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Special Issue

on

Futuristic Agriculture: Technology, Sustainability and Beyond

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 2000 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 5.02 and Journal ID J171. 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

The evolving landscape of agriculture necessitates a forward-looking approach that integrates cutting-edge technology, sustainability principles, and holistic development paradigms. The need for *Futuristic Agriculture* arises from pressing challenges such as climate change, resource depletion, demographic shifts, and market volatility, which demand innovative, inclusive, and resilient agri-food systems. Strategies must prioritize digital agriculture, climate-smart practices, agroecological intensification, and farmer-centric innovation ecosystems. Leveraging artificial intelligence, IoT, biotechnology, and big data can revolutionize farm productivity, decision-making, and resource efficiency. However, for these advances to translate into equitable development, strong policy frameworks are essential, such as promoting public-private-people partnerships, ensuring digital and financial inclusion of smallholders, strengthening research-extension-farmer linkages, and fostering adaptive governance mechanisms, etc. A community mobilization approach that emphasizes local knowledge, institutional capacity, and participatory engagement will be vital in operationalizing this futuristic vision, ensuring sustainability, inclusivity, and long-term impact.

The Society for Community Mobilisation for Sustainable Development, widely recognized as the MOBILISATION Society, is a multidisciplinary professional organization committed to fostering innovation and collaboration in support of sustainable development across the field, policy, and research domains. As part of its ongoing efforts, the Society is organizing the 12th National Seminar on "Futuristic Agriculture: Technology, Sustainability and Beyond", in collaboration with the National Horticulture Board (NHB), Government of India, and in association with the Central Agricultural University, Imphal. The seminar will be held from 22nd to 24th May 2025 at the College of Post Graduate Studies in Agricultural Sciences, Umiam, Meghalaya. In conjunction with this landmark event, the Society is proud to announce a special issue of the Journal of Community Mobilisation and Sustainable Development. This issue will feature a curated selection of insightful contributions from leading experts, capturing the seminar's thematic essence and advancing discourse on futuristic, technology-driven, and sustainable agricultural systems. The papers of the seminar special issue emphasize practical innovations and challenges in farming systems, including agri-horti-livestock integration, feed-based aquaculture, and crop-specific technologies such as quality protein maize, turmeric cultivation, and grapevine hybridization. Several studies focus on sociological and economic dimensions, examining women's empowerment, SHG entrepreneurship, rural credit, marketing behaviour, and the psychological impact of poverty and hunger are also included. Climate resilience emerges as a recurring theme in this issue through assessments of traditional knowledge, varietal diversity, and perceptions of climate change. Health, nutrition, and medicinal practices are also addressed through studies on milk composition, food safety, and indigenous knowledge of healthcare.

On behalf of the editorial board, I convey my sincere appreciation to all the contributors whose scholarly articles have significantly enriched this Special Issue. The depth and diversity of research presented reflect a strong commitment to advancing the frontiers of agricultural and rural development. I also extend my profound thanks to the editorial team for their professionalism, meticulous review, and seamless coordination throughout the publication process. Collectively, your efforts have culminated in a special issue that stands as a meaningful resource for both academic and practitioner communities. I also extend my heartfelt thanks to the regular readers of the journal, whose continued engagement and support serve as a source of inspiration for our editorial endeavours.

J.P. Sharma
Chief Editor

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Research Article

Demonstration of Feed-based Aquaculture in *adivasi* Villages of Tripura, North-East India

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ABSTRACT

The study aimed to evaluate the effectiveness of feed-based aquaculture (FBA) in enhancing fish productivity in an *adivasi* village in Tripura, Northeast India, under the Schedule Tribe Component (STC). Six ponds managed by farmers, each measuring 0.08 ha and 1-1.5 m in depth, were utilized to compare two types of feed: floating feed (FF) and conventional feed (CF), made from a 1:1 mixture of rice bran and mustard oil cake, with community participation. The ponds were stocked with Catla (40%), Rohu (30%), and Mrigal (30%) at a stocking density of 10,000 fish per hectare. Fish were fed daily at 2 per cent of their biomass. Over six months study period, monthly monitoring of water quality parameters showed no significant fluctuations. At the end of the study, fish growth assessment revealed that Catla and Rohu exhibited better weight gain ($P \leq 0.05$) with FF, while Mrigal performed better ($P \leq 0.05$) with CF. FF also resulted in higher fish survival rates and improved feed conversion ratios ($P \leq 0.05$). Total fish production was significantly higher ($P \leq 0.05$) with FF (4052 kg/ha) compared to CF (3520 kg/ha), indicating the profitability of FBA with FF. The study concluded that FBA, whether using FF or CF, can enhance fish productivity. FF is highly recommended for increased production in *adivasi* villages. The participatory approach used in the study facilitated community mobilization and empowerment. Further participatory technology assessment and adoption are recommended for sustainable aquaculture development in underprivileged areas.

Keywords: Feed-based farming, Tribal aquaculture, Floating feed, Fish productivity enhancement, Community aquaculture

INTRODUCTION

Aquaculture, the controlled cultivation of aquatic organisms is an important sector in supporting the rural economy and providing livelihood security in the North-Eastern state of Tripura, India. With an impressive growth rate in fish production, from 19,840 MT in 2004-05 to 82,000 MT in 2020-21, the state has witnessed a remarkable surge of over 313 per cent (Directorate of Economics & Statistics, Government of Tripura, 2021). However, despite this commendable progress, the average fish productivity of the state is still below (2.8 MT/ha/year) the national average of 3 MT/ha/year, indicating untapped potential for further growth and development.

One of the key factors contributing to suboptimal fish productivity in Tripura is the uneven growth seen across different regions of the state, stemming from the absence of location-specific technology assessment, refinement, and demonstration. Specifically, in *adivasi* (tribal) villages under the jurisdiction of the Tripura Tribal Areas Autonomous District Council (TTAADC), current fish productivity remains notably low, ranging from 1-1.5 MT/ha/year. This disparity can be attributed to several factors, such as a lack of

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innovative practices, limited awareness of scientific production technologies, subsistence-oriented farming practices, insufficient availability of low-cost fish feeds, poor pond health management, and the occurrence of diseases, particularly during the winter months (Debnath *et al.,* 2017).

Fish feed plays a crucial role in aquaculture operations, constituting a significant 50-60 per cent of total operational expenses (Debnath *et al.,* 2017). The success of any aquaculture venture heavily relies on the quality of feeds and feeding strategy employed, as it directly influences fish growth and production, the water quality in which fish housed, and the overall profitability of the farming system (Debnath *et al.,* 2018a,b).

Rice bran and mustard oil cake are among the most conventional fish feed ingredients due to their cost-effectiveness and local availability. However, these ingredients have drawbacks; they sink rapidly into pond sediment and remain in the water column for a short time, giving fish less opportunity to consume them. This results in more wastage and water quality deterioration (Limbu, 2015). Furthermore, it is challenging to gauge fish satiation levels and feed conversion ratios (Yaqoob *et al.,* 2010). In contrast, floating feeds offer several advantages. They do not sink rapidly into the pond sediment and float in the water column for a longer period, providing fish with more time to consume them. This leads to reduced wastage, better feed utilization, and improved monitoring of fish's satiation levels (Nahar *et al.,* 2000). However, the higher cost of floating feeds (Rs. 40-50/kg) compared to conventional farm-made feeds (Rs. 25-30/kg) poses a financial barrier for small-scale farmers in *adivasi* villages.

To enhance fish productivity, it's essential to provide fish with quality feeds. In our current demonstration, we evaluate the effectiveness of feed-based aquaculture (FBA), utilizing both floating and sinking feed types, to improve fish productivity in *adivasi* villages. Through local participation, our goal is to contribute to sustainable fisheries development by mobilizing the community and ultimately enhancing the livelihoods and well-being of these underserved communities.

MATERIALS AND METHODS

Study site and experimental setup: The study was conducted in Lembucherra, an *adivasi* village in Tripura under the Schedule Tribe Component (STC) programme, which aims to promote the welfare and development of scheduled tribes. Six farmers' ponds, each measuring 0.08 ha in size and 1-1.5 m in depth, were selected for the study. Pond preparation and management followed the method outlined by Debnath *et al.* (2016). The study evaluated the efficacy of two different feed types: floating feed (FF) and conventional feed (CF), which consisted of a 1:1 mixture of rice bran and mustard oil cake. The feed ingredients were procured from a local market in Tripura.

Fish culture: The ponds were stocked with fingerlings of Indian Major Carps (IMC) at a stocking density of 10,000 individuals per hectare, with a species composition of Catla (*Catla catla*) 40 per cent, Rohu (*Labeo rohita*) 30 per cent, and Mrigal (*Cirrhinus mrigala*) 30 per cent. These fingerlings were sourced from the ICAR fish farm in Tripura. Among the six ponds, three were broadcasted with FF, while the remaining three with CF. The feeding rate remained consistent at 2 per cent of fish biomass for both types of feed. After two months of culture, the feeding rate was adjusted assuming a 90 per cent fish survival rate, and further adjustments were made in the last two months, assuming an 80 per cent survival rate. Throughout this demonstration, community participation was actively encouraged in various aspects of farming such as fish seed procurement and stocking, pond preparation and management, feed preparation, fish feeding, netting operations, and disease management.

Feed composition: The proximate compositions of FF and CF were analyzed using the methods outlined

Table 1: Proximate composition of floating feed (FF) and Conventional Feed (CF) used in this study

Component (%)	CF	FF
Moisture	12.2	11.5
CP	18.4	21.4
Crude lipid	6.2	6.5
Crude fibre	9.6	8.6
Ash	18.5	16.3
Nitrogen free extract (NFE)	35.1	35.7

by the Association of Official Analytical Chemists (AOAC, 1984). FF was observed to contain a crude protein (CP) content of 21.4 per cent, whereas CF contained a CP content of 18.4 per cent. Detailed proximate compositions of the two feeds are provided in Table 1.

Water quality monitoring: Water quality parameters, including temperature, dissolved oxygen (DO), pH, total alkalinity, and ammonia, were monitored on a monthly basis following the standard methods outlined by the American Public Health Association (APHA, 1998).

Growth and production assessment: Fish growth in terms of total length and wet weight, was evaluated bimonthly by sampling a portion of the fish (n=10) using a cast net. After 6 months (May-October), all fish were harvested using a drag net, segregated by species, and counted. The following production attributes were calculated:

- Average monthly gain (AMG, g/month) = (Final weight – Initial weight) / 6 months
- Survival rate (SR, %) = (Number of fish recovered × 100) / Number of fish stocked
- Feed conversion ratio (FCR) = Total feed given (g) / Weight gain (g)
- Benefit-cost ratio (BCR) = Total profit / Total expenditure

Data analysis: The collected data were analyzed using SPSS (version 21) software. One-way analysis of variance (ANOVA) and Duncan's Multiple Range Test (Duncan, 1955) were performed to determine if significant differences ($P \leq 0.05$) existed between the feed types for various parameters.

RESULTS AND DISCUSSION

Throughout the study, the water quality parameters consistently remained within acceptable ranges for fish culture (Table 2), indicating effective pond preparation and management practices. The DO levels displayed normal variations across all ponds, which is consistent with previous findings (Debnath *et al.,* 2016). During the initial 2-3 months of culture, the dissolved oxygen (DO) levels remained consistently high (>6 ppm) in all ponds. However, as time progressed, the DO levels gradually decreased to 4-5 ppm. This drop indicated that the fish were in the growing phase and thus required more oxygen (Debnath and Sahoo, 2017).

Table 2: The water quality parameters of ponds applied with floating feed (FF) and ponds applied with conventional feed (CF)

Parameter	Ponds applied with	
	FF	CF
Temperature (°C)	24.5-34.3	24.4-34.4
Dissolved oxygen (ppm)	4.4-7.4	3.2-6.6
pH	6.5-7.7	6.7-7.5
Total alkalinity (ppm)	65-76.3	56.4-75.5
Ammonia (ppm)	0.45-0.96	0.84-1.32

An interesting observation was that ponds applied with CF had lower mean DO levels than those applied with FF. This suggests that CF-fed ponds might have experienced higher feed wastage and subsequent DO depletion due to the breakdown of unused feed particles (Klanjscek *et al.,* 2012).

Proper monitoring and management of water quality parameters, including temperature, are crucial for maintaining optimal conditions for fish growth and survival. In our study, water temperature varied from 24.4°C to 34.4°C, with the highest temperature recorded in July. This observation is consistent with previous findings on fish culture in Tripura conditions (Debnath *et al.,* 2015a). The peak temperature in July coincided with the region's summer peak. Overall, the fluctuations in temperatures remained within acceptable ranges for fish, indicating suitable conditions for fish, as well as a stable agro-climatic environment for their growth.

The pH levels remained within the range required for fish growth and survival (Debnath *et al.,* 2016), and the difference between ponds applied with FF and those applied with CF was not statistically significant. This observation suggests a similar level of management followed across all ponds. The total alkalinity levels were within the normal range and comparable to the findings of Debnath *et al.* (2015b). Based on the observed pH and total alkalinity, the ponds under study could be broadly classified as low to medium productive in range (Debnath *et al.,* 2015a,b).

The concentration of ammonia-nitrogen increased as the culture progressed; however, it mostly remained

within the ranges required for thriving fish and other aquatic life (Debnath *et al.,* 2015c). Notably, the mean ammonia-nitrogen concentration was higher in the CF-applied ponds compared to the FF-applied ponds. This observation can be attributed to the higher feed wastage and subsequent release of nitrogen from the wasted feed in the former system (Boyd and Tucker, 1998).

The mean final weight of Catla was significantly higher ($P \leq 0.05$) in ponds applied with FF (585g) compared to those applied with CF (525g), representing an 11.4 per cent increase with FF (Table 3). Similarly, the final weight of Rohu was significantly higher ($P \leq 0.05$) with FF (488g) than CF (465g), a 4.9 per cent increase. This superior growth performance can be attributed to the longer retention period of FF in the water column, making it more readily available to Catla, a surface feeder, and Rohu, a column feeder (Debnath *et al.,* 2020). On the other hand, the final weight of Mrigal was significantly higher ($P \leq 0.05$) with CF (430g) compared to FF (405g), a 6.2 per cent increase. This can be explained by the quick sinking nature of CF, making it more available to Mrigal a bottom-feeder.

The AMG of Catla experienced a significant increase ($P \leq 0.05$) to 109.4g/month with FF, compared to 86.1g/month with CF, marking a 27.1 per cent rise. Similarly, Rohu's AMG showed a notable increase ($P \leq 0.05$) to 90.3g/month with FF, surpassing CF at 76.4g/month by 18.2 per cent. This heightened growth can be attributed to the prolonged presence of FF in the water column and the fish's tendency to predominantly feed from the surface to the middle of the water column. On the other hand, Mrigal's AMG was notably higher ($P \leq 0.05$) when supplied with CF at 71.0g/month, in contrast to FF at 66.8g/month, reflecting a 6.3 per cent increase. This observation suggests that the rapid sinking of CF enhanced its accessibility to fish that primarily inhabit the bottom of the aquatic ecosystem. Analyzing the collective AMG across all three species, FF contributed significantly more to fish weight gain compared to CF. This indicates that FF led to better feed utilization and growth performance in fish, possibly due to its prolonged presence in the water column and enhanced accessibility to fish that predominantly inhabit the aquatic ecosystem's column.

The SR of Catla was significantly higher ($P \leq 0.05$) with FF (82%) compared to CF (74%), representing a 10.8 per cent increase. Similarly, the SR of Rohu was higher ($P \leq 0.05$) with FF (76%) than CF (72%), a 5.6 per cent increase and the SR of Mrigal was higher ($p \leq 0.05$) with FF (84%) compared to CF (76%), an 10.5 per cent increase. The higher survival rates observed with FF across all three species can be attributed to the better availability and assimilation of feed nutrients with the use of FF, leading to improved fish health and survival.

The total fish production soared to 4052 kg/ha with FF, significantly surpassing ($P \leq 0.05$) the production obtained with CF, which stood at 3520 kg/ha, representing a notable 15.1 per cent increase with FF (Figure 1). This substantial difference in production levels can be directly attributed to FF's superior performance in promoting better growth, survival, and overall feed utilization in fish. An interesting observation is that by FBA, whether with FF or CF, it is feasible to exceed the current national average of 3 MT/ha/year. Hence, it is highly recommended in aqua-farming to realize enhanced fish productivity.

