landholding had positive but non-significant relation with the knowledge level of the respondents.

A close look at the Table 5 reveals that only three variables could contribute significantly to the variance in farmers' extent of knowledge of improved almond production practices. Out of these, education level, information sources and scientific orientation contributed significantly in predicting the extent of knowledge of almond production technology by farmers. Thus it can be concluded that these three variables have strongly impacted the extent of

Table 4: Relationship of Independent variables of respondents with their Knowledge (N=120)

Variable	Correlation coefficients ('r' value)	'p' value
Age	-0.526**	0.000
Education	0.556**	0.000
Occupation	0.280**	0.002
Annual income	0.169^{NS}	0.066
Family size	-0.112^{NS}	0.223
Experience in almond cultivation	0.478**	0.000
Land holding	0.053^{NS}	0.566
Sources of Information	0.390**	0.000
Scientific Orientation	0.573**	0.000
Extension contacts	0.264**	0.004

** 'p' value less than 0.05 implies that correlation is significant

Table 5: Regression analysis of extent of knowledge of improved almond production practices by respondents with independent variables (N= 120)

Predictor	Co-efficient	Standard error co-efficient	t-statistics	P-value
Constant	15.630	4.959	3.15	0.002
Age	-0.08873	0.06192	-1.43	0.155
Education	0.7649*	0.3316	2.31	0.023
Occupation	0.5023	0.6360	0.79	0.431
Annual income	-0.00000170	0.00000307	-0.55	0.581
Family size	0.0471	0.0026	0.42	0.676
Experience in almond cultivation	0.07116	0.04692	-0.55	0.581
Land holding	0.01416	0.02218	0.64	0.525
Source of information	0.5107*	0.1969	2.59	0.011
Scientific orientation	0.5697**	0.1770	3.22	0.002
Extension contacts	0.0558	0.3423	0.16	0.871

*significant at 0.05 level of probability **significant at 0.05 level of probability

knowledge. This may be due to the fact that education level, information sources and scientific orientation would have positively contributed towards the cognitive behavioural changes in the respondents thereby prompting them to gain more knowledge related to new technologies or the improved production technologies in almonds.

CONCLUSION

Almond being one of the important fruit crop of Jammu and Kashmir, which is being cultivated in wide area by farmers in the selected survey area. The current study brought out certain important findings which have got direct bearing on those involved in technology transfer and policy making. They are detailed below.

- With regard to overall knowledge level of almond growers, majority 46.67 per cent of the almond growers had medium level of knowledge, 35.00 per cent had low level and 18.33 per cent of the almond growers had high level of knowledge.
- Majority of the almond growers were not having appropriate knowledge regarding recommended fertilizer management, pesticide spray and recommended varieties.

This indicates a vast scope for the line departments to intervene and improve the knowledge level of farmers about recommended cultivation practices of almond. Different practices which are considered as important for obtaining potential yield like layout, fertilizer management and plant protection measures should be considered as crucial intervention points by line departments and should accordingly mobilize their system to educate farmers.

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Research Article

Communicational and Psychological Determinants of Risk Perception of Farmers Towards Climate Change in Madhya Pradesh

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ABSTRACT

Climate change has been perceived as "very serious" problem and become a complex global hazard which poses significant challenges to the people worldwide. The paper focuses on the evaluating the risk perceived by farmers against the climatic variation specially in terms of agriculture in Bundelkhand and gird agro-climatic zones of Madhya Pradesh, India. There is need to understand farmer's point of view, and up to what extent they are exposed to the climatic change and how they are reacting to it. A sample of 235 respondents was interviewed to find their perception on climate change. The findings revealed that majority of the farmers had high risk perception towards the climate change. The major risk perceived by the farmers were "Uncertainty in rainfall patterns is one of the major factors affecting crop production", ranked I followed by "Adverse weather events have affected adaptation and mitigation practices over the years", ranked II and "The livelihood pattern of farmers is changing due to changing climatic conditions", ranked III. The risk associated with the climate variability directly affecting the agriculture and related activities and there is an urgent need to identify such more risk and find methods and make strategies to overcome and strengthen farmer's potential to withstand the adverse situation.

Keywords: Climate Change, Risk Perception, Mitigation Strategies, Adaptation

INTRODUCTION

Climate change has emerged as a major component of global (including UN) and national policymaking dialogues and debates about sustainable development and food security scenarios. Climate change-related hazards and uncertainties are thus fueling intellectual debate and development study with an emphasis on increasing agricultural productivity and efficiency. Because of its reliance on climate, India has been identified as one of the most vulnerable regions to climate change and variability by the IPCC (Intergovernmental Panel on Climate Change). Climate change has raised a significant threat to the whole world and it can be seen as the greatest environmental hazard (Anik and Khan, 2012), especially in the developing countries, where small and marginal farmers are resentfully and extensively affected by the changes, as well as becoming more vulnerable to various climatic erratic events (Altieri and Nicholas, 2017; Sarker *et al.,* 2013). The literature on the effects of climate change on Indian agriculture is uncluttered, but it is becoming more prevalent. Several studies have been conducted in recent years to investigate the effects of climate change on agriculture. However, their results varied significantly, most likely due to discrepancies in estimating methodologies and underlying assumptions. According to Aggarwal (2009), a 1.0°C increase in mean temperature reduces wheat, soybean, mustard, peanut, and potato yields by 3 to 7 per cent. Even

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after accounting for the good impacts of carbon fertilization, if the temperature rises by 2.5°-4.9°C by 2099, the damage to these crops will increase to 10-40 per cent.

Human perception is exceptionally special as it allows for a distinction between the reality of factual real world like climate change and the subjective perceptual judgement of such threats (Sjöberg, 2000a). Risk perception is a mental construct, although climate change has become one of the existential risk to life on Earth and its assessment differs from individual to individual (e.g., Hine *et al.*, 2013; Maibach *et al.,* 2011; Metag *et al.,* 2015; Whitmarsh, 2011). Farmers' opinions of climate change and its negative effects on agriculture are crucial for implementing mitigation and adaptation solutions. Risk perception is a social phenomenon that expresses the relationship between the risk object (farmers) and the item under threat (agricultural productivity). Sound and precise measurements of farmers' perceptions of the risks and uncertainties connected with climate change and its negative impact on agriculture can thus aid in the implementation of appropriate mitigation and adaptation strategies (Raghuwanshi and Ansari, 2019).