When assessing the contributions of each species, Catla's production with FF reached 1918.8 kg/ha,

Table 3: The production parameters of fish under different feeding treatments. Data with the same superscripts in the same column for different fish under different feeds indicate no significant difference ($P \geq 0.05$)

Feeds	Fish	Final weight (g)	AMG (g)	SR (%)	Production (kg/ha)	FCR	BCR
FF	Catla	585^{a}	109.4^{a}	82^{a}	1918.8	2.2^{a}	2.1^{a}
	Rohu	488^{a}	90.3^{a}	76^{a}	1112.7		
	Mrigal	405^{a}	66.8^{a}	84^{a}	1020.6		
CF	Catla	525^{b}	86.1^{b}	74^{b}	1554	3.2^{b}	1.75^{b}
	Rohu	465^{b}	76.4^{b}	72^{a}	984.9		
	Mrigal	430^{b}	71.0^{b}	76^{b}	980.4		

marking a 23.5 per cent increase over CF at 1554 kg/ha. Similarly, Rohu's production with FF reached 1112.7 kg/ha, indicating a 13.0 per cent rise compared to CF at 984.9 kg/ha. Mrigal's production with FF was 1020.6 kg/ha, showing a modest 4.1 per cent increase compared to CF at 980.4 kg/ha. These findings suggest that among the IMCs, Catla is the most efficient, followed by Rohu and Mrigal, in utilizing feed nutrients for their growth and production. Another reason for the better growth and production of fish with FF (21.4%) was its higher CP level compared to CF (18.4%) in the present study.

An interesting observation in Mrigal is that while individual weight gain was better with CF, overall fish productivity was higher with FF. This difference can be attributed to the lower SR with CF compared to FF, possibly due to feed wastage and the deterioration of the pond bottom where fish actually inhabit.

The FCR is a critical measure of feed efficiency, with a lower value indicating more efficient utilization of the feed by the fish, resulting in better growth and higher productivity (Bai *et al.,* 2022). In this study, the FCR was significantly better ($P \leq 0.05$) with FF at 2.2 compared to conventional feed (CF) at 3.2, representing a substantial 31.3 per cent improvement. The superior FCR observed with FF can be attributed to its floating nature, which allowed it to remain accessible to fish for longer durations, consequently reducing feed wastage.

The economic analysis of the two feeding systems revealed a BCR of 2.1 for FF and 1.75 for CF (Figure 2), signifying FF-based farming as 20.0 per cent more profitable (Figure 2). Both systems were profitable

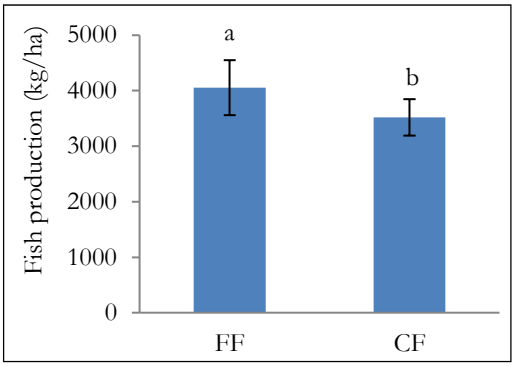

Figure 1: Total fish production level (kg/ha/6 months) in different feeding systems (FF: floating feed and CF: conventional feed)

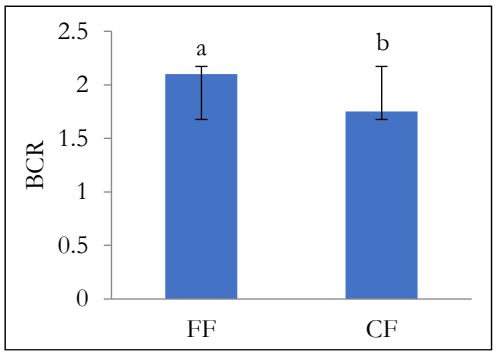

Figure 2: The benefit-cost ratios (BCRs) in different feeding systems (FF: floating feed and CF: conventional feed)

according to BCR (Debnath *et al.,* 2015b, 2018c), yet FF stood out for its superior profitability. This advantage can be clearly attributed to FF's superior fish production ability and enhanced feeding efficiency in fish compared to CF.

The study's participatory approach, involving local indigenous farmers, played a crucial role in fostering community mobilization and empowerment. By directly engaging the community members in the research process and enabling them to witness the potential benefits of FBA firsthand, the study facilitated the transfer of knowledge and practical experience (Debnath *et al.,* 2017). This empowerment increased the likelihood of the community adopting and implementing improved practices in their own aquaculture endeavors, leading to increased fish productivity and improved livelihoods (Sheheli *et al.,* 2014).

Moreover, FBA aligned with the principles of sustainable development, a critical aspect of ensuring long-term societal and environmental well-being. By optimizing feed utilization and minimizing waste, this approach promoted resource efficiency and reduced the environmental impact associated with conventional aquaculture practices, such as water pollution and ecosystem disturbances. The potential for increased fish production through FBA contributed to food security and nutritional well-being in rural and tribal communities, where access to affordable and nutritious food sources was often limited. Increased income from aquaculture could facilitate access to better education, healthcare, and infrastructure, ultimately improving the overall quality of life and well-being of these

marginalized communities. This aligned with the overarching goals of sustainable development, which aimed to eradicate poverty, ensure food security, and promote sustainable agriculture practices (Ferranti, 2015).

CONCLUSION

The analysis highlights the superiority of floating feed over conventional feed in various fish growth and production parameters, including final weight, average monthly gain, survival rate, total fish production, feed conversion ratio, and economic profitability in *adivasi* villages with farmers-operated pond systems. While Mrigal performed better with conventional feed in some aspects due to its bottom-feeding nature, floating feed showed overall benefits across all three species studied. This underscores the potential of feed-based farming, particularly with floating feed, to enhance fish productivity and profitability in *adivasi* villages and other disadvantaged sections with low fish productivity. The participatory approach used in the study facilitated community mobilization and empowerment. However, ensuring the availability and affordability of low-cost feed is crucial for long-term sustainability. Further participatory technology assessment and adoption are recommended for sustainable aquaculture development in these areas.

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REFERENCES

AOAC. 1984. Animal feed. In: Howritz, W. (ed) Official Methods of Analysis, 14th edn. Association of Official Analytical Chemists, pp 69–88.

APHA. 1985. Standard Methods for the Examination of Water and Wastewater, 16th edn. APHA/AWWA/WPCF, 1268.

APHA. 1998. Standard Methods for the Examination of Water and Waste-water, 20th edn. American Public Health Association.

Ayotunde, E.O.; B.O. Offem; I.B. Okey; G.U. Ikpi and S.N. Ochang. 2010 Toxicity of pawpaw (*Carica papaya*) seed powder to sharp-tooth catfish *Clarias gariepinus* fingerlings and effects on haematological parameters. *International Journal of Fisheries and Aquatic Studies,* 2: 71-78.

Bai, S.C.; R.W. Hardy and A. Hamidoghli. 2022. Diet analysis and evaluation. In: Fish Nutrition, Academic Press, pp 709–743.

Boyd, C.E. and C.S. Tucker. 1998. Pond Aquaculture Water Quality Management. Kluwer Academic Publishers.

Debnath, B.; R. Singh and C. Debnath. 2017. Analysis of reasons behind partial adoption of recommended practices at scientific fish farming in South Tripura: farmers' perception. *Journal of Community Mobilization and Sustainable Development,* 12(2): 304-305.

Debnath, B.; R.S. Biradar; M. Krishnan; S.K. Pandey; C. Debnath; S.K. Srivastava and S.C.S. Das. 2015b. Economic evaluation on fish production and demand in Tripura-strategic options. *Indian Journal of Animal Sciences,* 85(10): 1139-1145.

Debnath, C. and L. Sahoo. 2017. Demonstration of aeration: assessment of fish growth and survival at field condition. *Indian Journal of Hill Farming,* (Special Issue): 110-112.

Debnath, C. and L. Sahoo. 2020. Fish productivity enhancement through aquaculture diversification with small indigenous species *Esomus danricus*. *Journal of Krishi Vigyan,* 9(Special issue): 114-120.

Debnath, C.; K. Dube; N. Saharan; V.K. Tiwari; M. Datta and L. Sahoo. 2020 Assessment of growth and production potential of Indian butter catfish *Ompok bimaculatus* as a substitute for mrigal *Cirrhinus mrigala* in polyculture of Indian major carps. *Indian Journal of Fisheries,* 67(4): 48-55.

Debnath, C.; K. Dube; N. Saharan; V.K. Tiwari; M. Datta; L. Sahoo and P. Das. 2015a. Growth and production of endangered Indian butter catfish (*Ompok bimaculatus*) at different stocking densities in earthen ponds. *Aquaculture Research.*

Debnath, C.; L. Sahoo; B. Debnath and G.S. Yadav. 2018a. Effect of supplementary feeding on growth responses of endangered Indian butter catfish (*Ompok bimaculatus*) in polyculture. *Indian Journal of Animal Research.*

Debnath, C.; L. Sahoo; B. Debnath; G.S. Yadav and M. Datta. 2018b. Effect of supplementary feeds with different protein levels on growth and production of Indian butter catfish *Ompok bimaculatus* (Bloch, 1794) in fertilised ponds. *Indian Journal of Fisheries,* 65(3): 110-115.

Debnath, C.; L. Sahoo; B. Debnath; S.K. Das and S.V. Ngachan. 2018. Economics of fish farming in Tripura. *Indian Journal of Hill Farming,* Special Issue: 87-91.

Debnath, C.; L. Sahoo; G.S. Singh; M. Datta and S.V. Ngachan. 2016. Grow-out production of Pabda (*Ompok bimaculatus*) in earthen ponds under low stocking density. *Indian Journal of Hill Farming,* 29(1): 99-103.

Debnath, C.; L. Sahoo; G.S. Singh; M. Datta and S.V. Ngachan. 2015c. Participatory fish production in Dhalai district of Tripura, North-East India. *Indian Journal of Hill Farming,* 28(2): 121-125.

Directorate of Economics & Statistics, Government of Tripura. 2021. Economic Review of Tripura 2021-22. Retrieved from https://ecostat.tripura.gov.in

Duncan, D.B. 1955. Multiple range and multiple F-Tests. *Biometrics,* 11: 1-42.

Ferranti, P. 2015. The United Nations Sustainable Development Goals. doi:10.1016/B978-0-08-100596-5.22063-5

Klanjscek, J.; S. Gecek and T. Legovic. 2012. Influence of fish feed composition on oxygen utilization during decomposition of aquaculture effluents. *Aquaculture Research,* 43(12): 1845-1860.

Limbu, S.M. 2015. The effect of floating and sinking diets on growth performance, feed conversion efficiency, yield and cost-effectiveness of African sharptooth catfish, *Clarias gariepinus* reared in earthen ponds. *International Journal of Fisheries and Aquatic Studies,* 2(5): 253-259.

Nahar, Z.; A.K.M. Azad Shah; R.K. Bhandari; M.H. Ali and S. Dewan. 2000. Effect of different feeds on growth, survival and production of African catfish (*Clarias gariepinus* Burchell). *Bangladesh Journal of Fisheries Research,* 4(2): 121-126.

Sheheli, S.; M.A. Sarker; D.S. Dev and A.K. Das. 2014. Improvement of Livelihood through Fish Farming in Haor Areas of Bangladesh. *Bangladesh Journal of Extension Education,* 26(1&2): 77-84.

Yaqoob, M.; M.R. Ali and M. Sultan. 2010 Comparison of growth performance of major and Chinese carps fed on floating and sinking pelted supplementary feeds in ponds. *Pakistan Journal of Zoology,* 42(6): 765-769.

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Research Article

Friedman-based Ranking for Unveiling Constraints Perceived by Members of Farmer Producer Organizations in Bihar

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ABSTRACT

The current study presents the constraints faced by member farmers of Farmer Producer Organizations in Bihar. Farmer Producer Organization unites small and marginal farmers and conquers agriculture and marketing hurdles and others. The collective action empowers primary producers as it boosts profits and eliminates middlemen participation. Two FPOs were chosen from Pusa and Kalyanpur blocks of Samastipur district. Disproportionate stratified random sampling was adopted to select 30 member-farmers from each FPO which constitute 60 FPO members. A well-structured interview schedule was prepared to collect the data from 60 member farmers of FPO. Within five broad constraints rank was assigned based on frequency and percentage viz., uncertainty regarding the field-worthiness of FPOs, postponement of profit sharing, absence of adequate storage facilities and others are the major specific constraints faced by members farmers of FPOs. Friedman test results revealed the order of most severe broad constraints faced by FPO members were economic constraint (Friedman Mean Rank, FMR=4.27) was ranked first as constraint, followed by marketing (FMR=3.22), managerial (FMR=3.00), social & psychological (FMR=2.86), and technical (FMR=1.66) constraints respectively. Asymptotic significance was found 0.000 ($p<0.001$) with chi-square value of 88.011 having 4 degree of freedom. Significance level from Monte Carlo analysis at a 99 percent Confidence Interval (CI) indicates notable variations among the five broad constraints. The study concludes that FPOs should be strengthen with the funds provided by Bihar government as well as NABARD. So, that above-mentioned constraints can be reduced gradually.

Keywords: Bihar, Constraints, Ex-post facto research, FPOs, Friedman ANOVA test, Monte Carlo test

INTRODUCTION

Agriculture serves as the mainstay for a huge number of people in India. The agricultural sector provides a livelihood to approximately 54.6 percent of Indians (DACFW, 2021). The strongest background of the economic upgrading status of India is the agriculture which comprises of smallholder and subsistence farmers. As 86.2 percent farmers accounts for marginal and small land-holdings (Agriculture Census, 2016). This study focuses on Bihar, where marginal and small farmers operate 76 percent of the agricultural area and almost 97 percent of the landholdings (Verma *et al.*, 2019). The fragmented land was a consequence of the modern trend of moving from joint families to nuclear families (NSSO, 2011). Small-scale farmers now face a multitude of opportunities and problems as a result of the globalization and market liberalization waves that started in 1980s (Penrose-Buckley, 2007). The collective action empowers primary producers as it

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boosts profits and eliminate middlemen participation. In this way, Farmer Producer Organization (FPO) can readily help farmers overcome the various challenges that contemporary small producers encounter. "Unity is strength" is the idea based on the ability of FPOs to resolve important issues in agriculture (Neti & Govil., 2022; Gupta *et al*., 2023). There are five possible roles that Farmer Producer Companies can play in bolstering the markets for commodities that smallholders produce, purchase and sell: decreasing transaction costs; minimizing risk; creating social capital; enabling collaborative action; and remedying missing markets (Torero, 2011). Inadequate access to infrastructure like intermediate collecting locations, transportation, agricultural equipment, storage facilities, reasonably priced, high-quality inputs, investments in environmental assets, technology, quality extension, credit resources, marketing and secondary agricultural operations are the main obstacles facing rural areas' agriculture sector (Makal *et al*., 2017). Initially, the government provided support to FPOs when they started as cooperative organizations, but over time, that government aid has been diminished. Fresh producer firms are therefore forming with a legal framework comparable to that of corporations. In an effort to bridge the gap between industry and agriculture, the Indian government has encouraged small-scale and marginal peasants who are the main producer of agricultural product to connect with buyers from corporations and introduce new organizational patterns in agro-based production and marketing to connect big corporations (Sawairam, 2015). 'Atmanirbhar Krishi' is an initiative to achieve self–reliant agriculture which involves establishment and advancement of Farmer Producer Organization. As it generates employment opportunities and advancement of rural economies for the youth within the villages. (MAFW, PIB, 2021). To reduce this hindrance innovative digital technique called "Open Network for Digital Commerce (ONDC)" platform has welcomed Farmer Producer Organizations (FPOs) to sell produce to customers nationwide online (The Economic Times, 2024). This will also help in combat the constraints that are faced by members of FPOs. In SFAC ranking, Bihar secures third place in the year-2023. SFAC has allocated a total of 290 FPOs to Bihar, out of which 180 FPOs have already been registered. (SFAC, 2023). Thus, the current investigation was carried out to unveiling constraints perceived by members of Farmer Producer Organizations in Bihar.

MATERIALS AND METHODS

Bihar is consisting of 38 districts. Pusa and Kalyanpur blocks were randomly selected out of 20 blocks of Samastipur. Dighra Farmer's Producer Company Limited and Krishi Kalyanpur Producer Company Limited had been selected from Pusa and Kalyanpur block respectively. As the maximum number of respondents were found in these FPOs in research area, therefore, selected for the study. Among these FPOs, disproportionate stratified random sampling was adopted to select 30 respondents from each FPO which constitute 60 respondents. The current study acquired an ex-post facto research design (Shruti *et al*., 2016; Sinha *et al*., 2018; Verma *et al*., 2021; Lal *et al*., 2023; Srivastava *et al*., 2024). According to Kerlinger (1964), ex-post facto research is a systematic empirical investigation where the researcher lacks direct control over variables as they have already occurred or were not internally manipulated.

Frequency and Percentage as well as Friedman two-way ANOVA by ranks were used to analyse the data collected for the constraint variable (Chandana *et al*., 2022; Lal *et al.,* 2016, Tripathi, 2014; Banik *et al*., 2024). Within broad constraints rank was assigned based on frequency and percentage. The study's primary research variable for the operationalized study was constraints. The constraints were broadly categorized into 5 subheads i.e. social and psychological, economic, technical, managerial and marketing constraints. Well-structured questionnaire was prepared to interrogate the respondents. The most severe constraints amongst the five major constraints that member farmer of FPO encountered was determined by using the Friedman two-way ANOVA via ranks test was used by the following formula of difference between treatments or conditions:

$$x_{r1}^2 = \frac{12}{\mathrm{Nn}(n+1)} \sum \mathrm{R}_1^2\text{-}3\mathrm{N}(n+1) \text{at df} = n\text{-}1$$

N= Number of subjects, respondents or groups

N = Number of treatments or broad constraints

$\sum \mathrm{R}_1^2$= Row ranks summed up in each column, square and then added

Table 1: Social and psychological constraints perceived by members farmers with FPOs (n=60)

S. No.	Statements	f (%)	Rank
1	Absence of cooperation and collaboration	8 (13.33)	V
2	Absence of a conflict management strategy	5 (8.33)	VI
3	Trust issues among the members	14 (23)	III
4	Absence of coordinated decision making	11 (18)	IV
5	Uncertainty regarding the field-worthiness of FPOs	56 (93.33)	I
6	Concern about the proper use of grants received and the resource institutions	49 (81.67)	II

RESULTS AND DISCUSSION

The current study sought to priortise and identify the constraints that were faced by members of Farmer Producer Organization (FPOs) while encountered their business. An effort was made to comprehend the difficulties faced by farmers in the study region, which can be divided into five broad constraints viz., social and psychological; economic; technical; managerial; and marketing constraints.

Social and psychological constraints: The social and psychological constraints were identified and presented in Table 1. In this category, 'uncertainty regarding the field-worthiness of FPOs', ranked 1st by the members with 93.33 per cent followed by 'concern about the proper use of grants received and the resource institutions' was the 2nd most important constraint as reported by the members 81.67 per cent, respectively. Likewise, 'trust issues among the members was given 3rd rank by the members 23.00 per cent. 'Absence of coordinated decision making', 'absence of cooperation and collaboration' and 'absence of a conflict management strategy' was ranked 4th, 5th, and 6th by the members with 18.00, 13.33 and 8.33 per cent, respectively.

Economic constraints: The economic constraints were identified and presented in Table 2. The findings revealed that 'postponement of profit sharing' was accorded as most serious constraint by members ranked 1st with 21.67 per cent as funds from associated bodies were not allocated to board member's account on time. Followed by 'lack of timely credit availability' was ranked 2nd and 'insufficient profit for each member' was ranked 3rd by the members with 18.33 per cent, respectively. Likewise, 'balance has been negative since conception' was ranked 4th by the members with 8.33 per cent.

Table 2: Economic constraints perceived by member farmers with FPOs (n=60)

S. No.	Statements	f (%)	Rank
1	Balance has been negative since conception	5 (8.33)	IV
2	Lack of timely credit sharing	12 (20)	II
3	Insufficient profit for each member	11 (18.33)	III
4	Postponement of profit sharing	13 (21.67)	I

Technical constraints: The findings regarding technical constraints in Table 3 revealed that 'absence of adequate storage facilities' and 'absence of processing facilities' was ranked 1st by the members with 100 per cent as neither FPOs have their own cold storages nor linked with any industry. Followed by 'absence of ICT knowledge' and 'absence of highly skilled labour' was given rank 2nd and 3rd with 16.66 and 13.33 per cent by the members, respectively. Similar result was revealed by Yadav *et al.* (2022) and Chauhan *et al.* (2021) in their study.

Table 3: Technical constraints perceived by member farmers with FPOs (n=60)

S. No.	Statements	f (%)	Rank
1	Absence of adequate storage facilities	60 (100)	I
2	Absence of processing facilities	60 (100)	I
3	Absence of highly skilled labour	8 (13.33)	III
4	Absence of ICT knowledge	10 (16.66)	II

Managerial constraints: The findings regarding managerial constraints in Table 4 revealed that 'insufficient business expertise' was accorded most serious constraints by members ranked 1st with 91.67 per cent as FPO are established in rural area and members of FPO prefer to look from shallow level

Table 4: Managerial constraints perceived by member farmers with FPOs (n=60)

S. No.	Statements	f (%)	Rank
1	Account management errors	11 (18.33)	IV
2	Impotent group membership	13 (21.66)	III
3	Insufficient business expertise	55 (91.67)	I
4	Absence of accountability in operation	6 (19)	V
5	Needs of members are complex	24 (40)	II

of business expertise or they lack deep knowledge in business expertise as their background has low level of education, followed by 'needs of members are complex' was ranked 2nd with 40.00 per cent and 'impotent group membership' was given ranked 3rd by the members with 21.66 per cent, respectively. Likewise, 'account management errors' and 'absence of accountability in operation' was ranked 4th and 5th by the members with 18.33 percent and 19.00 per cent, respectively.

Marketing constraint: The findings regarding marketing constraint in Table 5 revealed that 'far-off market and expensive transportation' ranked 1st by the members with 95.00 per cent as routes are not well connected due to bad construction of roads. The data also revealed that 'products; shelf life nature', 'late payments', 'market items are subject to fierce rivalry', 'outlets with an uncertain market', 'middlemen's exploitation' was ranked 2nd, 3rd. 4th, 5th, 6th by the members with 85.00, 11.67, 10.00, 8.33 and 6.67 percent respectively.

Friedman test, a non-parametric test used to employ the severity level of all the 5 major severe constraints. Table 6 showed that the highest mean rankings obtained through the use of the Friedman test were for economic constraints (4.27) which means that it was most severe constraint among all the five broad constraints. The mean rank of technical constraints was 1.66 which implied that it was least severe broad constraints. The marketing, managerial and social and psychological constraints mean rank score was 3.22, 3.00 and 2.86 respectively with rank 2nd, 3rd and 4th. The result interprets that asymptotic significance was found 0.000 ($p<0.001$) with chi-square value of 88.011 having 4 degree of freedom. Significance level obtained from a Monte Carlo significant at 99 percent Confidence Interval (CI) and therefore, it is possible to conclude that there were notable variations among the five broad constraints.

Table 5: Marketing constraints perceived by member farmers with FPOs (n=60)

S. No.	Statements	f (%)	Rank
1	Outlets with an uncertain market	5 (8.33)	V
2	Market items are subject to fierce rivalry	6 (10)	IV
3	Far-off market and expensive transportation	57 (95)	I
4	Middlemen's exploitation	4 (6.67)	VI
5	Late payments	7 (11.67)	III
6	The products' shelf life nature	51 (85.00)	II

Table 6: Response of member-farmers of FPO on extent of severity of constraints (Friedman's Mean Rank)

S. No.	Constraints	Mean Rank	Overall Rank
1.	Economic constraints	4.27	I
2.	Marketing constraints	3.22	II
3.	Managerial constraints	3.00	III
4.	Social and psychological constraints	2.86	IV
5.	Technical constraints	1.66	V

CONCLUSION

This research endeavors to identify and address primary constraints hindering progress or development of members of Farmer Producer Organization. From the findings by applying frequency and percentage, it is concluded that 'uncertainty regarding the field-worthiness of FPOs' was the major social and psychological constraint. 'Postponement of profit sharing' was the prime economic constraint. The major constraint found under technical constraint are 'absence of storage facilities' and 'absence of processing facilities' with 100 per cent among all the given constraints as the FPOs not have their own cold storages and also not linked with any industry. Under managerial constraint, 'insufficient business expertise' was accorded as major constraint. 'Far-off market and expensive transportation' is the vital marketing constraint. The most stringent constraints were determined using the Friedman test, and the test's suitability was verified using the asymptotic and Monte

Carlo significant levels. A framework for policy that will ensure that Farmer Producer Organizations operate efficiently can be generated from a consideration of the constraints.

REFERENCES

Agriculture Census. 2016. All India Report on Number and Area of Operational Holdings. Agriculture Census Division, Government of India.

Annual Report. 2021. Department of Agriculture, Cooperation & Farmers' Welfare, Ministry of Agriculture & Farmers' Welfare, Government of India. 1-298.

Banik, T.; S. Prakash and S.P. Lal. 2024. A Comprehensive Analysis of the Impediments Perceived by the Members of Farmer Producer Organizations in North Bihar, India. *Journal of Scientific Research and Reports,* 30(7), 226–233.

Chandana, T.S.; P.L.R.J. Praveena; T. Lakshmi; D. Subhramanyam and B.R. Reddy. 2022. Constraints Faced by Integrated Farming Systems (IFS) Farmers and Suggestions to Overcome the Constraints. *Journal of Community Mobilization and Sustainable Development,* 17(3): 854-860.

Chauhan, J.K.; A. Adhikary and K. Pradhan. 2021. Identification of Constraints Associated with Farmers' Producer Organisations (FPOs). *International Journal of Current Microbiology and Applied Sciences*, 10(1): 2319-7706.

Chris Penrose-Buckley. 2007. Producer Organisations: A Guide to Developing Collective Rural Enterprises. Oxford, United Kingdom: Oxfam, i-viii, 2-178.

Gorai, S.K.; M. Wason; R.N. Padaria; D.U.M. Rao; S. Paul and R.K. Paul. 2022. Swot and Constraint Analysis of Farmer Producer Organization in West Bengal. *Journal of Community Mobilization and Sustainable Development*, 17(1): 1-7.

Gupta, M.K.; S.P. Lal; S. Prakash and G. Shukla. 2023. Comparative Impact Assessment of Diverse Farmers Producers Organisations (FPOs) in Bihar: An Inter-FPO Variation Analysis using Post Hoc Tukey's HSD Test. Biological Forum- An International Journal. 15(9): 644-648.

Kerlinger, F.N. 1964. Foundations of Behavioural Research, Holt, Rinehart and Winston Inc. New York.

Khare, A. and R.P. Kadam. 2018. Constraints Faced by the Village Leaders in their Role for Village Development in Maharashtra State. *International Journal of Current Microbiology and Applied Sciences*, (7): 3988-3996.

Lal, S.P.; K.S. Kadian; R.B. Kale and Shruti. 2016. Friedman based analysis of perceived constraints among dairy farmers affected by national calamity in India. *Indian Journal of Dairy Science*, 69(6): 725-727.

Lal, S.P.; K.S. Kadian; W.A. Wodajo and Shruti. 2016. Is that Environmental Factor Affected the Distressed Farmers' most!? - An Exploratory Factor Analysis of Constraint and Amelioration Strategies in National Calamity Hit Region of India. *Current World Environment*: 11(3): 859-868.

Lal, S.P.; S.K. Jha and S. Sinha. 2023. Climate Vagaries in Two Green Revolution States of India: An Inter-Zonal Variation Analyses Through Post Hoc Tukey's HSD Test. *Journal of Community Mobilization and Sustainable Development*, 18(1): 186-192.

National Sample Survey Office. 2011. Press Information Bureau, Government of India.

Neti, A. and R. Govil. 2022. Farmer Producer Companies report II: inclusion, capitalization and incubation.

Press Information Bureau. 2021, 9 February. Central Sector Schemes "Formation and Promotion of 10,000 new Farmer Producer Organizations (FPOs)" of Rs. 6865 Crore. Ministry of Agriculture & Farmers Welfare, Government of India, PIB Delhi. 1-2.

Sawairam, P. 2015. Case Study of Farmer Producer Organization in Maharashtra in the Era of Globalization. *IBMRD's Journal of Management and Research,* 4(2): 55-63.

SFAC. 2023. Farmer Producer Organization Scheme: Small Farmers' Agri-Business Consortium. Department of Agriculture and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India.

Shruti; S.K. Jha and S.P. Lal. 2016. Factors Affecting Job Satisfaction of Lay Inseminators in Haryana. *Journal of Community Mobilization and Sustainable Development,* 11(2): 197-201.

Sinha, S.; G. Sankhala and S.P. Lal. 2018. Effectiveness of ICT based Mobile App in Knowledge Gain apropos 'Environment-Friendly Dairy Farming Practices': Paired 't' and Wilcoxon Signed paired Rank test Analogy. *Journal of Community Mobilization and Sustainable Development,* 13(3): 561-566.

Srivastava, D.; A. Kumari and S.P. Lal. 2024. Factors Determining Awareness and Role of Community Moblization vis-à-vis Bio- degradable Jan Aushadhi Suvidha Sanitary Napkins among Women in India. *Journal of Community Mobilization and Sustainable Development,* 19(2): 1-7.

The Economic Times. 2024. Govt says 5,000 Farmer Producer Organizations onboarded on ONDC. The Economic Times.

Torero, M. (2011, January). A framework for linking small farmers to markets. In IFAD Conference on New Directions for Smallholder Agriculture (Vol. 24, p. 25).

Verma, A.; A.K. Singh; S.K. Dubey; O.P. Singh; R.K. Doharey and V. Bajpai. 2020. Constraints Faced by Board of Members of Farmer Producer Organizations. *Indian Journal of Extension Education*, 56(3): 75-78.

Verma, A.K.; V.K. Singh; K. Asha; S.K. Dubey and A.P. Verma. 2021. Constraints Perceived by the Members and Non-members towards Functioning of FPO-AKPCL in Kannauj District of Uttar Pradesh. *Economic Affairs*, 66(2): 335-341.

Verma, S.; V.K. Sonkar; A. Kumar and D. Roy. 2019. Are farmer producer organizations a boon to farmers? The evidence from Bihar, India. Conference Paper in *Agricultural Economics Research Review*, 32: 123-137. DOI:10.5958/0974-0279.2019.00022.3.

Yadav, V.K.; A. Mukherjee; S. Roy; K. Pradhan; R.S. Pan; U. Kumar; D.K. Yadav; A. Kumar; A.K. Singh and D.K. Raghav. 2022. Analyzing the Constraints as Perceived by the Board of Directors in the Initial Development Phase of the Farmer Producer Organizations. *Indian Research Journal of Extension Education*, 22(3): 170-175.

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Research Article

Analysis of the Adoption of the Agri-Horti-Livestock Based Farming System in Hyper Arid Western Region of Rajasthan

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ABSTRACT

Among Crops component in *kharif* crops Bajra, Moong bean, Moth bean, Cluster bean were taken while in *Rabi* Chickpea, Wheat, Isabgoal, Mustard, fennel, Jeera while in Livestock component among Large Ruminant Buffalo, Cow, and Camel Were taken while among Small Ruminant Sheep, Goat were taken among Horti component in Vegetables Cachri, Tinda, Onion, Kakri, Loki were taken while in Fruit Pomegranate, Date Palm Ber, Moringa, Ker, Sangri were taken for the sample collection of the study Livestock rearing is the integral part of the farming in hyper arid region of western Rajasthan, predominantly in Jaisalmer district. Among the livestock, large ruminant's viz. Tharparkar breed of cow is most widely reared animal for milk and other dairy products. Addressing these constrains results in adoption of good rearing practices of livestock could be a major step to improving the livestock productivity and enhancing the income of farmers involved in livestock farming thus improving their livelihood status. Lumpy virus epidemic was observed as the major constraints among the cattle rears in Jaisalmer Barmer and Pali district of Rajasthan. Pomegranate is the most cultivated fruit crop followed by ber and date palm. In crops Jeera is most remunerative crop followed by the isabgoal and groundnut, trend is changing in the IGNP area. A total of 75 farmers have been taken for the study from 5 tehsils.

Keywords: Livestock, Adoption, Hyper arid region, Farming system

INTRODUCTION

Under agro-climatic condition of Jaisalmer, adoption of new technology crop/fruit or livestock is quite less as compared to other part of the country. There is a huge technology gap exists in the present agricultural systems because of less adoption of improved technologies. For increasing production and productivity of crop/fruit or livestock, it is essential to fill this gap through making technology transfer more efficient and effective. Sometimes technology is available for particular crop/fruit or livestock but it does not suit to particular location/situation. Hence the factor responsible for technological gap should be identified for refinement and increase the adoption of improved technologies. The study has been prepared to assess the gap in adoption of different practices of the different technologies in the different agriculture systems e.g. Agri–horti–livestock systems. Adhikari (2007). The study was developed to measure the constraints in the adoption also e.g. Social-economic and, in fractural and other constraints other than this a study also was conducted on the measurement of the socio economic status of the farmers. Through this study it was assed that how much adoption gap exist in the technology adoption of the farmers through the measurement of the constraints we can find the remedies of the constraints this project will help in assessment and refinement of the technology also after measuring the constraints in adoption of the technology it will be easier for the researcher to refine the technology so that betterment of the technology could be done according to necessity of the farmers. After

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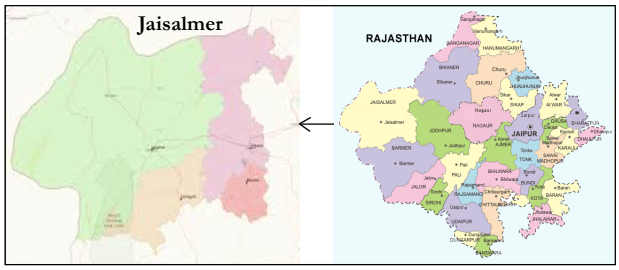
measurement of the adoption gap it will be easier for the farmers and researchers to move the farmers from the laggards to the early adopters Based on this study it will be easier to recommend the exact technology based on the bottom up approach and problem and situation specification technology for the researcher and the policy makers Barodia (2005).