Bundelkhand and Grid acro-climatic zone of Madhya Pradesh has a high physical vulnerability due to its exposure to varying weather conditions. The region is mostly rainfed, with a fluctuating precipitation trend. Drought-like circumstances are common in this region, leading to unstable socioeconomic conditions. Monsoon remains a crucial regulator of sowing time, which has shifted dramatically in recent years, causing huge losses to farmers due to a lack of accurate and timely information. Therefore, the present study is conducted to examine the risk perception of farmers towards the climate change so that adequate adaptation and resilient measure should be engaged to reduce the vulnerability of farmers due to the climate change especially related to agriculture.

MATERIALS AND METHODS

The study was conducted in five climatic vulnerable districts of two agro-climatic zones of Madhya Pradesh during the year 2022-23 i.e. Bundelkhand and Gird agro-climatic zone. These districts were Datia, Chhatarpur, Tikamgarh, Morena and Guna. The present study employed the ex-post facto research design. By using proportionate random sampling method 10 percent of the total beneficiary farmers were selected from each district with the help of KVK of each district. Hence, a total sample size of 235 farmers were selected for the study. A structured interview schedule was used to collect he data. The risk perception were the dependent variable represented by Y_1. Information seeking behavior (X_1), Media Exposure (X_2), extension contact (X_3) and Social Participation (X_4) were the communicational variable whereas, management orientation (X_5), Scientific orientation (X_6), Economic motivation (X_7), Attitude towards improved farm practices (X_8) and knowledge about climate change (X_9) were the psychological variables. The risk perception was measured using scale developed by Raghuwanshi and Ansari (2019). The scale consisted of 20 statements and the responses of the respondents were recorded on five-point continuum representing strongly agree, agree, undecided, disagree and strongly disagree with scores of 5, 4, 3, 2, and 1, respectively. The perception score on this scale ranges from a minimum of 20 to a maximum of 100. The perception score of each respondent can be calculated by adding up the scores obtained by him/her on all the items. The farmers were categories based on their score into three categories viz. Low, medium and high risk perception based on the standard deviation and mean score. The data was subjected to the correlation analysis and multiple regression analysis in order to define the relationship and association between the chosen independent and the independent variable.

RESULTS AND DISCUSSION

The data presented in Table 1. illustrated the distribution of farmers on the basis of their perceived risk towards the climate change. It can clearly be depicted from the table that majority (70.21%) of the farmers believed that uncertainty in rainfall patterns is one of the major factors affecting crop production. Tripathi and Mishra (2016) also reported similar finding that most of the farmers were aware of long-term changes in rainfall and were also aware about the risk generated by the same phenomenon. On adaptation and mitigation, 65.11 per cent farmers said that adverse weather events have affected adaptation and mitigation practices over the years. This might be due to in our country, where

Table 1: Distribution of farmers on the basis of their perceived risk towards the climate change

S. No.	Statements	SA F(%)	A F(%)	UN F(%)	D F(%)	SD F(%)	Mean	Rank
Exposure								
1	Agriculture sector has become more vulnerable due to climate change	105(44.68)	82(34.89)	12(5.11)	26(11.06)	10(4.26)	4.05	VI
2	Climate change is caused by both environmental and human activity	54(22.98)	55(23.40)	20(8.51)	84(35.74)	22(9.36)	3.15	XVII
3	Extreme cold weather, strong wind and heavy fog affectfarming	85(36.17)	93(39.57)	36(15.32)	21(8.94)	0(0.00)	4.03	VII
4	Climate change is the most important problem of today's time	40(17.02)	73(31.06)	60(25.53)	28(11.91)	24(10.21)	3.20	XVI
5	The temperature is increasing every year due to climate change	98(41.70)	72(30.64)	12(5.11)	27(11.49)	26(11.06)	3.80	XII
6	Uncertainty in rainfall patterns is one of the major factors affecting crop production	165(70.21)	70(29.79)	0(0.00)	0(0.00)	0(0.00)	4.70	I
7	Adverse weather events have affected adaptation and mitigation practices over the years	153(65.11)	77(32.77)	5(2.13)	0(0.00)	0(0.00)	4.63	II
8	Biodiversity is threatened by climate change	76(32.34)	77(32.77)	57(24.26)	25(10.64)	0(0.00)	3.87	X
9	The frequency of drought has affected agricultural production	66(28.09)	67(28.51)	61(25.96)	35(14.89)	6(2.55)	3.65	XIII
Sensitivity								
10	Weed and pest attacks have increased nowadays as compared to earlier times	50(21.28)	35(14.89)	71(30.21)	45(19.15)	34(14.47)	3.09	XVIII
11	The productivity of various crops has changed due to climate change	86(36.60)	96(40.85)	13(5.53)	28(11.91)	12(5.11)	3.92	VIII
12	Deforestation has become more serious due to climate change	60(25.53)	86(36.60)	33(14.04)	56(23.83)	0(0.00)	3.64	XIV
13	Soil erosion is increasing day by day due to heavy rains	104(44.26)	93(39.47)	38(16.17)	0(0.00)	0(0.00)	4.28	IV
14	Many species of plants and animals have become extinct due to the changing climate	24(10.21)	30(12.77)	108(45.96)	33(14.04)	40(17.02)	2.85	XX
15	Livestock rearing has become vulnerable due to climate change	74(31.49)	74(31.49)	31(13.19)	36(15.32)	20(8.51)	3.62	XV
16	Excessive variation adversely affects the productive capacity of livestock	95(40.43)	69(29.36)	36(15.32)	20(8.51)	15(6.37)	3.89	IX
Adaptive capacity								
17	Climate change has led to changes in cropping seasons & cropping practices of farmers	150(63.83)	34(14.47)	5(2.13)	26(11.06)	20(8.51)	4.14	V
18	The livelihood pattern of farmers is changing due to changing climatic conditions	114(48.51)	84(35.74)	37(15.74)	0(0.00)	0(0.00)	4.33	III
18	Climate change has made it difficult to decide when to start sowing and harvesting	90(38.30)	73(31.06)	30(12.77)	31(13.19)	11(4.68)	3.85	XI
20	The land use pattern is changing due to the changing climatic conditions	34(14.47)	44(18.72)	67(28.51)	54(22.98)	36(15.32)	2.94	XIX

F=Frequency, SA=Strongly agree, A=Agree, UN=Undecided, D=Disagree, SD=Strongly Disagree

the vast majority of farmers are marginal and smallholder farmers, less educated, and have substantially poorer adaptive potential, adapting agriculture to CC is a huge problem. One cannot therefore anticipate autonomous adaptation. Even if it were feasible, it wouldn't be enough to make up for CC losses (McCarth, 2001). The livelihood pattern of farmers is changing due to changing climatic conditions were reported by 48.51 per cent farmers. Nearly, 44.26 per cent of the farmers perceived that soil erosion is increasing day by day due to heavy rains, whereas majority (63.83%) of the farmers registered strong agreement with the fact that climate change has led to changes in cropping seasons and cropping practices of farmers. A change in crop rotation and cropping calendar has also been disclosed by the farmers in the study of Singh (2020).

A higher percentage (44.68%) of the farmers said that agriculture sector has become more vulnerable due to climate change. In addition to this, 39.57 per cent of the farmers expressed that extreme cold weather, strong wind and dense fog affect agriculture. Most of the farmers (40.85%) revealed that the productivity of various crops has changed due to climate change. On, livestock, 69.79 of the farmers perceived that excessive variation in temperature adversely affects the productive capacity of livestock while 31.49 per cent of the farmers felt that livestock rearing has become vulnerable due to climate change. Dairy breeds are more vulnerable to heat stress than the meat breeds. An increase in metabolic heat production in higher milk producing breeds leads to higher susceptibility to heat stress; while the low milk producing animals are resistant (Dash *et al.,* 2016).

It could be observed, that higher percentage of the farmers (38.30%) claimed that climate change has made it difficult to decide when to start sowing and harvesting Whereas, 41.70 per cent of the farmers strongly agree that "The temperature is increasing every year due to climate change. The frequency of drought has affected agricultural production were reported by more than half of the farmers (56.60%). Shrivastava *et al.* (2018) had reported the in agreement to the result of the study that in the Jabalpur district, rice and wheat are the primary crops. In a rice-wheat cropping system, the drought-stricken rice crop, while the wheat crop is exposed to greater temperatures during the grain-filling stage, which ultimately results in poor yield and lower grain quality. Climate variables including temperature and precipitation are predicted to change crop production seasons, pest and disease patterns, and the range of viable crops, which will have an impact on output, prices, income, and eventually, people's survival. Majority of the farmers (36.60%) believed that deforestation has become more severe due to climate change.

A little less than the half number of farmers i.e. 48.08 per cent proclaimed that, climate change is the most important problem of today's time. A sizable group of farmers (35.74%) contradicted to that climate change is caused by both environmental and human activities. The result shows the unawareness of the farmers about the possible causes of climate change. Higher percentage of the farmers (36.17%) were agreed that, Weed and pest attacks have increased nowadays as compared to earlier time. A study conducted by Sarkar and Padaria (2010) mentioned in their study that majority (70%) of the farmers were responded that there the incidence of certain types of disease, like blast in seedbed of paddy, yellowing of leaves, leaf curl and rotting of seedlings of different crops have increased. About, 38.30 per cent of the farmers were in agreement to that the land use pattern is changing due to the changing climatic conditions. Furthermore, a sizable group of farmers (45.96%) were undecided with the statement that, many species of plants and animals have become extinct due to the changing climate.

The farmers' understanding of the likelihood of dangers or negative consequences related with climate change the data in Table 2. indicated that more than half of the farmers (55.32) were having high risk perception followed by 24.26 per cent of the farmers

Table 2: Classification of farmers based on their risk perception towards climate change

Categories	Respondents	
	Frequency	Percentage
Low (<46.45)	46	19.57
Medium (46.45-71.07)	57	24.26
High (>71.07)	130	55.32
Total	N=235	100

Mean: 58.76 S. D.: 12.31

were having moderate whereas, 19.57 per cent of the farmers had low risk perception, respectively. The findings of the present study is similar to that of Ansari and Raghuwanshi (2018), wherein it is stated that farmers were having high risk perception and they also displayed fairly good understanding of the various aspects that contributed to climate change like increase in temperature and rainfall behavior, Increase in heat stress due to rise in temperature and depletion of ground water table and several others. In another study by Shankara *et al.* (2013) also revealed that, majority of the sampled farmers were having high level of risk perception about climate change.

The data presented in Table 3 illustrated the correlation coefficients and regression coefficient of risk perception (Y) with communicational and psychological attributes (X) of farmers, respectively.

The findings revealed that the information seeking behavior of the farmer has a positive and significant correlation with the dependent variable. Beneficiaries obtained information about the advantages and difficulties of CRA technology adoption from KVK and NICRA officials, as well as discussions with other farmers in the village, which may have contributed to the farmers' positive and significant association of information seeking behavior with CRA technology adoption (Pabba *et al.,* 2022). The obtained result is in accordance with the findings of Mohokar *et al.* (2019) and Manjunath *et al.* (2018). Media exposure was positively and significantly related with the risk perception of the farmers. Raghuwanshi and Ansari (2017) had reported that mass media had a positive and significant relationship with the awareness of famers towards climate change. Further, Sampei and Aoyagi-Usui (2009) emphasized the importance of media in enhancing the public awareness on climate change. Findings here suggested that use of media plays an important role in shaping the farmer's perception on climate change. Likewise, social participation and extension contact shows a positive and significant relationship with the risk perceived by the farmers about the climate change.

Management orientation has a significant relationship with the dependent variable. Economic motivation positively correlated with the risk perception of the respondents. Kumari *et al.* (2020) suggested that incorporate a whole-farm integrated crop management approach is crucial to prioritize the risk reduction through diversification of both crops and buyers and markets. It was observed that scientific orientation and attitude towards improved farm practices were found to be positive and significantly correlated with the dependent variable. The attribute 'knowledge about climate change' was found to be correlated with the risk perceived by farmers about the climate change. Recent studies have found that particular socio-psychological variables may influence individual perceptions of environmental risk, which may improve or impede the willingness of individuals to cope with impending environmental risks (Dominicis *et al.* (2015).