MATERIALS AND METHODS

A study was conducted by ICAR–CAZRI-RRS Jaisalmer during year 2020-23. Five tehsils viz., Jaisalmer, Bhaniyana, Fathehgarh, Mohangarh and Pokaran tehsil of Jaisalmer district has been selected for the study. Total of 75 farmers has been selected from all the five tehsils.



Map 1: Map of the Jaisalmer

Adoption index

$$KI = \frac{A}{P} \times 100$$

Where, KI = Adoption Index

A = Adoption Obtained

P = Possible Maximum Score

Percentage: The term 'percentage' means a fraction whose denomination is 100 and the numeration of the fraction is called percentage. For calculating percentage, frequency was multiplied by 100 and divided by total respondents.

$$P = \frac{X}{N} \times 100$$

Where, P = Percentage
X = Frequency of respondents
N = Total number of respondents

Mean: Mean was obtained by dividing the sum of the scores by the total number of respondents, according to the following formula

$$X = \frac{N}{\Sigma i}$$

Σi = Sum of all the pairs in a distribution
n = Total number of items involved.

The study will be conducted on the Jaisalmer regional station of the CAZRI at RRS Rajasthan is selected Purposely because Institute is located, Jaisalmer is selected Purposely because RRS is located Selections of tehsils is made Purposely. Sampling selection of all five tehsils is made. Selections of farmers are made by Simple Random Sampling, Selection of farming systems were done purposely. Under Crop-Horti-livestock farming system 5 farmers will be selected in each tehsil thus 25 farmers in four tehsils of Jaisalmer under Crop-Horti-Livestock System. Thus total sample size reached to 75 in all five tehsils of the Jaisalmer. Thus from each tehsil 15 beneficiaries will be selected through simple random sampling thus total 75 beneficiaries will be selected.

Socio-economic data of selected farmers: Socio-economic information was collected in five tehsils. Thus total of 75 farmers interviewed from all five tehsils. The results show that most of the farmers belong to middle age group while most of the farmers belong to primary education, in caste wise most of the farmers fall in OBC category while among type of the family, most of the farmers fell in the joint family, while most

Table 1: Different Agri, Livestock and Horti Component taken for the study

Crops component	*Kharif* Bajra, Moong Bean, Moth bean, Cluster bean	*Rabi* Chickpea, Wheat, Isabgoal, Musterd, fennel, Jeera
Livestock component	*Large Ruminant* Buffalo, Cow, Camel.	*Small Ruminant* Sheep, Goat
Horti component	*Vegetable* Cachri, Tinda, Onion, Kakri, Loki	*Fruit* Pomegranate, Date PalmBer, Moringa, Ker, Sangri

Table 2: Sampling plan of the farmers for data collection

Particulars	Jaisalmer	Bhaniyana	Pokaran	Fategarh	Mohangarh
Crop	5	5	5	5	5
Crop-Horti	5	5	5	5	5
Horti-Horti-Livestock	5	5	5	5	5
Total			**75**		

Table 3: Socio-economic data of selected farmers–2022-23

Practices	Range	Jaisalmer	Fatehgarh	Mohangarh	Pokaran	Bhaniyana	Overall
Age	Young <30	1	0	1	1	0	3
	Middle 30-60	12	7	11	13	11	54
	Old <60	2	8	3	1	4	18
Education	Upto primary	10	6	4	10	9	39
	Upto secondary	4	4	4	4	2	18
	Higher level	1	5	7	1	4	18
Cast	General 1	5	9	3	2	7	26
	S.C. 2	0	2	0	0	0	2
	ST3	0	0	0	0	0	0
	OBC 4	10	4	12	13	8	47
Type of family	Nuclear (1)	5	3	7	5	5	25
	Joint (2)	10	12	8	10	10	50
No. of family member	Less $\leq$5	4	1	7	7	6	25
	Medium (5-10)	6	2	6	5	4	23
	High $\geq$10	5	12	2	3	5	27
Land holding	Small (1-3) h	9	1	5	6	2	23
	Medium (4-10) h	1	0	6	1	4	12
	Large >10 h	5	14	4	8	9	40
Entrepreneurship	Agriculture	0	0	0	0	0	0
	Agri-Hort & Livestock	15	15	15	15	15	75
	Agri-Hort & job	0	0	0	0	0	0
Average income	<1 LAC	4	0	0	2	1	7
	1-5 LAC	6	4	9	11	11	41
	>5 LAC	5	11	6	2	3	27
Social participation	Low $\leq$0	11	9	11	14	12	57
	Medium (0-7)	4	5	4	1	3	17
	High $\geq$7	0	1	0	0	0	1
Number of livestock	Low <20	14	12	14	13	13	66
	Medium 20-30	1	2	0	1	0	4
	High >30	0	1	1	1	2	5
Milk production	Low <5 liters	6	1	7	8	9	31
	Medium 5-8	4	9	5	5	4	27
	High >8	5	5	3	2	2	17

Table 4: Adoption of improved technology of crops

Practices	Range	Jaisalmer	Fatehgarh	Mohangarh	Pokaran	Bhaniyana	Overall
Right time of sowing	Low ≤4.74	0	0	0	10	4	14
	Medium 4.74-7.04	9	14	14	5	11	53
	High ≥7.04	6	1	1	0	0	8
Varity grown	Low ≤4.17	2	0	0	14	13	29
	Medium 4.17-6.06	10	7	6	1	2	26
	High ≥6.06	3	8	9	0	0	20
Seed rate	Low ≤3.40	0	0	0	13	7	20
	Medium 3.40-5.89	7	8	3	2	8	28
	High ≥5.89	8	7	12	0	0	27
Seed treatment	Low ≤4.14	4	0	0	15	10	29
	Medium 14-5.99	2	0	3	0	5	10
	High ≥5.99	9	15	12	0	0	36
Method of sowing	Low ≤3.94	0	0	0	13	8	21
	Medium 3.94-5.20	8	4	9	2	7	30
	High ≥5.20	7	11	6	0	0	24
Use of fertilizer	Low ≤3.64	2	0	0	15	5	22
	Medium 3.64-5.49	7	8	8	0	9	32
	High ≥5.49	6	7	7	0	1	21
Plant protection	Low ≤3.55	0	0	0	15	9	24
	Medium 3.55-5.37	10	8	5	0	6	29
	High ≥ 5.37	5	7	10	0	0	22
Intercultural operation	Low ≤4.68	0	0	0	15	15	30
	Medium 4.68-5.95	3	0	0	0	0	3
	High ≥5.95	12	15	15	0	0	42
Crop storage	Low ≤2.93	0	0	0	7	4	11
	Medium 2.93-4.34	12	13	5	8	11	49
	High ≥4.34	3	2	10	0	0	15
Total production	Low ≤3.75	1	0	2	0	2	5
	Medium 3.75-5.47	12	11	13	10	13	59
	High ≥5.47	2	4	0	5	0	11

of the family members have less than 5 family members. Most of the farmers have small land holdings. Among entrepreneurship most of the farmers fell in the agriculture and Livestock category. Most of the farmers have in medium social participation; most of the farmers have small ruminants. Diwan (2000).

Adoption of improved technology of crops: Medium level of adoption has been found about Right time of sowing, Varity grown, Seed rate, Seed treatment., Method of sowing, Use of fertilizer, Plant protection Intercultural operation, Crop storage total production. Deotale (1994).

Adoption of improved technology of Horticulture: High Adoption level of improved variety of horticulture crops, medium level about Plant to plant Distance, low adoption Time of sowing, medium adoption about Fertilizer, Medium about Plant protection, medium about Pruning time. Harvesting time and Production. Chouhan (2007).

Extent of adoption new technology of Livestock: Table 6 Divulges that among breeding practices having A.I. done at proper time of heat was highest adopted practice (78.00) followed by having the cow served with in 60-90 days after calving (72.00). Having

Table 5: Adoption of improved technology of Horticulture

Practices	Range	Jaisalmer	Fatehgarh	Mohangarh	Pokaran	Bhaniyana	Overall
Improved variety	Low ≤3.58	0	1	1	4	14	20
	Medium 3.58-4.70	5	6	10	4	1	26
	High ≥4.70	10	8	4	7	0	29
Plant to plant Distance	Low ≤3.36	3	5	5	3	7	23
	Medium 3.36-4.81	5	6	8	4	6	29
	High ≥4.81	7	4	2	8	2	23
Time of sowing	Low ≤4.13	2	2	10	6	13	33
	Medium 4.13-5.48	1	6	4	7	2	20
	High ≥5.48	12	7	1	2	0	22
Fertilizer	Low ≤3.11	1	3	7	2	7	20
	Medium 3.11-5.08	11	10	8	13	8	50
	High ≥5.08	3	2	0	0	0	5
Plant protection	Low ≤3.30	2	6	9	4	2	23.
	Medium 3.30-4.75	6	6	5	7	6	30
	High ≥4.75	7	3	1	4	7	22
Pruning time	Low ≤3.24	2	8	7	5	2	24
	Medium 3.24-4.59	6	4	8	9	8	35
	High ≥4.59	7	3	0	1	5	16
Harvesting time	Low ≤4.06	3	4	12	4	3	26
	Medium 4.06-6.04	8	10	3	11	10	42
	High ≥6.04	4	1	0	0	2	7
Production	Low ≤3.05	1	3	4	5	4	17
	Medium 3.05-5.63	11	10	0	7	7	35
	High ≥5.63	3	2	11	3	4	23

Table 6: Extent of adoption new technology of livestock

S.No.	Practices	Percentage	Rank
A.	**Breeding**		
1.	Having A.I. done at proper time of heat	78	I
2.	Having the cow served with in 60-90 days after calving	72	II
3.	Having pregnancy diagnosis done between 60 -90 days after service	56	III
4.	Treatment of repeat breeding and anoestrus cases by a veterinarian	45	IV
5.	Following the natural service with superior bulls	36	V
B.	***Feeding***		
1.	Providing mineral mixture to animals	82	I
2.	Feeding of balanced diet to their adults (Dry and milk animals)	78	II
3.	Feeding of balanced diet to their calves	67	III
4.	Feeding of balanced diet to their calves	56	IV
5.	Cultivation of hybrid fodder	55	V
6.	Feeding of balanced diet to their heifers	54	VI
7.	Use of hybrid fodder for their animals	45	VII
8.	Feeding of balanced diet to their heifers	44	VIII

Table 6 contd...

S.No.	Practices	Percentage	Rank
C.	***Management***		
1.	Do you castrated male calves	100	I
2.	Do you weather protection practices in animal	89	II
3.	Timely drying of animals	87	III
4.	Care of advanced pregnant animals	85	IV
5.	Proper Care at the time of parturition	82	V
6.	Following clean milk practices and right method of milking	76	VI
7.	Maintaining records	64	VII
D.	***Health care***		
1.	Timely and regular vaccination of animals	57	I
2.	Isolation of sick animals	12	II
3.	Treatment of sick animals by veterinary staff	56	III
4.	Periodical testing of animals against diseases by veterinary doctors	45	IV
5.	Protection against eco-parasite	56	V

pregnancy diagnosis done between 60-90 days after service (56.00). Treatment of repeat breeding and anestrus cases by a veterinarian (45.00) following the natural.

Service with superior bulls etc. (36.00). Among feeding practices providing mineral mixture to Barodia (2005). animals Was highest adopted practice (82.00) followed by Feeding of balanced diet to their adults (Dry and milk animals) (78.00), Feeding of balanced diet to their calves (67.00), Feeding of balanced diet to their calves (56.00), Cultivation of hybrid fodder (55.00), Feeding of balanced diet to their heifers, Use of hybrid fodder for their animals (54.00) Among Management practices castrated male calves Was highest adopted practice (100.00). Adhikari (2007).

CONCLUSION

Medium level of adoption has been found in case of the adoption of the crop, horticulture and livestock. Among feeding practices providing mineral mixture to animals was highest adopted practice (82.00) followed by Feeding of balanced diet to their adults (Dry and milk animals) (78.00), Feeding of balanced diet to their calves (67.00), Feeding of balanced diet to their calves (56.00), Cultivation of hybrid fodder (55.00). Among breeding practices having A.I. done at proper time of heat was highest adopted practice (78.00) followed by having the cow served with in 60 - 90 days after calving (72.00).

REFERENCES

Adhikari, G. 2007. Knowledge and adoption behavior of rice growers in Hoshangabad district of Madhya Pradesh. An unpublished M.Sc. (Ag.) Thesis, R.A.K. College of Agriculture, J.N.K.V.V., Jabalpur.

Barodia, A.R. 2005. A study on adoption behavior of vegetable growers in relation to improved technology in Funda block of Bhopal district. (M.P.). Unpublished M.Sc. (Ag) thesis, JNKVV, Jabalpur.

Chouhan, D.K. 2007. "A study of the technological knowledge possessed by the tribal cotton growers and its adoption in Manawar block of District Dhar (M.P.)". M.Sc. (Ag.) Thesis (Unpublished), R.A.K. COA, JNKVV, Jabalpur.

Deotale, S.L.; M.R. Choudhry; G.R. Tidke and L.D. Nagalwade. 1994. Adoption behaviour among vegetable growers in Nagpur district. *Journal of Soil and Crops,* 4(2): 141-144.

Diwan, Y.B. 2000. Study on Role performance of Tribal farm women in adoption of Maize production technology in Dahod district of Gujarat state. M.Sc. (Agri.) thesis, G.A.U., Anand Campus, Anand.

Dongardive, V.T. 2002. A study on adoption of recommended technology of chilli growers in Anand district of Gujrat state. M.Sc. (Ag.) thesis, Unpublished. G.A.U., Anand campus, Anand

Kushwaha, C.L.; Ramganesh; V.B. Singh and O.P. Daipuria. 2004. Knowledge of Solanicious vegetable growers towards plant protection measures- A correlation and path analysis. 2nd National Extension Education

Congress. Society of Extension Education, Agra & MPUAT, Udaipur. pp 63-64.

Painkra, S.K.; A.S. Chouhan and K.J. Thombre. 2005. Knowledge and adoption gap formers towards weed technology presented in third National Extension Education Congress, April 27-29. Society of Extension Education, Agra. ENDRI, Karnal. pp. 158-159.

Pandey, A.K. 1998. Differential attributes of potato growers in relation to their adoption behaviour. *Madhya Pradesh Journal of Extension Education,* 1(1): 53-56.

Parashar, A.N. 2004. A study on adoption of rose cultivation in Vadodara district of Gujarat state. M.Sc. (Agri.) thesis, A.A.U., Anand Campus.

Patel, B.J. 1995. A study on adoption behavior of kharif paddy growers in relation to recommended plant protection measures in Panchamahal district of Gujarat. M.Sc. (Agri.) thesis, G.A.U.

Patel, R.C. 2000. A study on the consequences of adoption of watershed management technology by beneficiary farmers in watershed area of Kheda district of Gujarat state. Ph.D. thesis, G.A.U., Anand Campus, Anand.

Tomar, J.S. 2005. A study on knowledge and adoption of Barseem production technology in Ashta block of Sehore district. M.Sc. (Ag.) thesis. R.A.K.COA, JNKVV, Jabalpur. *International Journal of Current Microbiology and Applied Sciences,* 8(8): 3049-3058.

Toppo. 2005. A study of participation and Decision making of farm women in Dairy occupation. M.Sc. (Agri.) thesis, A.A.U., Anand Campus, Anand.

Upahayaya, J.N. 1993. A study on prospectus of orchard and vegetable growing under present farming system in Rewa district, M.P. Msc. Ag. Thesis J.N.K.V.V College of Agriculture Rewa. pp 86.