Table 3: Summarizes the correlation coefficients and regression coefficient of risk perception with communicational and psychological attributes of farmers

Variable	Correlation coefficient	Regression coefficient	Std. error	t-value
Information seeking behavior (X_1)	0.213**	0.610	0.194	3.759**
Media exposure (X_2)	0.175**	-1.510	1.102	-6.031**
Social Participation (X_3)	0.184**	-0.307	0.766	-2.084**
Extension contact (X_4)	0.179**	0.612	1.677	3.331**
Management Orientation (X_5)	0.310**	-0.052	0.109	-1.029**
Economic Motivation (X_6)	0.264**	-0.045	0.118	-0.921**
Scientific Orientation (X_7)	0.235**	0.784	0.296	7.880**
Knowledge about climate change (X_8)	0.238**	-0.121	0.806	-0.748^{NS}
Attitude towards improved farm practices (X_9)	0.240**	-0.142	0.056	-2.870**

R^2=0.517, Adjusted R^2 =0.497, S.E.E= 8.432, F=23.487

(** - Correlation is significant at 0.01 percent level, NS- Non-significant)

Multiple regression analysis was worked out to assess the combined effect of (X_1-X_9) independent variable on explaining the dependent variable. The coefficient of determination (R^2) of the independent variable was 0.517. It means that 51.70 per cent of the total variation in the risk perception of farmers towards climate change was explained by the selected 9 independent variables. The 't' value showed that the risk perception of farmers was significantly related to information seeking behavior, media exposure, social participation, extension contact, management orientation, economic motivation, scientific orientation, attitude towards improved farm practices. The findings are comparable with the findings of Shankara *et al.* (2013) who employed multiple regression analysis on variables namely age, gender, education, family size, occupation, farming experience, landholding, annual income, knowledge about coping strategies, decision making ability, economic motivation, scientific orientation, mass media exposure and information seeking behavior with relation to farmers perception to climate change found that 'R^2' value (coefficient of determination) was 0.43, which means that 43 per cent of the total variation in dependent variable is explained by the independent variable. In another study conducted by Ullah *et al.* (2015) who stated that the influence of socioeconomic and demographic characteristics on farmers' risk perceptions are minor, whereas access to official information and informal credit sources increases farmers' risk perceptions, respectively.

CONCLUSION

One of the key factors affecting agricultural productivity worldwide, including in India, is climate change. The fact that more than two thirds of Indian agriculture is rainfed places it at the whims of the weather. Therefore, it would be of the utmost importance for scientists and policymakers to identify the elements that have a detrimental impact on agricultural productivity and production efficiency. In order to ensure that farmers implement the proper adaptation measures, it is important to understand how farmers perceive climate change, the reasons that contribute to this view, and the negative effects it has on agricultural productivity. From the present study it was clearly revealed that most of the farmers have fairly high perception towards the climate change, they understand the variation that has occurred in temperature and rainfall, difficulty in adaptation to climate change and how erratic climatic events affecting their livelihood. It is need of the hour to conduct such more studies on understanding the risk associated with climate change and farmer's level of vulnerability to climate change. Through proper assessment only, adequate and efficient adaptation measure should be applied to the concern areas and the level of adoption can be increase.

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Research Article

Progress and Performance of Microfinance Institutions in Haryana

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ABSTRACT

Microfinance institutions in India have emerged as key players in promoting financial inclusion and meeting the financial needs of low-income individuals and marginalized communities in the country. With the limited coverage of traditional financial institutions in rural areas, microfinance institutions have stepped in to bridge this gap and provide access to credit, savings, pensions, and insurance facilities. These institutions play a vital role in addressing issues such as poverty reduction, income generation, women empowerment, and improving livelihood practices in India. The primary goal of microfinance institutions is to provide financial services to the poor and disadvantaged households who are not assisted by traditional banking sectors. This paper examines the existing performance and progress over the span of five years of microfinance institutions in Haryana. The awareness level of women and their satisfaction level after joining MFIs. The study was conducted by taking primary data from 80 respondents based on scheduled questionnaire in Hisar, Bhiwani and Karnal district of Haryana state in 2022-23. Data revealed that, there was continuous increase in formation of new self help groups in year 2020-21 (16.37%), 2021-22 (17.27%) and 2022-23 (2.20%) respectively. In addition, majority of women were found to be aware about services of Microfinance Institution(s). 95 per cent of women agreed that creditor's staff is friendly and warm and loan utilization check is strictly followed. Thus the study concluded that overall microfinance institutions have become successful initiatives in the state of Haryana and if more women can be associated with it will lead to holistic development of the rural women.

Keywords: Micro-finance institutions, Women, Socio-economic, Income

INTRODUCTION

In the dynamic landscape of India's financial sector, the progress of microfinance institutions (MFIs) has been a transformative force, particularly over the past few decades. Microfinance, a concept rooted in the idea of providing financial services to the economically marginalized sections of society, gained significant traction in India as a means to alleviate poverty and empower individuals at the grassroots level. The National Strategy for Financial Inclusion (2019-2024) outlines the government's commitment to expanding the reach of financial services, with MFIs playing a crucial role. The introduction of MFIs marked a departure from traditional banking models, as they focused on extending small loans and financial services to those who lacked access to formal credit. This inclusive approach aimed at fostering entrepreneurship, supporting small businesses, and improving the overall economic well-being of underserved communities. According to a study by Morduch and Haley (2002), microfinance gained prominence in India as a response to the limitations of traditional banking systems in reaching the economically marginalized populations. MFIs often collaborate with SHGs to reach a larger section of the population. The impact of MFIs on poverty alleviation and economic development has been a subject of research and evaluation. The National

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Bank for Agriculture and Rural Development (NABARD) has been actively involved in promoting SHGs and MFIs as a means of financial inclusion (NABARD Annual Report, 2020-21).

MATERIALS AND METHODS

The study was conducted in Hisar, Bhiwani and Karnal districts of Haryana state. Two villages were selected from Hisar district namely Mangali and Nyoli Kalan, Bahri and Karnal rural from Karnal district. Kikral and Kalod from Bhiwani district were selected randomly. For primary data, eighty respondents were surveyed with the help of well-structured interview schedule. The sample size of 30 females from Hisar district and 25 females from each Bhiwani and Karnal districts was taken. The data was collected by interview method from the respondents to gather information on dependent and independent variables. The objective of the study is also based on secondary data. The relevant data has been collected from National Bank for Agriculture and Rural Development (NABARD) (Status of microfinance in India report). The data were coded, tabulated, analyzed and interpreted according to the objectives of the present study with the help of appropriate statistical techniques. The descriptive statistical tools such as frequency, percent, chi-square, weighted mean and total weighted score were calculated to draw the inferences.

RESULTS AND DISCUSSION

In the context of the study, socio-economic profile sheds light on the demographics of the respondents involved. This analysis provides valuable insights into the distribution of age groups and regional variations, offering a comprehensive understanding of the participants' backgrounds. It was found from the field of the study that majority of the women (56.25%) were from 30 to 45 years of age group and up to 30 years of age group (25.00%) respectively. Region-wise analysis revealed that majority of the women (60.00%) was from 30 to 45 years of age group in Karnal district. On the other hand, more than half of the farmers (53.34%) were from 30 to 45 years of age group in Hisar district and 56.00 per cent from Bhiwani district. Analysis revealed that fifty per cent women hailed from backward caste. Rest 35.00 and 15.00 per cent women were from schedule caste and general caste respectively. Approximately same trend was found in all three regions. It was found that more than one-third of the women (37.50%) were educated up to middle school level and secondary/senior secondary school level (26.25%) respectively. Further, region-wise analysis revealed that almost half of the women (48.00%) were educated up to middle school in Karnal district. Data revealed that majority of the women (45.00%) were member of one organisation followed by no social participation (35.00%). It was found that 50.00% and 37.50% of the respondents had medium and high social participation followed by low (12.50%) social participation. Lastly, almost half of the women (47.50%) had medium social participation followed by low (27.50%) and high (25.00%) social participation.

The dynamic changes in the number of microfinance self-help groups in Haryana over the last five years, as presented in Table 2, underscore the evolving landscape of community-based financial initiatives. This phenomenon is not unique to Haryana but resonates with broader trends observed in the microfinance sector globally.

According to recent studies (Smith *et al.*, 2020; Gupta and Patel, 2021), the fluctuations in the formation of new self-help groups mirror the impact of external factors such as economic conditions, government policies, and social dynamics. The decrease in new self-help groups in 2019-20 may be attributed to certain challenges or shifts in the regulatory environment, as noted by Morduch and Haley (2018).

Table 2 below presents the change in number of microfinance self help groups in the last five years in Haryana. Data revealed that in last five years there was decrease in new self help groups' formation in the year 2019-20. Contrary to that, there was continuous increase in formation of new self help groups in year 2020-21 (16.37%), 2021-22 (17.27%) and 2022-23 (2.20%) respectively. Further table revealed that in last five years there was continuous increase in saving amounts of self help groups. As in year 2018-19 savings of groups increase by 63.79 per cent, followed by 2019-20 (15.79%) and 2020-21 (34.01%) and 2021-22 (54.72%) respectively. The substantial rise in savings, especially in 2018-19 (63.79%), indicates a positive trend that can be associated with the strengthening of financial literacy programs and the fostering of a savings culture within these groups (Besley *et al.*, 2017).

Table 1: Socio-economic profile of the women (n=80)

Socio-economic variables	Hisar (n=30)	Bhiwani (n=25)	Karnal (n=25)	Total (n=80)
Age				
Up to 30 years	07 (23.33)	06 (24.00)	07 (28.00)	20 (25.00)
30^{+} to 45 years	16 (53.34)	14 (56.00)	15 (60.00)	45 (56.25)
45^{+} to 60 years	07 (23.33)	05 (20.00	03 (12.00)	15 (18.75)
Caste				
General	03 (10.00)	05 (20.00)	04 (16.00)	12 (15.00)
Backward	15 (50.00)	12 (48.00)	13 (43.33)	30 (50.00)
Schedule	12 (40.00)	08 (32.00)	08 (26.67)	28 (35.00)
Level of education				
Illiterate	05 (16.67)	06 (24.00)	03 (12.00)	14 (17.50)
Up to middle	10 (33.33)	08 (32.00)	12 (48.00)	30 (37.50)
Secondary and senior secondary	08 (26.67)	07 (28.00)	06 (24.00)	21 (26.25)
Graduation and above	07 (23.33)	04 (16.00)	04 (16.00)	15 (18.75)
Annual income of respondent (Rs.)				
Up to 1,00,000/-	05 (16.67)	09 (36.00)	09(36.00)	23(28.75)
Between 1,00,001 - 2,00,000/-	15 (50.00)	10 (40.00)	11(44.00)	36(45.00)
Above Rs. 2,00,000/-	10 (33.33)	06 (24.00)	05(20.00)	21(26.25)
Social participation				
No social participation	08 (26.67)	11 (44.00)	09(36.00)	28(35.00)
Membership one organization	12 (40.00)	09 (36.00)	11(44.00)	32(40.00)
Membership more than one organization	10 (33.33)	05 (20.00)	05(20.00)	20(25.00)
Mass media exposure				
Low	04 (13.34)	03 (12.00)	03 (12.00)	10(12.50)
Medium	13 (43.33)	12 (48.00)	15 (60.00)	40(50.00)
High	13 (43.33)	10 (40.00)	07 (28.00)	30(37.50)
Socio-economic status				
Low (13-21)	09 (30.00)	06 (24.00)	07 (28.00)	22 (27.50)
Moderate (22-30)	16 (53.33)	08 (32.00)	14 (56.00)	38 (47.50)
High (31-39)	05 (16.67)	11 (44.00)	04 (16.00)	20 (25.00)

Figures in parentheses denote percentage

Table 2: Progress of No. of SHGs in Haryana

Year	No. of SHGs	% of change	Progress/ Result	Saving Amount	% of change	Progress/ Result
2018-19	43,029	-	-	6076.42	+ 63.79	Increase
2019-20	41,131	-4.41	Decrease	7036.21	+15.79	Increase
2020-21	47,868	+16.37	Increase	9429.44	+34.01	Increase
2021-22	56,136	+17.27	Increase	14589.23	+ 54.72	Increase
2022-23	57,376	+2.20	Increase	-	-	-

Source: NABARD report on the status of microfinance in India in different years (Amount in Lakh rupees)

The findings presented in Table 3 highlight the importance of assessing women's awareness of microfinance institutions (MFIs) across various dimensions. Smith *et al.* (2018) demonstrated in their research that access to microfinance services significantly contributes to women's economic independence and enhances their financial decision-making capabilities. Evidently three-fourth respondents agreed to being aware about services of Microfinance Institution(s) (rank I), if they have taken loan over the past five years (rank II), MFIs require collateral securities while granting loans (rank III). Rank V and VI were given to awareness on operations of microfinance institutions and if MFIs enhanced managerial skill, financial management skill and overall business knowledge. Johnson and Williams (2020) highlighted the positive impact of microfinance on skill development among women entrepreneurs. They found that participation in microfinance programs led to notable improvements in managerial skills, financial acumen, and overall business knowledge among female borrowers. The findings presented in Table 4 provide a comprehensive overview of the satisfaction levels of women participating in microfinance institutions. Notably, 95 percent of

Table 3: Level of awareness regarding Micro Finance Institutions (MFIs) (n=80)

S.No.	Awareness statements	Aware (2)	Not Aware (1)	TMS	WMS	Rank
1.	Services of Microfinance Institution(s)	74	06	154	19.2	I
2.	If taken loan over the past 5 years	72	08	152	19.0	II
3.	MFIs require collateral securities while granting loans	71	09	160	20.0	III
4.	Microfinance Institutions operations	67	13	147	18.3	IV
5.	MFIs enhance managerial skill, financial management skill and overall business knowledge	65	15	145	18.1	V
6.	Received any training from MFIs	54	26	134	16.7	VI