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Research Article

Prioritisation of the Constraints Faced by Protected Vegetable Growers: A Case of North Western Himalayan State

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ABSTRACT

The protected vegetable cultivation not only amplify overall production and efficiency but also enables diversification, ensuring a steady year-round vegetable supply. The present study was conducted in the mid hill zone of Himachal Pradesh during 2022-23. The study employed a mixed sampling method, incorporating purposive sampling and multistage random sampling. A list of vegetable growers engaged in protected cultivation was obtained from agricultural and horticultural departments. To acquire the required data, a final sample of 240 growers was randomly selected. The goal is to identify constraints voiced by vegetable growers in the production, financial, technical, and marketing aspects of vegetable crops under protected cultivation. The constraints for various aspects were analysed using Response Priority Index (RPI), the scarcity of healthy planting material as the foremost concern, with a high priority score of 4.48. Examining financial and technical aspects, the study identifies a significant knowledge gap in post-harvest technologies as the most critical challenge, scoring 4.61. Among marketing constraints, the reliance on distant markets (4.69) emerges as the most pressing issue for polyhouse vegetable growers. To ensure the success of polyhouse cultivation, it is crucial to include them in insurance coverage for farmer protection. Providing comprehensive information and training on polyhouse design and maintenance, establishing cold storage facilities, and educating growers on optimal cultivation practices are key measures for sustainable and resilient agricultural practices.

Keywords: Protected cultivation, Vegetables, Mixed sampling, Response Priority index, Constraints

INTRODUCTION

India possesses a diverse range of production resources and a variety of cropping systems that play a pivotal role in fostering vegetable cultivation. On an average, the yield from vegetable farming surpasses that of cereals by five to ten times (Prakash, 2014). This emphasizes the considerable advantages and prospects associated with prioritizing vegetable cultivation in the Indian agricultural context. The abundance and diversity of resources available contribute significantly to the success and productivity of this sector, thereby augmenting the overall agricultural output of the nation. The recognition of these advantages underscores the importance of strategic focus and investment in vegetable farming for sustainable and robust agricultural development in India.

The adoption of protected cultivation methods for vegetable crops not only boosts overall production and productivity but also facilitates diversification, ensuring a continuous year-round supply of vegetables. When managed effectively, these cultivation techniques can lead to economically viable returns on investment (Dixit, 2007). The process involves safeguarding critical growth stages of vegetables from adverse conditions. Vegetables cultivated in hilly terrains are notably popular and in high demand due to their distinctive flavor, unparalleled freshness, and remarkable crispness compared to those grown in plains. Additionally, hilly

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regions enjoy the advantage of experiencing relatively lower occurrences of diseases and insect pests, resulting in produce with minimal residues. Despite the consistent production of vegetables in these areas, there has been limited growth. This underscores the need for pioneering technological innovations in agriculture to catalyze further advancements in vegetable production.

The advantages of protected cultivation for vegetable crops come with a number of problems that require careful consideration. Working together is necessary to overcome constraints such large initial investments, the requirement for technical know-how, and high energy expenses. Long-term profitability depends on maintaining soil health, effectively managing integrated pests, and being flexible enough to adjust to shifting market conditions. Policy makers and farmers must collaborate to develop strategies that improve protected cultivation's accessibility and resilience in order to support a more robust and effective vegetable farming enterprise. The main obstacles faced by vegetable growers were technical in nature, such as low confidence in recommended technology, hazardous application of plant protection measures due to a lack of knowledge and inaction of balanced fertiliser use. Input constraints, such as the high cost of hybrid seeds, fertilisers, and chemicals, were followed by the lack of quality protection chemicals (Kumar *et al.*, 2020). Researchers, policymakers, and extension workers must join forces to collectively tackle and surmount these constraints (George and Singh, 2006). Given this, the current study was conducted with the aim of analysing the constraints faced by protected growers of vegetable crops Himachal Pradesh, with a particular emphasis on the production, technical, financial and marketing aspects.

MATERIALS AND METHODS

The present study used mixed sampling technique consisting of purposive sampling and multistage random sampling for collecting the desired sample. A list of vegetable grower practicingprotected cultivation was procured from the agriculture or horticulture department and other agencies. In order to get a final sample, about 240 growers were selected randomly for collecting the requisite data and information. At the first stage, out of the two purposively selected districts of Himachal Pradesh which were Mandi and Solan, blocks were selected. Then, at the second stage, out of selected blocks, horticulturally dominant panchayats were selected. Further, from the selected panchayats, the list of villages was made to select villages where farmers actively practicing protected cultivation of vegetables were selected. At the last stage, farmers were selected from the selected villages for the collection of primary data. Final sample of around 240 respondents was made to conduct the study. To identify the constraints expressed by the vegetable growers in production, financial, technical and marketing of vegetable crops under protected cultivation and whether the emphasis should be given for the number of responses to a particular priority or the highest number of responses to a constraint in the priority (Ragasa and Golan, 2014; Christian, 2015 and Navaneetham *et al.,* 2019). Responses-priority index (RPI) was constructed as a product of the proportion of responses (PR) and priority estimate (PE) where PR for the constraint is the ratio of number of responses for a particular constraint to the total responses. Larger the RPI higher was the importance for that constraint.

RESULTS AND DISCUSSION

A prioritized response approach, employing a 5-point scale, was utilized to assess and rank farmers' issues. These problems were categorized into three distinct groups: input-related challenges, financial and technical issues and marketing issues.

Various inputs are crucial for vegetable production, and their scarcity poses several challenges. The results of the priority response analysis of protected vegetable growers regarding input problems are presented in Table 1. The findings indicated that, among the input-related challenges faced by polyhouse vegetable growers in the study area, the most prioritized issue was the unavailability of healthy planting material (score of 4.48). This was followed by the inability to fully benefit from subsidies on various inputs (score of 4.42), the absence of improved plant protection chemicals in local markets (score of 4.18), a shortage of irrigation water (score of 3.98), the higher cost of replacing polyhouse materials (score of 3.93), and a limited supply of farmyard manure (FYM) (score of 3.85). The results were similar to the findings of Shende and Meshram (2015); Roy and Ghosh (2022) who

Table 1: Prioritization of input related problems faced by the polyhouse growers

Problems	Number of respective problems					Total recorded responses	RPI	Rank
	5	4	3	2	1			
Higher cost of replacing the material of polyhouse (sheets, drip channels etc.)	53	31	16	14	6	120	3.93	V
Unavailability of improved plant protection chemicals at local markets	65	26	17	10	2	120	4.18	III
Unable to reap the benefits of subsidy on various inputs	72	28	18	2	0	120	4.42	II
Unavailability of healthy plant material	74	32	12	2	0	120	4.48	I
Limited supply of FYM	48	33	19	13	7	120	3.85	VI
Lack of irrigation water	58	27	15	14	6	120	3.98	IV

found that high input cost and unavailability of plant protection from insects and pests were the major constraints faced by farmers.

Polyhouse growers grapple with significant challenges, particularly in the financial and technical realms of polyhouse farming. Table 2 delineates the array of issues, their respective indices, and ranks concerning the financial and technical aspects within the study area. The predominant challenge identified was a deficiency in knowledge regarding post-harvest technologies (scoring 4.61), succeeded by the high costs associated with equipment and materials for constructing and operating polyhouses (scoring 4.38). Additional noteworthy challenges encompass a lack of awareness about suitable varieties (scoring 4.37), escalated electricity costs (scoring 4.28), insufficient knowledge about seed and plant treatments (scoring 4.13), the high cost of improved varieties (scoring 4.03), limited access to precise technical know-how (scoring 3.84), and a lack of confidence in adopting new techniques (scoring 3.77). The farmers perceived the financial problem like high cost of cultivation,

Table 2: Prioritization of financial and technical problems faced by the polyhouse growers

Problems	Number of respective problems					Total recorded responses	RPI	Rank
	5	4	3	2	1			
High Cost of improved varieties	52	33	24	9	2	120	4.03	VI
Higher electricity cost	68	26	19	5	2	120	4.28	IV
High cost of Equipments and material for constructing and operating polyhouses	72	24	22	2	0	120	4.38	II
Lack of knowledge about post harvest technologies	86	21	13	0	0	120	4.61	I
Lack of awareness about seed and plant treatments	62	27	19	8	4	120	4.13	V
Unavailability of exact technical knowhow	42	36	27	11	4	120	3.84	VII
Lack of awareness about using type of varieties	74	24	14	8	0	120	4.37	III
Lack of confidence of using new techniques	45	32	21	14	8	120	3.77	VIII

Table 3: Prioritization of marketing problems faced by the polyhouse growers

Problems	Number of respective problems					Total recorded responses	RPI	Rank
	5	4	3	2	1			
Absence of assured marketing at remunerative prices	85	22	11	2	0	120	4.58	III
Lack of storage facility to the produce	89	19	9	3	0	120	4.62	II
Lack of insurance facilities	62	31	16	8	3	120	4.18	V
Delay in Payments	53	17	21	20	9	120	3.71	VIII
Lower prices at harvest	58	18	21	18	12	127	3.78	VII
Lack of better transportation facility	71	20	12	9	8	120	4.14	VI
Unavailability of buyers at near markets	75	24	14	4	3	120	4.37	IV
Distant markets	88	27	5	0	0	120	4.69	I

equipment's and high labour wage and similar findings were also reported by Shasani *et al.* (2020); Gupta *et al.* (2020); Chandran and Pondikunju (2021); Singh and Hansra (2021).

The success of polyhouse vegetable cultivation hinges significantly on effective marketing strategies. The recorded responses pertaining to the marketing constraints faced by polyhouse vegetable growers are detailed in Table 3. Foremost among the challenges is the reliance on distant markets (scoring 4.69) for product distribution, particularly with the need to transport produce to major centers such as Delhi. Subsequently, the lack of storage facilities for perishable items (scoring 4.62) emerged as a notable concern. Other challenges include the absence of guaranteed marketing at profitable prices (scoring 4.58), a shortage of buyers in nearby markets (scoring 4.37), limited insurance facilities (scoring 4.18), and inadequate transportation options (scoring 4.14). The least impactful marketing issues for growers comprised lower prices at harvest (scoring 3.78) and delayed payments (scoring 3.71). Das *et al.* (2014) also reported that absence of remunerative market price and distant markets were the main marketing constraints.

CONCLUSION

The constraints faced by protected vegetable growers were evaluated through the Response Priority Index (RPI). The findings indicated that, in terms of input-related issues, the most pressing problem was the unavailability of healthy planting material, followed by the inability to utilize subsidies on various inputs, the lack of improved plant protection chemicals in local markets, insufficient irrigation water, the high cost of replacing polyhouse materials, and limited availability of farmyard manure (FYM). Similarly, concerning financial and technical matters for polyhouse growers, the primary challenge was a lack of knowledge about post-harvest technologies, succeeded by the high costs associated with equipment and materials for constructing and operating polyhouses, a lack of awareness about suitable varieties, increased electricity costs, limited knowledge about seed and plant treatments, high costs of improved varieties, and a shortage of precise technical know-how. Responses related to marketing constraints were also documented, with distant markets identified as the foremost issue, followed by a lack of storage facilities, uncertainty in marketing at profitable prices, a scarcity of buyers in nearby markets, limited insurance options, inadequate transportation facilities, lower prices at harvest, and delays in payments.

REFRENCES

Chandran, V. and B. Pondikunju. 2021. Constraints experienced by homestead vegetable growers in Kollam district. *Indian Journal of Extension Education*, 57(1): 32-37.

Christian, M.K. 2015. Characteristics and critical success factors' prioritization of MSMEs in African agribusiness: a case of DR Congo. *International Journal of Management Science and Business Administration,* 1: 31-41.

Das, L.; M.S. Nain; R. Singh and R.R. Burman. 2014. Constraints in marketing of fruits as perceived by the fruit growers and NERAMAC in Assam. *Journal of*

Community Mobilization and Sustainable Development, 9(2): 114-117.

Dixit, A. 2007. Performance of leafy vegetables under protected environment and open field condition. *The Asian Journal of Horticulture,* 2: 197-200.

George, S. and A. Singh. 2006. Vegetables for health and nutrition security, *Yojana*, 40: 36-40.

Gupta, B.K.; B.P. Mishra; V. Singh; D. Patel and M.P. Singh. 2020. Constraints faced by vegetable growers in adoption of IPM in Bundelkhand region of Uttar Pradesh. *Indian Journal of Extension Education*, 56(4): 92-97.

Kumar, A.; S. Singh; G. Paliwal; A.K. Singh and S. Chaurasia. 2020. Analysis of constraints faced by vegetables growers in production of rabi Season vegetables. *Indian Journal of Extension Education*, 56(4): 181-185.

Kumari, N.; P. Chahal and J.S. Malik. 2022. Analysis of marketing facilities available for tomato growers of Haryana. *Indian Journal of Extension Education*, 58(2): 86-90.

Navaneetham, B.; K. Mahendran and S.D. Sivakumar. 2019. Analysis of constraints for performance improvement of FPCs in Tamil Nadu. *International Journal of Farm Sciences,* 9: 12-18.

Prakash, K.C. 2014. An analysis of supply chain of tomato from farm to retail outlets for spencers retail outlets in Bangalore city. *International Journal of Commerce and Business Management*, 7(2): 243-250.

Ragasa, C. and J. Golan. 2014. The role of rural producer organizations for agricultural service provision in fragile states. *Agricultural Economics,* 45: 537-553.

Roy, P. and S. Ghosh. 2022. Constraints faced by pineapple growers in Tripura. *Indian Journal of Extension Education*, 58(2): 140-143.

Shasani, S.; P.K. Baneree; H.K. De and S. Panda. 2020. Constraints in adoption of groundnut cultivation technology by the farmers of Odisha. *Indian Journal of Extension Education*, 56(2): 39-44.

Shende, N.V. and R.R. Meshram. 2015. Cost benefits analysis and marketing of Tomato. *American International Journal of Research in Formal, Applied & Natural Sciences*, 11(1): 46-54.

Singh, S. and B.S. Hansra. 2021. Minimising vegetable production constraints in hills: Boon to attain sustainable vegetable farming system. *Indian Journal of Extension Education*, 57(2): 52-55.

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Research Article

Performance of *Gobhi sarson* Crop Under Cluster Frontline Demonstrations in Ropar District of Punjab

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ABSTRACT

The present study was conducted by Krishi Vigyan Kendra, Ropar to demonstrate the improved package of practices in cultivation of *Gobhi sarson*, through a cluster village approach, with the objective of enhancing the yield and economic returns from the farmers' fields. The technology gap, extension gap and technology index were also studied. The study, which was conducted for six consecutive years from 2018-19 to 2023-24, revealed that the demonstration plots on improved technology had 19.93 per cent higher yield as compared to the yield obtained from farmers' practice plots. Economically, the average net returns and BC ratio were also found to be higher in the demonstration plots (Rs. 65,552.72 per ha and 3.37, respectively) as compared to check plots cultivated i.e. farmer practices (Rs. 46,512.62 per ha and 2.65, respectively). The average technology gap, extension gap and technology index of were found to be 3.45 q/ha, 2.90 q/ha and 15.49 per cent, respectively.

Keywords: Frontline demonstrations, Rapeseed mustard, *Brassica*, Technology index

INTRODUCTION

Oilseeds play a crucial role in the agriculture economy of India. The current annual production of edible oilseeds in India is only about 35–40 per cent of the domestic requirements, and the shortfall is filled by imports of about 13.45 million tonnes of vegetable oil worth Rs. 81,682 crores (Bhagat *et al.,* 2022). Rapeseed-mustard, one of the primary sources of oilseed & oil, is cultivated on a wide range of agroclimatic regions in the country due to its high adaptability. In India, the rapeseed-mustard was grown on an area of 6.70 million ha, with a production of 10.21 million tonnes and a productivity of about 15.24 q/ha during 2020-21 (Anonymous, 2022), while, in Punjab, the area under rapeseed-mustard was 45.0 thousand hectares with production of about 73.0 thousand tonnes and average yield of 16.23 q/ha in 2022–23, respectively (Anonymous, 2024).

Gobhi sarson (*Brassica napus* L.) is the third most important oilseed crop in the world, after soybean and palm oil. It is one of the major oil producing crops among rapeseed and mustards in India (Kaur *et al.,* 2015). In Punjab, it is cultivated during the *rabi* season, mainly for its edible oil in addition to oilcakes for livestock, and is suitable for growing both under irrigated as well as rain-fed conditions. Generally, oils having high erucic acid content results in thickening of arteries, which causes heart problems and high glucosinate content in oilcake used as animal feed results in reduced appetite, reproductive and thyroid related health problems in animals. To overcome this, canola or double low ('00') varieties and hybrids of rapeseed have been developed, that have less than 2 per cent of erucic acid in the oil and less than 30 micromoles glucosinates per gram defatted meal, thus are healthy for use as edible oil for human and as oilcake to animals. The canola varieties and hybrids of *gobhi sarson* developed by the Punjab Agricultural University Ludhiana have a yield potential of 22-22.25 q/ha, with good quality grains and high oil content. However, in the current scenario of *gobhi sarson* cultivation in Punjab,

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the farmers get an average yield of only 16.23 q/ha (Anonymous, 2024), hence indicating huge scope of enhancement in the yield of this crop.