Table 4: Perceived satisfaction level from microfinance institutions (n=80)

S.No.	Statements	Agree (2)	Disagree (1)	TMS	WMS	Rank
1.	Creditor's staff is friendly and warm	76	04	156	52.00	I
2.	Loan utilization check from the agency is strictly followed	76	04	156	52.00	
3.	The creditor gives you due recognition and respect	74	06	154	51.33	II
4.	Complaints/problems are well entertained by creditor	69	11	149	49.67	III
5.	Adequate information provided by creditor	68	12	148	49.33	IV
6.	Loan Repayment policy of creditor is liberal	68	12	148	49.33	
7.	Compulsory saving requirements	65	15	145	48.33	V
8.	Well aware of the consequences of non-repayments	62	18	142	47.33	VI
9.	Procedures for raising loan are convenient	62	18	142	47.33	
10.	Terms and conditions of the creditor are satisfactory	59	21	139	46.33	VII
11.	Rate of interest charged by the creditor is justified	57	23	137	45.67	VIII
12.	File charges and other paperwork costs are tolerable	56	24	136	45.33	IX
13.	Requirement of guarantee is enforced by the agency	55	25	135	45.00	X
14.	Accessing credit is less time taking and reasonable	54	26	134	44.67	XI
15.	Time taken to get the loan sanctioned is reasonable	53	27	133	44.33	XII
16.	Transportation cost to visit the financing agency is affordable	43	37	123	41.00	XIII
17.	Loan amount received is enough to meet the needs	43	37	123	41.00	XIV
18.	Suitable schemes are available as per needs of the borrower	22	58	102	34.00	XV
19.	Demand for collaterals is enforced by the agency	00	80	80	26.67	XVI

women expressed satisfaction with the friendliness and warmth exhibited by the creditor's staff, emphasizing a positive interpersonal dynamic. Additionally, the strict adherence to loan utilization checks, ranked first, highlight the importance of financial responsibility and transparency within the microfinance system. Furthermore, 92.50 per cent of respondents reported feeling recognized and respected by the creditor, highlighting the significance of acknowledgment in fostering a positive client-creditor relationship.

The efficient handling of complaints and problems by the creditor, ranked third, demonstrates a commitment to customer service and issue resolution, contributing to overall satisfaction. The rankings for adequate information provision by the creditor and a liberal loan repayment policy, both placed fourth, indicate that transparent communication and flexible repayment terms are valued by the women surveyed. The importance of compulsory savings requirements, ranked fifth, suggests an acknowledgment of the role of savings in financial planning and security. The respondents also demonstrated a clear understanding of the consequences of non-repayment, as reflected in the sixth ranking. This awareness underscores the importance of educating clients about the implications of their financial commitments. The subsequent rankings, from seventh to tenth, encompass various aspects such as convenient loan-raising procedures, satisfactory terms and conditions, justified interest rates, and manageable paperwork costs. These findings collectively suggest that women participating in microfinance programs appreciate the convenience, fairness, and transparency in the operational processes of the creditors.

CONCLUSION

In conclusion, the study conducted in Hisar, Bhiwani, and Karnal districts in 2022-23 among 80 women associated with microfinance institutions reveals a positive trend in the formation of new self-help groups (SHGs). Despite a decline in 2019-20, subsequent years saw significant growth, with a 16.37 per cent increase in 2020-21, a 17.27 per cent rise in 2021-22, and a 2.20 per cent increase in 2022-23. The satisfaction level among women engaged with microfinance institutions is notably high. Around 95 per cent expressed satisfaction with the friendliness of creditor staff, and a similar percentage confirmed strict adherence to monitoring loan utilization. Recognition and respect from creditors also contribute to satisfaction, with 92.50 per cent affirming positive experiences. Additionally, the responsiveness of creditors in addressing complaints and problems received commendable feedback, with 92.50 per cent expressing satisfaction. Overall, microfinance institutions have proven successful in Haryana, and expanding women's participation holds the potential for holistic development in rural areas. The positive trends in SHG formations, coupled with high satisfaction levels, accentuate the positive impact of microfinance initiatives on the lives of women in the region.

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Research Article

Analysis of Training Needs Regarding Extension Competencies of Faculty in Selected Northern State Agricultural Universities

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ABSTRACT

The present study was conducted to analyze the training needs of faculty for acquiring desired extension competencies at three different Northern State Agricultural Universities of India in November 2021. The study sample was comprised of total 360 faculty members. Data were collected from each university 120 faculty members, 40 each from teaching, research, and extension. Inventory related to major and sub-areas of training need regarding extension competencies was prepared for analyzing and comparing the area of training needs. The response of the faculty was taken on three point continuum i.e. Needed, Somewhat needed, and Not needed. This study revealed that a significant difference among faculty in different universities for all the major area of training needs related to extension competencies except knowledge competency. The finding of the study also observed that faculty was expressed high training need in the area of the latest technical knowledge, ICT skills, editing and proof-reading competency, collaborating skills, maintain ethical standards, and PRA techniques. So, there is need to train the faculty in above the extension competency area of training need to improve their extension competencies.

Keywords: Training needs, Extension competencies, State Agricultural Universities

INTRODUCTION

Training is the process of obtaining specialized abilities in order to do a task more effectively. It entails the process of instructing, informing, and educating individuals. It assists in becoming certified and proficient in carrying out the responsibilities. Training needs are defined as the discrepancies between two elements of individuals: the first is the desired level of person competency and the second is the current level of competence. For success of any organizations, employees should be proficient in different areas, including communication, new technology, new information, technical matters, management, programming, human relations, and leadership etc. Training is a powerful tool for improving an organization's reputation, performance, and efficiency (Yondeowei and Kwarteng, 2006). Training is considered as the process of acquiring specific skills to perform a job in better way. It helps people to become qualified and proficient in doing some jobs. Training is one of the major activities in extension organizations that consumes a large share of the resources because extension personnel have a critical role in transmission and dissemination of technology and practices. Davis *et al.* (2014) ascertained that most of the training in extension system was not properly conducted, monitored, and evaluated. Hence, a systematic analysis of training needs, efforts, training effectiveness, and job performance in terms of building the desired competencies needs to be done through a research investigation.

MATERIALS AND METHODS

The study was conducted at three Northern State Agricultural Universities of India namely Govind Ballabh Pant University of Agriculture and Technology,

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Pantnagar (Uttarakhand), Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (Uttar Pradesh), and Punjab Agricultural University, Ludhiana (Punjab). A multistage random sampling technique was used to select the sample for the study. A sample of 360 faculty members working on campus and off campus engaged in teaching, research and extension was selected. Further, from each university 120 faculty members 40 each from teaching, research and extension were randomly selected.

Training need for acquiring extension competencies was operationalized as competencies perceived by faculty to be essential and expressed their need for training in carrying out the extension activities that lead to the superior performance of the organization. Inventory related to major areas of training need regarding extension competencies was prepared by consulting the relevant literature and experts' advice. Training need inventory was comprised of 31 items related to major and sub-extension competencies i.e. knowledge, skills, communication, leadership, programme planning, and continuous learning were included whereas the latest technical knowledge, language proficiency, listening skill, team building, writing skills, decision-making skill, conflict management, collaboration skill, techniques of need assessment, program planning, program delivery skill, personal and professional development, lifelong learning, etc. were analyzed in terms of training need related to sub-extension competencies. The response of faculty was taken on a three-point continuum i.e. Needed, Somewhat needed, and Not needed with the score of 3, 2, and 1 respectively. The training needs of faculty members were measured by calculating average mean scores. To compare the major areas of training need among faculty members of three different State Agricultural Universities was measured by One Way ANOVA with Duncan's Multiple Range Test and the Karl-Pearson coefficient of correlation was also used to study the relationship between job profiles of the faculty members with their training needs.

RESULTS AND DISCUSSION

The data in Table 1 indicated that average mean scores of all areas of training needs for desired extension competencies in all selected universities. Training need for sub-area of knowledge competencies the, "Latest technical knowledge of subject" was obtained highest training need with the mean score (1.99) by all faculty of three State Agricultural Universities followed by "Application of technical knowledge" (1.97) whereas the lowest mean score (1.87) was observed for "Research/Scientific skill".

The highest mean score (2.54) was obtained by "ICT skill" of major skill competency which was followed by "Resource management skill" and "Coordinating skill" with the mean scores of 2.47 and 2.36 respectively while the lowest mean score (2.26) was observed for "Decision-making skill". This finding was in line with the study conducted by (Shamna *et al.,* 2019) who found that only 30.76 per cent of farmers had the most favorable attitude towards ICT tools due to fear of access to technology. So, it can be concluded that they needed training in ICT skills. Another finding was contradicted by the study conducted by (Strong and Hardy, 2009), they also found that the highest training need for management skills such as decision-making and teamwork for Subject Matter Specialist.

Training need in the sub-area of communication was found to be highest for "Editing and proof-reading competency" with a mean score of 2.42 followed by "Presentation skill" with a mean score of 2.37 while "Language proficiency skill" obtained the lowest mean score of 1.98. In the area of leadership, the faculty of selected SAUs expressed the highest training needs in "Collaborating skills" indicated by the highest mean score of 2.38 which was followed by "Conflict management competency" with a mean score of 2.12, whereas the lowest training need was observed for "Team building competency" with the mean score of 1.89. A similar study conducted by (Lopokoiyit *et al.,* 2013) found that competencies with the highest training need as conflict management. Another finding concurs with (Gibson and Schwarz, 2010) that all carders of extension staff identified the development of leadership abilities as most necessary for effective extension work.

As far as, the area of Programme planning was concerned intensity of training need in "Participatory rural appraisal techniques" was high with a mean score of 2.42. Almost an equal mean score of 1.98 and 1.96 was observed for "Methods of program evaluation"

Table 1: Training needs of faculty for acquiring desired extension competencies in different SAUs (n=360)

Areas of training need	University			Average
	GBPUAT, Pantnagar (n_1=120)	PAU, Ludhiana (n_2=120)	CSAUAT, Kanpur (n_3=120)	Mean score
Knowledge				
Latest technical knowledge of subject	2.02	2.09	1.85	1.98
Research/Scientific skill	1.83	2.03	1.75	1.87
Application of technical knowledge	2.01	2.06	1.83	1.96
Skill				
Reasoning skill	2.31	2.28	2.36	2.32
Decision making skill	2.42	2.41	1.94	2.26
Coordinating skill	2.64	2.38	2.07	2.36
ICT skill	2.56	2.54	2.53	2.54
Resource management skill	2.49	2.51	2.43	2.47
Time management skill	2.43	2.29	2.28	2.33
Problem solving skill	2.32	2.38	2.18	2.29
Communication				
Listening skill	2.16	2.29	1.99	2.15
Language proficiency skill	2.02	2.09	1.83	1.98
Presentation skill	2.33	2.39	2.39	2.37
Writing skill	1.98	2.06	1.98	2.01
Editing and proof-reading competency	2.43	2.51	2.33	2.42
Leadership				
Team building competency	1.97	1.97	1.74	1.89
Delegating responsibility	2.09	2.11	1.68	1.96
Collaborating skill	2.61	2.48	2.05	2.38
Conflict management competency	2.13	2.21	2.01	2.12
Programme planning				
Techniques of need assessment	2.31	2.43	1.93	2.22
Participatory Rural Appraisal Techniques	2.47	2.42	2.37	2.42
Planning Demonstration	1.93	2.13	1.81	1.96
Programme delivery skill	1.90	2.05	1.70	1.88
Techniques of motivation	2.33	2.38	2.01	2.24
Methods of program evaluation	2.03	2.15	1.77	1.98
Impact assessment competency	2.13	2.19	1.88	2.07
Continuous learning				
Personal development	1.60	1.86	1.52	1.66
Professional development	1.83	1.99	1.64	1.82
Lifelong learning	2.09	2.22	1.83	2.05
Self-evaluation competency	1.98	2.22	1.75	1.98
Maintaining ethical standards in the organization	2.53	2.51	2.21	2.41

Mean score range; (1-3), GBPUAT= Govind Ballabh Pant University of Agriculture and Technology, PAU= Punjab Agricultural University, Ludhiana, CSAUAT= Chandra Shekhar Azad University of Agriculture and Technology

and "Planning demonstration" respectively while the lowest training need was reported for "Programme delivery skill" with a mean score of 1.88. In the area of continuous learning "Maintaining ethical standards in the organization" required the highest training need with the mean score of 2.41 followed by "Lifelong learning" (2.05) whereas the least training need was required in "Personal development" with the mean score of 1.66. It was evident that most of the faculties required training in these areas due to one reason they may be deficient in these competencies. This result was in accordance with the study conducted by (Lopokoiyit *et al.,* 2013), they found that competencies with the highest training need as; motivating employees, stress management, strategic planning and management, and administrative techniques.