Thus, the current study was conducted for demonstrating the improved cultivation practices along with improved varieties/hybrids of *gobhi sarson* with the aim of getting higher economic returns per unit area. For this purpose, the canola variety GSC 7 and hybrid PGSH 1707 were demonstrated at the fields of the selected farmers over a period of six years from *rabi* 2018-19 to 2023-24, under the project on Cluster frontline demonstrations (CFLD) on oilseeds.

MATERIALS AND METHODS

The present study was conducted during *rabi* season from 2018-19 to 2023-24 by Krishi Vigyan Kendra, Ropar in different villages covering the district Ropar of Punjab (Table 1; Figure 1). A minimum fifty farmers were selected each year and the seed of improved variety GSC 7 and hybrid PGSH 1707, released in 2014 and 2019, respectively, by Punjab Agricultural University, Ludhiana was supplied to the farmers for conducting field demonstrations at one acre each of their land. The farmers were trained for cultivation of the crop according to the package of practices recommended by PAU, Ludhiana. The performance of the demonstrated variety and the recommended practices were compared to that of the local variety cultivated by the farmers along with the farmers' practices. The extension gap, technology gap and technology index were calculated using the following formulas given by Samui *et al.* (2000):

Technology Gap (q/ha) = PY (q/ha) – DY (q/ha)

Extension Gap (q/ha) = DY (q/ha) – LY (q/ha)

$$\text{Technology Index (\%)} = = \frac{\text{PY}\left(\frac{\text{q}}{\text{ha}}\right) - \text{DY}\left(\frac{\text{q}}{\text{ha}}\right)}{\text{PY}\left(\frac{\text{q}}{\text{ha}}\right)} \times 100$$

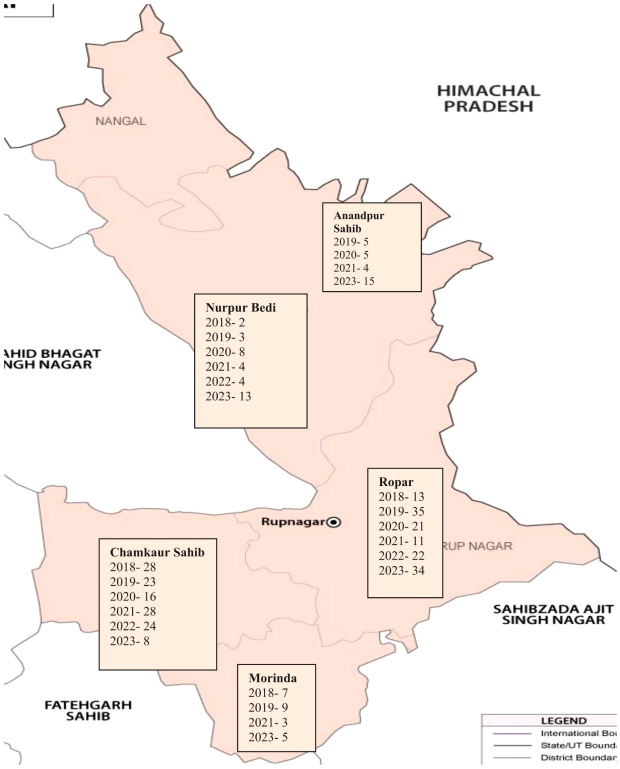

Figure 1: Location of the study area

Where, DY= Demonstration Yield; LY = Local Check Yield and PY= Potential Yield of the demonstrated variety/hybrid

The package of practices recommended by the Punjab Agricultural University, Ludhiana (Table 2), was demonstrated at the farmers' fields. Along with the demonstration fields, a check plot was maintained where the *gobhi sarson* crop was cultivated as per the conventional practices followed by the farmers for comparison.

RESULTS AND DISCUSSION

The yield obtained from the demonstration and farmers' practice plots every year is presented in the Table 3. It was observed that the yield of the

Table 1: Year-wise demonstrations conducted in different blocks of the district

Year	2018-19		2019-20		2020-21		2021-21		2022-23		2023-24	
Block	No. of farmers	Area (ha)	No. of farmers	Area (ha)	No. of farmers	Area (ha)	No. of farmers	Area (ha)	No. of farmers	Area (ha)	No. of farmers	Area (ha)
Anandpur Sahib	-	-	5	1.0	5	1.8	4	1.6	-	-	15	6
Chamkaur Sahib	28	11.2	23	7.2	16	3.6	28	11.2	24	9.6	8	3.2
Morinda	7	2.8	9	2.2	-	-	3	1.2	-	-	5	2
Nurpur Bedi	2	0.8	3	0.6	8	2.0	4	1.6	4	1.6	34	13.6

Table 2: Technology demonstrated *vs* farmers' practice

Particulars	Farmers' practice	Technology demonstrated
Varieties	Local unrecommended variety with low yield- hyola	High yielding improved variety GSC-7 & hybrid PGSH 1707
Sowing method	Broadcasting	Line sowing at spacing of 45 cm Thinning operation to maintain plant to plant distance of 10 cm
Disease incidence of white rust	Spray of unrecommended insecticides sold by dealers	Varieties demonstrated are resistant to attack of white rust
Incidence of mustard aphid	Spray of unrecommended insecticides sold by dealers	Cultural practices and spray of thiamethoxam/ oxydemetonmethyl/ dimethoate/chloropyriphos @ 40 g/ 400 ml/ 400 ml/ 600 ml per acre in 80-125 litres of water respectively.
Weed infestation	Spray of unrecommended weedicides	First hoeing at 3-4 weeks after sowing and second hoeing after first hoeing if needed
INM	Application of 75-90 kg Urea per acre and 50 kg DAP	Application of 90 kg Urea and 75 kg SSP per acre
Market price	Poor quality produce fetches lower market price	Bold, dark and round seeds fetches higher market price

Table 3: Productivity of *Gobhi sarson* under CFLD conducted in Ropar district of Punjab, India

Year	No. of FLD	Area (ha)	Yield (q ha^{-1})				Increase in yield (%)
			Demonstration			Farmer's Practice	
			Maximum	Minimum	Average	Average	
2018-19	50	30	22.25	18.50	19.67	15.00	3.11
2019-20	75	20	19.00	14.60	16.80	15.80	6.33
2020-21	50	20	23.75	16.88	21.12	16.75	20.69
2021-22	50	20	21.18	11.55	16.56	13.13	26.32
2022-23	50	20	24.58	16.08	19.71	17.58	12.02
2023-24	75	30	22.50	11.25	18.72	16.90	10.72
Average					18.77	15.65	19.93

demonstrated technologies were higher than the check plots' yield where farmers' practices were followed. The maximum demonstration yield ranged from 19.00 q/ha in the year 2019-20 to 24.58 q/ha in the year 2022-23, where the minimum yield ranged from 11.25 q/ha in 2023-24 to 18.50 q/ha in 2018-19. The lower yield in certain plots was due to the wild animal attack and crop damage due to heavy rainfall. The average yield from the demonstration plots was 18.77 q/ha which was 19.93 per cent higher than the average yield obtained from the farmers' plots (15.65 q/ha).

It was recorded that the net returns from the demonstrated technology ranged from Rs. 39,946.0 /-per hectare during 2018-19 to Rs. 94,527/- in 2020-2021. However, the net returns under farmers' practice were Rs. 22,966.7 per ha in 2018-19 to Rs. 69,363/- in 2020-21. The BC ratio was also found to be higher in demonstration plots (2.48-4.27) as compared to farmers' plots (1.87-3.5), thus indicating a considerable enhancement in the economic returns by adoption of the demonstrated package of practices. The detailed economics are given in Table 4.

The technology gap ranged from 0.88 q/ha in the year 2020-21 to 5.69 q/ha in 2021-22 and the average technology gap over the five years under the study was observed to be 3.45 (Table 5). This indicates that there exists a gap in the technology demonstrated, and this gap may be attributed to the differences in field

Table 4: Economic analysis of CFLDs on *Gobhi Sarson* in Ropar district of Punjab, India

Season/ Year	Cost of cultivation (Rs/ha)		Gross returns (Rs/ha)		Net returns (Rs/ha)		B:C ratio		Selling price
	DP#	FP*	DP	FP	DP	FP	DP	FP	(Rs/kg)
2018-19	27,000.0	26,500.0	66,946.0	49,466.7	39,946.0	22,966.7	2.48	1.87	4,200.0
2019-20	23,230.0	25,800.0	80,640.0	69,608.0	57,410.0	43,808.0	3.47	2.70	4,700.0
2020-21	28,937.0	27,518.0	1,23,465.0	97,154.0	94,527.0	69,636.0	4.27	3.5	5,837.0
2021-22	30,455.2	30,700.0	1,04,603.6	73,600.0	74,148.5	42,900.0	3.48	2.40	6,477.0
2022-23	28,667.2	29,500.0	94,081.7	79,125.0	65,414.4	49,625.0	3.28	2.68	4,763.0
2023-24	28,056.5	28,700.0	89,926.9	78,840.0	61,870.4	50,140.0	3.21	2.75	4,804.0
Mean	27,724.32	28,119.67	82,898.65	74,632.28	65,552.72	46,512.62	3.37	2.65	5,195.40

DP – Demonstration plot; * FP – Farmers' practice

conditions, soil properties and microclimatic conditions of the area. The average extension gap was found to be 2.90 q/ha. The extension gap i.e. the difference between the demonstration yield and the local check yield, was found to be maximum (4.67 q/ha) during 2018-19 and minimum (1.00 q/ha) during the year 2019-20. This gap can be further minimized by dissemination of the information on improved practices and technologies through different extension programmes like trainings, awareness camp, field days, demonstrations, etc. Technology index is the ratio between technology gap and potential yield expressed as percentage, which shows the feasibility of the demonstrated technology. Lower technology index reflects the effectiveness of the transfer of technology. The current study revealed an average technology index of 15.49 per cent, which can be further improved by decreasing the extension gap. Similar studies were conducted by various workers who reported higher yield and net returns from demonstration plots in *Brassica juncea* (Singh *et al.,* 2017), in soybean (Meshram *et al.,* 2022) and in pulses (Singh *et al.,* 2020).

Table 5: Technology gap, extension gap and technology index for *gobhi sarson* in Ropar district of Punjab, India

Year	Technology gap (q/ ha)	Extension gap (q/ ha)	Technology index (%)
2018-19	2.58	4.67	11.60
2019-20	5.45	1.00	24.49
2020-21	0.88	4.37	4.00
2021-22	5.69	3.43	25.57
2022-23	2.54	2.13	11.42
2023-24	3.53	1.82	15.86
Average	3.45	2.90	15.49

Potential yield of GSC- 7= 22.25 q/ha; Potential yield of PGSH 1707= 22.00 q/ha

CONCLUSION

The study revealed that demonstrations on the improved technology at farmers' field with active participation of the farmers can result in higher crop yield and increased income from the field. The cluster frontline demonstration approach can, thus, be utilized to enhance the economic status of the farmers in the area.

REFERENCES

Anonymous. 2022. Annual Report, Department of Agriculture and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India, New Delhi. pp. 68.

Anonymous. 2024. Package of practices for crops of Punjab-Rabi 2024-25, p 45-54.

Bhagat, R.; M. Singh and B.C. Sharma. 2022. Growth and productivity of *gobhi sarson* (*Brassica napus*) cultivars under diverse sowing environments. *Indian Journal of Agricultural Sciences,* 92(10): 1202–1207, October 2022/ Article https://doi.org/10.56093/ijas .v92i10.122648.

Kaur, S.; M.S. Bhullar; S. Singh and T. Singh. 2015. Control of weeds in canola *gobhi sarson* cultivars and their tolerance to herbicides. *Indian Journal of Weed Science,* 47(4): 376–378.

Meshram, V.; R.P. Ahirwar; K.V. Sahare; N.K. Pandre; D. Ketki and M. Meshram. 2022. Impact of cluster frontline demonstrations (CFLD) oil seeds on yield enhancement of mustard (*Brassica juncea*) in tribal district of Mandla, Madhya Pradesh, *The Pharma Innovation Journal*, 11(1): 1183-1185.

Samui, S.K.; S. Maitra; D.K. Roy; A.K. Mondal and D. Saha. 2000. Evaluation of font line Demonstration on groundnut (*Arachis hypogea* L.) in Sundarbans, *Journal of Indian Society of Coastal Agriculture Resources*, 18(2): 180-183.

Singh, J.; H. Singh; S. Ahuja and A. Kumar. 2017. Frontline demonstration to enhance yield of soybean in Ropar district of Punjab. *Trends in Biosciences*, 10(28): 5997-5998.

Singh, R.P.; A.K. Singh; R.P. Singh; R.K. Singh and M. Singh. 2020. Impact of cluster frontline demonstrations on pulses productivity and profitability in farmer's field. *Indian Journal of Extension Education*, 56(1): 134-141.

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Research Article

The Influence of Residential Area and Gender on Adolescent Emotional Maturity

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ABSTRACT

The process through which an individual is consistently found to have a stronger feeling of emotional wellbeing is known as emotional maturity. The emotional development of a person has an impact on their behaviours. A person with emotional maturity can adapt to any circumstance and face any difficulties in a calm manner with the help of the appropriate decisions. In order to develop into a strong, emotionally mature person with a balanced personality in life, teenagers must be properly guided. The purpose of this study is to determine the effect of residential area and gender on adolescent's emotional maturity. The investigational sample was purposively drawn from the Bikaner city, Rajasthan state. A sample of 100 respondents, (equally taken both the gender from residential area categories i.e. Rural and urban area) adolescent students was selected. Data were collected by administering the Emotional Maturity Scale developed by Prof. Yeshver Singh and Prof. Mahesh Bhargave (1990) and analysed by Mean, SD, and t-test to compare mean scores between groups. Therefore, the results reflective of male adolescents had relatively better emotional maturity then female. Whereas the urban areas' adolescents had comparatively better emotional maturity than their counterparts.

Keywords: Adolescent, Maturity, Emotional maturity, Emotions, Behaviour

INTRODUCTION

The ability to achieve one's personal potential within the confines of social expectations is referred to as emotional maturity. Every person must develop emotionally, therefore the sooner we accomplish the delicate balance between the elements of the early adolescents self, the better we can create a more solid personality structure for adults. The capacity to comprehend and regulate emotions is referred as emotional maturity. It promotes a balanced social and personal life. According to another definition, emotional maturity is "the adolescent's capacity to stabilise emotions, which includes emotional development, independence, social adjustment, emotional stability, personality integration, etc." The feeling wherein one has attained an adult degree of emotional growth, or emotional maturity, entails emotional control in social situations (Shimsiya and Parambat, 2016).

Emotional maturity does not necessarily increase with chronological age; we don't become more emotionally mature as we get older. Some adults are very emotionally immature and some never mature. Since students are the foundation of the country and the future generations to come, their emotional maturity level remains very significant in how they behave. "Our social and mental landscapes are shaped by emotions. They see our lives as uneven, unstable, and vulnerable to reversal, much like the "geographic convulsions" that a traveller might spot in a region where only a flat plane was previously visible, Nussbaum (2001). The capacity to react properly to one's surroundings defines

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maturity. Most of the time, this reaction is learnt rather than instinctual. Knowing when to respond in accordance with the situation and the culture of the society in which one lives is another aspect of maturity (David Wechsler, 1950).

Emotional maturity not only serves as an efficient predictor of personality type, but it also aids in regulating an adolescent's developmental growth. A person who is able to restrain their emotions, slow the flow, and endure suffering without showing self-pity might nonetheless be emotionally rattled. As a result, the emotionally mature person will have greater happiness in life; he or she will be at peace with himself or herself and have a healthy balance between the two (Singh, 1977).

As a transition from childhood to maturity, adolescence is an important period of life during which significant changes occur. Biological, cognitive, social and emotional, moral and other changes are prominent. Therefore, they all have a hard time adjusting to the new surroundings of this scientific era. Since adolescents will be the adults of tomorrow, it is important to understand how emotionally mature they are. It is crucial for both our children and adults to have the proper emotional growth in order to manage their emotions appropriately. Since students are the foundation of the country and the future generation, emotional maturity is crucial to understanding how each individual behaves. This study is significant because it can inform parents, teachers, and administrators about the emotional development of their children.

MATERIALS AND METHODS

This study was conducted to determine the effect of residential area and gender on adolescent emotional maturity. The investigational sample was purposively drawn from the Bikaner city, Rajasthan state. A sample of 100 respondents, (equally taken both the gender from residential area categories i.e. Rural and urban area) adolescent students was selected. For the final sample, school/college students were approached according to their time availability and their willingness to be part of the study. They were explained the purpose of the study and asked to fill in the questionnaires. They were also assured that information they provided would be used purely for research purposes and would be kept confidential. Purposive sampling method was used for data collection and "Emotional Maturity" was assessed using Yashvir Singh's Emotional Maturity Scale (1977). The independent variables taken in the study were the personal variables of the respondents; gender and residential area while emotional maturity was taken as dependent variable.

Tool: Emotional maturity scale developed by Dr. Yashvir Singh and Dr. Mahesh Bhargava was used to collect the data. The scale consists of 48 items under five broad categories of emotional maturity.

1. Emotional stability- 10 item
2. Emotional progression- 10 item
3. Social adjustment- 10 item
4. Personality integration- 10 item
5. Independence- 8 item

RESULTS AND DISCUSSION

Table 1 depicts that highly Significant differences was found in one component i.e. personality Disintegration ($Z=6.36^{**}$, $p<0.01$) and non-significant differences existed in other components of emotional maturity as

Table 1: Emotional maturity as per residential area (N-100)

Residential area → Emotional maturity ↓	Rural (n=50) Mean ± SD	Urban (n=50) Mean ± SD	Z-value
Emotional un-stability	1.40±.49	1.48±.54	2.37^{NS}
Emotional regression	1.42±60	1.54±.57	0.00^{NS}
Social Maladjustment	1.42±.57	1.44±.54	0.06^{NS}
Personality Disintegration	1.24±.43	1.36±.52	6.36**
Lack of independence	1.46±.54	1.54±.54	0.01^{NS}
Total Emotional maturity	1.22±.41	1.46±.54	18.87**

**Significant at 0.01% level; NS= Non-significant difference

per residential area categories of Rural and urban. The mean scores of emotional maturity components Personality Disintegration (M=1.24) were low for rural respondents in comparison to urban respondents i.e. (M=1.36) reflecting urban areas' adolescents had comparatively better emotional maturity on above mentioned aspect.

Highly significant difference (Z=18.87**, p<0.01) was found in Total emotional maturity of rural and urban adolescents with mean score of rural and urban respondents (M=1.22; M=1.46) respectively. The results reflected that urban adolescent were more emotionally mature as compare to rural. Since the environment is important for nurturing individual development, the resources available to people vary greatly between rural and urban areas. Adolescent in rural areas are more geographically isolated from each other than adolescent in urban areas. This affects adolescent development, and affects emotional maturity both positively and negatively. Similarly, Pasodi (2014), noted that urban male athletes are more emotionally mature than rural male athletes. Rural athletes are moderately mature in their emotions. But in the study of Vyas and Gunthey (2017) determined that there was no significant difference between the urban and rural adolescents on emotional maturity. Whereas Trivedi (2017) reported significant difference exists between urban and rural adolescents Girls on Emotional maturity. Urban adolescents Girls have more Emotional maturity than rural adolescents Girls.

Table 2 portrayed that highly Significant differences were found in two component of emotional maturity i.e. social maladjustment & personality disintegration (Z=6.36**, p<0.00, Z=18.87**, p<0.00) respectively of male and female adolescents.

The mean scores of emotional maturity components i.e. Social Maladjustment, Personality Disintegration, (M=1.60; M=1.40; respectively) were high for male respondents in comparison to female respondents (M=1.26; M=1.20; respectively), reflecting male adolescents had comparatively better emotional maturity on above mentioned aspects than their counterparts. This may be explained by the fact that female adolescents, who are in the pubertal stage, experience a number of dramatic bodily changes that, combined with other stressors like scholastic pressures and social obligations, contribute to their psychological turmoil and ultimately produce emotional instability. As a result, female teenagers are more likely to have psychological issues and feel worried, irritated, and frustrated easily. In comparison with boys, girls also experience more control over the majority of their life. Their lack of independence has a negative impact on their social skills. Boys, meanwhile, are more autonomous, socially adept, and mature.

Similarly, Rawat and Singh (2014) found that boys in both Uttarkashi and U.S Nagar district of Uttarakhand were more emotionally stable, emotionally progressive, socially adaptable, had a consistent personality, and were more independent compared to girls. The emotional maturity scores of men and women were significantly different, according to Kumar and Soundararajan (2012). According to a study by Kumar (2014) that looked at the differences between boys and girls adolescent students. He asserted males exhibit independent behaviour earlier than females.

In the study of Wani and Masih (2015) on university students' emotional development, they discovered substantial gender and educational variations in emotional maturity. The study's conclusions showed

Table 2: Emotional maturity as per gender (N=100)

Gender → **Emotional maturity ↓**	**Male (n=50)** **Mean ± SD**	**Female (n=50)** **Mean ± SD**	**Z-value**
Emotional un-stability	1.50±.544	1.38±.490	3.51 NS
Emotional regression	1.52±.646	1.44±.541	2.63 NS
Social Maladjustment	1.60±.606	1.26±.443	13.75**
Personality Disintegration	1.40±.535	1.20±.404	16.57**
Lack of independence	1.46±.542	1.54±.542	0.01 NS
Total Emotional maturity	1.38±.530	1.30±.463	2.97 NS

** Significant at 0.01% level; NS= Non-significant difference

that the majority of the university's research scientists and graduate students are emotionally unstable. On the personality disintegration component of emotional maturity, the results indicated that male students are less emotionally mature than female students. On the other hand, recent literature of Ghosh (2022) showed that there was a significant differences between boys and girls on emotional maturity and boys were more emotionally mature than girls.

MAJOR FINDING

- This assessment unfolds that highly positive significant differences were found in personality disintegration component of emotional maturity as per residential area.
- Total emotional maturity of rural and urban adolescents also had highly significant difference. The urban areas' adolescents had comparatively better emotional maturity than rural area adolescent.
- Highly positive significant differences were found in two component social maladjustment & personality disintegration of emotional maturity of male and female adolescents.
- Male adolescents had comparatively better emotional maturity for social maladjustment & personality disintegration aspects than their counterparts.

CONCLUSION

The concept of emotional maturity is complicated and subject to various influences. Genetics, personality traits, life experiences, and environment are a few of these variables. As the results reflecting male adolescents from urban area had comparatively better emotional maturity on above mentioned aspects than their counterparts. Male adolescents are more emotionally mature then females due to their ability to control emotions and ignoring many situations of emotional outburst. They release their pent-up energy by engaging themselves in physical activities and in adventurous activities which helps them to build their self-esteem and confidence to control their emotions as well. Also the results from the study showed that urban areas' adolescents had comparatively better emotional maturity than rural area adolescent because urban adolescents may have more access to chances and resources that can aid in their development as emotionally mature individuals as compared to rural area adolescent.

REFERENCES

Kumar, S. 2014. Emotional Maturity of Adolescent Students in Relation to Their Family. *International Research Journal of Social Sciences*, 6-8.

Nussbaum, M. 2001. *The Fragility of Goodness: Luck and Ethics in Greek Tragedy and Philosophy* (2nd edn). Cambridge University Press. (David Wechsler 1950).

Pasodi, M.S. 2014. Emotional maturity among rural and urban athletes. *Editorial Board*, 3(3): 1.

Pastey, G.S. and V.A. Aminbhavi. 2006. Impact of emotional maturity on stress and self confidence of adolescents. *Journal of the Indian Academy of Applied Psychology*, 32(1): 66-70.

Rajakumar, R. and V. Soundararajan. 2012. Emotional maturity among adolescents. *International Journal of Innovative Psychology & Social Development*, 1(1): 1-6. https://ijip.in/wp-content/uploads/2020/03/18.01.065.20190704.pdf

Rawat, C. and R. Singh. 2017. The paradox of gender difference on emotional maturity of adolescents. *Journal of Human Ecology*, 58(3): 126-131.

Smritikana Ghosh. 2022. Emotional maturity among adolescents. *International Journal of Indian Psych/logy*, 7(4). https://doi.org/ 10.25215/0704.065

Trivedi, D.R. 2017. Emotional Maturity Among Adolescent Girls with Regards to type of family and Area of Residence. *Journal of Information, Knowledge and Research in Humanities and Social*, 4(2): 285-289.

Vyas, T. and R. Gunthey. 2017. Emotional maturity, self confidence and academic achievement of adolescents in relation to their gender and urban-rural background. *International Journal of Indian Psychology*, 4(4): doi:10.25215/0404.075

Wagde, A.D. and S.A. Ganaie. 2013. Study on emotional maturity and coping strategies among the students pursuing rehabilitation studies. *International Journal of Science and Research*, 2(8): 451-457.

Wani, M.A. and A. Masih. 2015. Emotional maturity across gender and level of education. *The International Journal of Indian Psychology*, 2(2): 63-72.

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Research Article

Quality Protein Maize (QPM): Impact Assessment in Ri-Bhoi District of Meghalaya

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ABSTRACT

Meghalaya being an agrarian state about 80 per cent of its population depends on agriculture for their livelihood. Maize, queen of cereals is the second most important food crop of Meghalaya after rice occupies about 18000 ha area (8% of total area) with an average yield of 2150 kg/ha. The area of maize has remained stagnant for the last five years and per unit productivity is lagging behind the national average (6105 kg/ha) of India. The constraints in achieving are cultivation of low yielding variety, local land races in acid soils with Al toxicity and non availability of improved variety of seed. In spite of several important nutritious use, maize has a drawback with two essential amino acids *viz.,* Lysine and Tryptophane which leads to poor net utilization and low biological value of traditional maize causing malnutrition. Quality Protein Maize (QPM) has been developed by incorporating *opaque 2* gene to overcome this problem which contains twice the quantity of essential amino acids. Thus, QPM cultivation provides an opportunity to the tribal farmers for producing nutritionally superior maize grains. Hence, KVK, Ri-Bhoi introduced and demonstrated QPM (Var.HQPM-1) in 6 villages covering 20.0 ha area in Ri-Bhoi district of Meghalaya during Kharif season of 2021-22 with an objective to increase the production, productivity of the district. The results of the demonstration revealed that an average QPM yield was enhanced by 28.90 per cent from 32.11 q/ha to 41.39 q/ha without application of any fertilizer. No incidence of disease and insect-pests attack was recorded at farmers' field. The enhancement of net return was Rs. 42153 /ha with a profitability ratio of 2.20 in demonstration plots. Higher production efficiency and economic efficiency were recorded in demonstration plot than the farmer's practice. The reduced feeding cost for pig and poultry was also observed at the tribal farmers' field. The horizontal spread was very fast in few pockets but non availability of quality seeds in remote areas hindrance further spread though it might help to raise income, food and nutritional security significantly for the tribal farmers.

Keywords: Quality protein maize, Tryptophane, Lysine, Amino acid and farmers' field

INTRODUCTION

Maize is an important food, feed as well as raw material for producing high quality protein and carbohydrate products. It has been recognized as one of the most important crops for food, feed and industrial purpose (TAAS, 2015) in most parts of the world. Maize is also the leading world cereal in both total yield (1,104.88 million metric tons) and yield in per unit area (FAS, 2019). Maize alone contributes over 20 per cent of the total calories in human diets in 21 countries and over 30 per cent in 12 countries that are home to a total of more than 310 million people (Aman *et al.*, 2016). However, maize is deficient in certain essential amino acids such as lysine and tryptophan (Abate, 2015). The effort to improve maize protein quality began in mid 1960s with the discovery of mutants that produce enhanced levels of lysine and tryptophan (Mpofu, 2012).

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International maize and wheat improvement centre (CIMMYT) discovered mutant maize with an opaque-2 gene, which codes for a double increase in levels of the two most limiting essential amino acid for growth and development of humans and animals (Tefera, 2020).

Maize being queen of cereals is the second most important food crop of Meghalaya after rice occupies about 18000 ha area with an average yield of 2150 kg/ha but per unit productivity of Maize in Meghalaya is lagging behind the national average of India. It is mainly cultivated in upland terraces during kharif season in the state and is an important feed ingredient for cattle, poultry and piggery feed. Maize is eaten after it is boiled in water, fried or burnt over fire. It sustains hunger for a longer period than Rice (Babu, 2019). In Meghalaya maize faces problems during reproductive stage, if stress affects in the form of drought, water logging etc. Poor drainage during *kharif* seasons leads to poor economic yield. Among the cereals for changing climate, maize is the best option but still to prepare it as a future crop with appropriate agronomic interventions. Good quality seed, timely planting, proper drainage, optimum cropping geometry, balanced fertilization, crop establishment techniques, weed management and proper crop rotation is the key for obtaining higher maize yield in Meghalaya (Babu, 2019). Thus QPM cultivation provides an opportunity to the tribal farmers for producing nutritionally superior maize grains.

In Ri-Bhoi district of Meghalaya maize occupies an area of 1520 ha and production of 3430 metric tonnes with productivity of 2257 kg/ha (Directorate of Agriculture, 2011-12). Farmers are still practicing the local maize varieties which are having lower yield potential in the district. As a result the income of farmers engaged in maize cultivation greatly reduced. Hence, KVK, Ri-Bhoi has initiated demonstrations of QPM variety HQM-1 during the year 2021-22 with the objectives of showing the production potential of the newly improved technology which will provide an opportunity to the tribal farmers for producing nutritionally superior maize grains. Keeping the above points in view, the present study was undertaken in six villages covering 20.0 ha area to find out the effects of FLDs on bridging the yield gap in terms of technology gap, extension gap and technology index.

MATERIALS AND METHODS

Ri-Bhoi district of Meghalaya lies between 25° 40' N to 25° 21' N longitude and 90° 55' E to 91°16' E latitude with and elevation of 100 m to 1350 m above sea level. The district has loamy to fine loamy soil and receives an average annual rainfall of 1636.46 mm. The maximum rainfall is in the month of June and July. The total annual rainfall received during 2021-22 was 2968.4 mm that included the entire monsoon season beginning from June to September. The average annual maximum and minimum temperature is 21.0°C and 13.0°C, respectively. Since most of the farmers are small, marginal or landless agricultural labourers (18.8%) and cultivators (52.4%) among total workers in the district.

Before conducting the FLD's, meetings with farmers, surveys were undertaken for selection of farmers and thereafter an orientation cum awareness programme were imparted to the beneficiaries related to crop under demonstration. Quality seeds of the variety were distributed to the selected farmers under FLDs and the crop was sown during the 2nd week of April 2021-22. The recommended doses of organic manures were applied in furrows during the sowing operations. During the programme from sowing to harvesting, frequent monitoring and follow up visits were carried out to inspect the adopted package of practices, timely weeding, effective plant protection measures in both the practices (Table 1). The average yield of each FLD and farmers practice, cost of cultivation, gross return, net return and B:C ratio was recorded for interpretation of the results. The extension gap, technology gap and technology index were calculated using the following formula:

$$\text{Extension Gap} = \text{Demonstration Yield} - \text{Yield under farmers practice}$$

$$\text{Technology Gap} = \text{Potential Yield} - \text{Demonstration Yield}$$

$$\text{Technology index} = \frac{\text{Potential Yield} - \text{Demonstration Yield}}{\text{Potential Yield}} \times 100$$

$$\%\ \text{increase over farmer's practice} = \frac{\text{Improved practice} - \text{Farmers practice}}{\text{Farmers practice}} \times 100$$

RESULTS AND DISCUSSION

During the FLDs, the problems faced by the farmers in quality maize production were documented and the perusal of data is presented (Table 2). The major

Table 1: Particulars of demonstration package and farmer's practice of QPM Var. HQPM-1

Particulars	Demonstration package	Farmers practice
Variety	HQPM-1	Local variety
Seed rate	20 kg	10-20 kg
Sowing method	Line Sowing (60 cm x 20 cm)	Broadcasting
Sowing Time	June-July	June-July
Fertiliser Dose	5 t/ha FYM,150 kg rock phosphate with lime @ 500 kg applied in furrows	FYM
Weeding/Earthing up	1st at 25-30 DAS, 2nd at 60 DAS.	No weeding, one earthing up operation
Insect pest management	Granular application of Carbofuran 3% CG @ 33.3 kg/ha in whorls of infested plants to control stem borer, shoot fly and thrips	No specific management practices followed

Table 2: List of production constraints and their rank given by farmers

Major constraints	Percentage	Rank
Lack of high yielding varieties	88.23	I
Timely availability of quality seeds	80.51	II
Low technical knowledge	70.87	III
Higher seed rate	63.68	IV
Farm mechanization	68.66	V
Fragmentation of land size	53.34	VI
Disease and insect pests	42.86	VII

problems faced by the farmers are lack of high yielding varieties (88.23), timely availability of quality seeds (80.51), low technical knowledge (70.87), use of high seed rate (63.68), farm mechanization (53.34), fragmentation of land size (42.86), disease and insect pests (30.45) etc. Singh (2017) also conducted a frontline demonstration on wheat in Rudraprayag District of Uttarakhand and reported almost similar production constraints. Dhruw *et al.* (2012) has also reported similar constraints in maize.