Data in Table 2 depicted the significant difference among universities in terms of all major areas of training needs of faculty members. SAUs wise comparison of data revealed that faculty from GBPUAT expressed the highest training need in the area of "Skill" with a mean score of 2.45 followed by "Leadership" and "Communication" with the mean score of 2.20 and 2.18 respectively, whereas the lowest training needs expressed by faculty of GBPUAT in the area of "Knowledge" with the mean score 1.95. Similarly, among the faculty of PAU, the highest training need was required in the area of "Skill" (2.39) followed by "Communication" and "Leadership" with a mean score of 2.27 and 2.25 respectively, while the lowest training need was required in the area of "Knowledge" with the mean score 2.06. A similar trend of training need was found among faculty of GBPUAT and PAU but their mean scores were different. Among the faculty of CSAUAT, Kanpur, expressed the highest training need in the area of "Skill" with a mean score of 2.25 followed by "Communication" (2.10) and "Leadership" (1.92) respectively, whereas the lowest area of training need was observed for continuous learning with the mean score of 1.79.

University-wise comparison of major areas of training need depicted that PAU had expressed the highest training need with the average mean score (2.22) compared to GBPUAT (2.15) and CSAUAT (1.95). The reason may be that majority of the respondents of PAU had a low level of competencies as compared to CSAUAT, Kanpur and GBPUAT, Pantnagar. A significant difference was also observed among all SAUs in terms of major areas of training need.

Further, overall training needs-wise analysis of data revealed that the highest need for training was "Skill" with a mean score of (2.36) followed by "Communication" with a mean score of 2.18, and the lowest training need was obtained by "Knowledge" with a mean score 1.94. It was concluded that most of the faculty required high training in all major areas except knowledge and continuous learning. A significant difference was also observed among the three universities for all the major areas of training needs except the Knowledge competency. This finding was according to the study conducted by (Lopokoiyit *et al.,* 2013) found that the strategic planning, management

Table 2: Comparison of major area of training needs among faculty in different Northern State Agricultural Universities (**n= 360**)

Area of training needs (Overall)	GBPUAT, Pantnagar (n_1=120)	PAU, Ludhiana (n_2=120)	CSAUAT, Kanpur (n_3=120)	Average mean score	P value
Knowledge	1.95[a]	2.06[a]	1.81[a]	1.94	.259[NS]
Skill	2.45[a]	2.39[a]	2.25[b]	2.36	.000**
Communication	2.18[ab]	2.27[a]	2.10[b]	2.18	.012*
Leadership	2.20[a]	2.19[a]	1.87[b]	2.08	.000**
Programme planning	2.16[a]	2.25[a]	1.92[b]	2.11	.000**
Continuous-learning	2.00[b]	2.16[a]	1.79[c]	1.98	.000**
Average mean score	2.15	2.22	1.95	2.10	.010*

Values are expressed as mean with different superscripts are significantly different using DMRT test; **Significant at 1% level; *Significant at 5% level

skills, and administrative techniques were significantly different with the public sector registering higher training needs in these competencies.

Job role wise comparison of data in Table 3 presented that teaching faculty expressed high training needs in concerned areas with an average mean score (2.12) than research and extension faculty with an average mean score of 2.11 and 2.09 respectively. The reason was that most of the faculty members had not received in-service training related to extension competencies during their period of service and they were lacking in various competencies.

A non-significant difference was observed among all the major job roles of faculty for the area of training needs. This concurs with the finding of (Lopokoiyit, 2013) who found that no significant difference between frontline extension workers and SMS for leadership and management competencies with frontline extension workers expressing higher training needs. The data for job related variables were continuous in nature and thus were subjected to a correlation test for the purpose of knowing their relationship with their training needs.

The data in Table 4 revealed that membership in professional societies and in-service training received by faculty members were found to have a positive and significant correlation with their training needs. On the other hand, a significant and negative correlation

Table 3: Comparison of different job roles in terms of major area of training needs of faculty (n=360)

Area of training needs (Overall)	Teaching (n_1=120)	Research (n_2=120)	Extension (n_3=120)	Average mean score	P value
Knowledge	1.99[a]	1.94[a]	1.89[a]	1.94	.303[NS]
Skill	2.37[a]	2.32[a]	2.41[a]	2.36	.596[NS]
Communication	2.24[a]	2.18[a]	2.14[a]	2.18	.171[NS]
Leadership	2.03[a]	2.08[a]	2.15[a]	2.08	.228[NS]
Program planning	2.16[a]	2.11[a]	2.06[a]	2.11	.276[NS]
Continuous-learning	1.96[ab]	2.07[a]	1.91[b]	1.98	.059[NS]
Average mean score	2.12	2.11	2.09	2.10	.918[NS]

Table 4: Relationship between personal and job related profile and training needs of the respondents in teaching, research and extension (n=360)

Independent variables	Correlation coefficient (r)			
	Training needs (Teaching) (n_1=120)	Training needs (Research) (n_2=120)	Training needs (Extension) (n_3=120)	Overall (n=360)
Personal profile				
Age	-.263**	-0.09	-.392**	-.220**
Job profile				
Academic qualification	0.156	0.014	-0.119	-.010
Designation	0.012	.197*	-.241**	.024
Service experience	-.304**	-0.093	-.455**	-.238**
Membership of professional societies	0.018	0.149	.190*	.124*
In-service training	0.094	.190*	0.051	.111*
Professional recognition	-0.12	0.056	-.180*	-.041
Participation in seminar/ conferences/workshops/ symposia	-0.143	.208*	0.081	.030
Number of research projects completed	-.286**	0.131	-0.106	-.029

**Significant at 1% level; *Significant at 5% level

was seen between age and service experience of faculty members i.e. as the age and service experience increases, the training needs decrease. This finding was similar to the study conducted by (Okeowo, 2015), he found a significant relationship between respondents' job experience with training needs.

CONCLUSION

The findings of the study identified that most of the faculty members of all SAUs expressed high training needs in the area of latest technical knowledge, ICT skills, resource management, editing and proof-reading competency, collaborating skill, participatory rural appraisal techniques, and maintaining ethical standards in the organization. Hence, it is suggested that above the extension competency areas of high training need must be considered and upgraded while imparting the training to faculty of State Agricultural Universities. In-service training of faculty was found to have a positive and significant correlation with their training needs. The reason may be that faculty members did not receive in-service training related to extension competencies. So, there is a need to train the faculty to improve their extension competencies.

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