Results indicated that the growth characters as well as the yield of HQPM-1 variety was substantially higher than the variety grown by the farmers during the cropping period. The average pooled data on growth and yield attributes recorded, viz., Plant height, number of cobs per plant, cob length, cob girth, number of grains per cob and 1000 grain weight were found to be higher in improved practice and presented in Table 3. Grain yield of Qpm variety in demonstration plots ranged from 39.53 q/ha to 43.19 q/ha and 30.15q/ha to 33.45 q/ha under demonstration and farmers practice respectively. Average grain yield was recorded 41.39 q/ha (demonstration) and 32.11 q/ha (farmers practice) and which was recorded 28.90 per cent higher yield in demonstration plot than farmers practices (Table 4). The results clearly indicated that the yield of qpm was significantly higher over the yield obtained under local variety with farmer's practices. These results confirm with Sarmah *et al.* (2014); Ahmed *et al.* (2017). Singh (2018) reported that the grain yield of Soybean in FLDs was increased by 30.96 per cent over Farmers practice. The poor productivity in farmers practice might be mainly due to factors like use of non descript local variety and low level of agronomic management in addition to non availability of resources in time. The result clearly depicts the positive effects of FLDs over the existing practices towards enhancing the yield of Qpm in the District.

The technology gap ranged from 8.81q/ha to 11.31 q/ha and average recorded was found to be 10.05 q/ha during the demonstration. The variation in technology gap observed might be due to dissimilarity in soil fertility and management factors. However, low technology gap also reflects farmers cooperation in carrying out such demonstrations. The extension gap was ranged from 8.41 q/ha to 12.57 q/ha with average extension gap of 9.95 q/ha, which suggests that there is a definite advantage of cultivating Qpm in that farming situation and also it emphasizes the need to educate the farmer through various means for adoption of improved agricultural production to reverse the trend of wide extension gap. Technology Index calculated varied from 16.94 per cent to 21.08 per cent with average technology index of 19.22 per cent respectively. The lower value of technology index, more is the feasibility of technology (Kumar *et al.*, 2014).

Table 3: Impact of improved variety and farmers practice on growth and yield attributes of quality protein maize

Parameters	Village											
	Umeit		Umsariang		Umsaitphrah		Kyrdem		Khweng		Thadnongiaw	
Variety	Hqpm-1	Local	Hqpm-1	Local	Hqpm-1	Local	Hqpm-1	Local	Hqpm-1	Local	Hqpm-1	Local
Plant Height(cm)	177.3	194.4	175.3	183.2	174.3	173.7	163.5	175.2	174.9	182.2	174.2	183.1
No of cobs/Plant	1-2	1	1-2	1	1-2	1	1-2	1	1-2	1	1-2	1
Cob length (cm)	19.7	13.8	17.8	12.4	19.3	12.6	18.6	12.8	18.7	14.3	18.9	14.5
Cob Girth (cm)	13.2	11.7	12.0	11.0	12.8	11.4	12.5	11.2	12.8	11.9	10.3	11.6
No. of Grains/Cob	687	394	615	381	665	389	631	390	651	408	389	400
Grain wt (g)	100	95	100	90	100	95	95	90	100	90	95	95

Table 4: Productivity, technology gap, extension gap and technology index in QPM

Village	No of farmer	Area (ha)	Demo Yield (q/ha)	Farmers Yield (q/ha)	% increase over farmers practice	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
Umeit	35	5.0	42.70	33.45	28.65	9.30	10.25	17.88
Umsariang	30	4.0	43.19	30.62	41.05	8.81	12.57	16.94
Umsaitphrah	36	5.0	42.13	32.53	29.51	9.87	9.6	18.98
Kyrdem	25	4.0	40.53	33.12	22.37	10.23	8.41	19.67
Khweng	37	4.0	40.26	30.15	33.53	10.81	10.11	20.78
Thadnongiaw	43	5.5	39.53	32.83	23.45	11.31	8.80	21.08
Total	206	27.5	248.34	-	-	-	-	-
Mean			41.39	32.11	29.76	10.05	9.95	19.22

Table 5: Economics and efficiency of demonstrated plot and farmers practices

Village	Net return (Rs/ha)		B:C ratio		Production efficiency (kg/ha/day)		Economic efficiency (Rs/ha/day)	
	Demo Plot	Farmers Practice	Demo Plot	Farmers Practice	Demo Plot	Farmers Practice	Demo Plot	Farmers Practice
Umeit	43995	28782	2.25	1.86	35.58	27.87	366.62	239.85
Umsariang	44721	23757	2.28	1.73	35.99	25.51	372.67	197.97
Umsaitphrah	42950	27285	2.21	1.82	35.10	27.10	357.91	227.37
Kyrdem	40800	28382	2.18	1.85	33.77	27.60	340.00	236.51
Khweng	39631	23227	2.13	1.71	33.55	25.12	330.25	193.55
Thadnongiaw	40823	27635	2.19	1.83	32.94	27.35	340.19	230.29
Mean	42153	26511	2.20	1.80	34.48	26.75	351.27	220.92

Fluctuation in technology index might be attributed to uneven rainfall distribution, long dry spell, increasing pressure of diseases and insect pests attack in the crop. Technology index indicates the feasibility of generated farm technologies in the farmers field under existing agro-climatic conditions as stated by Singh (2018) and Rawat *et al.* (2019).

Mean net return and benefit cost ratio were recorded Rs. 42153 /ha, 2.20 and Rs. 26511/ha, 1.80 in the demonstration plots and farmer's practices respectively (Table 5) Hence, higher B:C ratios proved the economic viability of the interventions made under FLD. Ahmed *et al.* (2017) and Singh (2018) also reported higher net returns and B:C ratio in the FLDs

on improved technologies compared to the farmers practices. Similarly higher net returns and B:C ratio in FLDs on improved technologies compared to farmers practice are reported by Joshi *et al.* (2014) in wheat.

Production efficiency and were found to be 32.94 -35.99 kg/ha/day with mean of 34.48 kg/ha/day in demonstrated plot and 25.12- 27.87 kg/ha/day, with mean of 26.75 kg/ha/day in farmers practices whereas economic efficiency of 330.25-372.67 kg/ha/day with mean of 351.27 kg/ha/day in demonstrated plot and 193.55-239.85 kg/ha/day with mean of 220.92 kg/ha/day was recorded in farmers practices respectively (Table 5). Therefore, to exploit the potential of improved production and protection technologies efforts through FLDs ought to be increased awareness among the farmers. This result was in conformity with the findings of Kumar *et al.* (2020).

CONCLUSION

Growing improved varieties in place of local varieties alone can result in incremental yield benefit of around 25–30 per cent. With introduction of QPM the farmers have saved almost 50 per cent of feed cost for their pigs and poultry birds and farmers were highly motivated with the crop performance. The productivity gain under FLD over farmer's practices created awareness among other farmers to adopt such maize variety in the district. For enhancing the production among the masses for food and nutritional security, KVK, Ri-Bhoi has been constantly working with the farming communities for economic upliftment. From the above mentioned study it can be concluded that there is immense potentiality of quality protein maize in the region therefore its popularization in the broader range is essential for the population to help in promoting the consumption of quality protein maize.

REFERENCES

Abate, T.; B. Shiferaw; A. Menkir; D. Wegary; Y. Kebede; K. Tesfaye and T. Keno. 2015. Factors that transformed maize productivity in Ethiopia. *Food Security*, 7: 965-981.

Ahmed, P.; R.K. Nath; A.C. Sarmah and P.C. Deka. 2017. Yield Gap Analysis of *Toria* (*Brassica campestris*) in Tinsukia District of Assam. *Indian Research Journal of Extension Education,* 17(3): 44-46.

Aman, J.; K. Bantte; S. Alamerew and B. Tolera. 2016. Evaluation of Quality Protein Maize hybrids at Jimma, Western Ethiopia. *Journal of Forensic Anthropology,* 1: 2-6.

Babu, S.; K.P. Mahapatra; J. Layek and D.M. Firake. 2019. Maize Production technology in Meghalaya. Technical bulletin, Umiam, doi: 10.13140/RG.2.2.17511.91047

Dhruw, K.S.; R.S. Sengar and K.N. Yadav. 2012. Level of knowledge and adoption about recommended maize production technology. *Agricultural Update,* 7(3&4): 311-315.

Joshi, N.S.; M.K. Bariya and B.B. Kunjadia. 2014. Yield gap analysis through demonstration in wheat crop. *International Journal of Scientific Research Publication,* 4(9): 1-3.

Kumar, M.; K.L. Meena and D.J. Rajkhowa. 2020. Impact assessment on frontline demonstration for popularization of *toria* in Longleng District of Nagaland. *Journal of Agriculture Search*, 7(2): 104-106.

Mpofu, I. D.T.; S. Sibanda; A. Shonihwa and K. Pixley. 2012. The nutritional value of quality protein maize for weaner pigs. *Journal of Petroleum & Environmental Biotechnology*, 3: 129.

Rawat, L.; S. Prasad; T.S. Bisht; D.C. Naithani and A. Tiwari. 2019. An impact assessment of front line demonstrations on yield and economics of finger millet and barnyard millet under rainfed conditions of Uttarakhand. *Indian Journal of Pure & Applied Biosciences,* 7(2): 408-414. doi: http://dx.doi.org/10.18782/2320-7051.7459.

Sarmah, H.; R. Sarma; A.K. Sarmah; G.K. Upamanya and N. Kalita. 2014. Yield gap analysis of *Toria* (*Brassica campestris*) in Barpeta district of Assam. *Indian Research Journal of Extension Education,* 14(2): 127-129.

Singh, S.B. 2017. Impact of frontline demonstrations on yield of wheat (*Triticum aestivum*) under rain fed condition in Uttarakhand. *International Journal of Environmental Science and Technology,* 6(1): 779-786.

Singh, S.B. 2018. Impact of frontline demonstrations on yield of soybean (*Glycine max* L. Merril) under rainfed conditions in Uttarakhand, India. *International Journal of Current Microbiology Applied Science*, 7(5): 986-992.

TAAS (Trust for Advancement of Agricultural Sciences). 2015. Up scaling Quality Protein Maize for Nutritional Security Indian Agricultural Research Institute, Pusa Campus, New Delhi-110 012, India.

Tefera. Abenezer, 2020. A review on quality protein maize.11(2):1-6. https:// www.interesjournals. org/ basic-clinical-studies.html. DOI: http:/dx.doi.org/ 10.14303/irjps.2020.0011.

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Research Article

Status and Prospects of the Farmers Towards Different Methods of Paddy Cultivation in Punjab

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ABSTRACT

The study was conducted in five agro-climatic zones of Punjab. From each zone one district was chosen at random (Faridkot, Bathinda, Ludhiana, Hoshiarpur and Rupnagar) for constituted a sample of 150 respondents to study about status and prospects of farmers regarding different methods of paddy cultivation. From the study it was revealed that 26 per cent of the respondents got information regarding mechanical transplanting from their friends or society. In case of direct seeded rice, respondents got first information regarding this technology from state dept. of agriculture (30.00%). Seventy-eight per cent of the respondents had their own drill of direct seeding (in group as well as individual). It was found that conventional transplanting was practiced before 2017. Fifty per cent of the respondents adopted mechanical transplanting in 2021. In direct seeded rice, 40.00 per cent of respondents practiced on 383 acres area in 2021. Sixty-four per cent respondents wanted to continue mechanical transplanting on constant area followed by conventional transplanting (62.00%) and direct seeded rice (50.00%). Moreover, 24.00 per cent of the respondents did not want to continue use of conventional transplanting.

Keywords: Status, Prospects, Paddy cultivation technologies and Covid-19

INTRODUCTION

Punjab and Haryana are the two leading states among all the states in India regarding agricultural production with the expected yield concerning to certain crops such as rice (Kaur and Vikram, 2013). Paddy (*Oryza sativa* L.) is consumed as a staple food by more than 50 per cent and 90 per cent population of the world and South Asia, respectively. Chauhan and Johnson (2011) reported that more than half of the human race depends on paddy as it was the daily sustenance. It was grown in areas from 16° to 28° N latitude and 79° to 90° E longitude in India (Pathak *et al.,* 2018). It is a *kharif* season crop that requires above 25°C high temperature and high humidity (Anonymous, 2021). It also provides 50-60 per cent calories and 40-45 per cent protein intake in India (Das *et al.,* 2013). After China, India is the second largest producer of paddy and also the largest exporter in the world. About 34 per cent rice food stocks of Haryana and Punjab was procured by the Food Corporation of India and other agencies (Anonymous, 2020). From the green revolution, production increased from 53.3 million tons to 120 million tons in 2020-2021. In Punjab, it occupied 31.42 lakh hectares and production of 126.75 lakh tonnes (Anonymous, 2021). Punjab shares 25.75 per cent of the central pool for paddy during 2019-20 (Anonymous, 2021a).

In paddy, cultivation was done mainly in the field by transplanting 20-25 days old seedlings in a traditional way called conventional puddle transplanted rice. The lockdown in the north-western regions of Haryana and Punjab has caused a massive reverse migration, with estimates that almost 1 million labourers had returned to their home states (Chaba and Damodara,

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2020). It was causing a labour shortage that was pervasive across all economic sectors (Gupta, 2020; Mukhra *et al.,* 2020). Kaur and Singh (2017) reported that rice could be grown using mechanical transplanting (MTR), dry direct seeding (D-DSR), or wet direct seeding (WDSR), depending on the establishment procedures. A paradigm shifts from manual paddy transplanting to mechanical paddy transplanting has been noted, primarily as a result of increased farm power availability, a decrease in the need for human labour, the import of a mechanical rice transplanter, and ongoing government support through various programmes. Many Southeast Asian nations have switched to cultivating Direct Seeded Rice (DSR) in recent years (Pandey and Velasco, 2005). Techniques have changed as a result of labour costs and water shortages. By avoiding nursery raising, seedling uprooting, puddling, and transferring, direct seeding (both wet and dry) decreases the labour demand (Kumar and Ladha, 2011).

Direct-seeding rice production (DSR) may be the best option for a rice production system that is water efficient (Pathak *et al.,* 2011). It is crucial to assess the technical proficiency of paddy farmers in Punjab during the COVID-19 pandemic and provide strategies that can improve their technical proficiency over the long term, not just during the pandemic (Singhania and Saini, 2020). The economic impact of COVID-19 lockdown on agriculture in the *kharif* season might be minimized, if the less labor-intensive techniques of rice cultivation and crop diversification adapt to meet future goals and paddy sowing and transplanting equipment is easily accessible. No technology or method is useful unless it offers farmers certain advantages and helps them practice cost- and environmentally-conscious farming. Therefore, identifying which method (conventional transplanting, mechanical transplanting and direct seeded rice) to use is crucial and considered best by famers.

MATERIALS AND METHODS

The study was conducted in five agro-climatic zones of Punjab viz. western zone, western plain zone, central plain zone, undulating plain zone, and sub-mountain undulating zone. One district from each zone was selected randomly (Faridkot, Bathinda, Ludhiana, Hoshiarpur and Rupnagar). So, total five districts were selected for the study. A list of respondents who were using direct seeded rice, mechanical transplanting and conventional transplanting technologies during Covid-19 for sowing of paddy crop was obtained from the chief agriculture office/ Krishi Vigyan Kendras of each district. From each district 10 farmers from the selected method of paddy cultivation during Covid-19 were selected. Thus, 30 respondents from each district constituted a sample of 150 respondents for the study. The status of paddy cultivation technologies for present investigation was studied in terms of percentage of farmers who were using paddy cultivation technologies, area under these technologies or amount paid as rent for using these technologies, etc. Prospects were studied in terms of the adoption of different cultivation methods of paddy cultivation in the coming period of time. It referred in terms of farmers willingness to maintain the area constant or make shift towards other methods of paddy cultivation in the coming years and it was studied on a dichotomous response in the form of yes or no.

RESULTS AND DISCUSSION

The status of paddy cultivation technologies during Covid-19 for the present investigation was studied in terms of first source of information, mode of acquiring of paddy cultivation machinery, area under different methods of paddy cultivation by the respondents in adoption of different methods of paddy cultivation during Covid-19.

Source of information is a one of the important components of diffusion process as innovation is first exposed to the social system through different communication channels. The data regarding different sources from where the respondents got first information about different paddy cultivation during Covid-19 were presented in the Table 1. The data in the table denoted that 26.00 per cent of the respondents got information regarding mechanical transplanting from their friends or society.

Same number of the respondents (22.00%) who got information about mechanical transplanting from KVKs, social media and department of agriculture. In case of direct seeded rice, respondents got first information regarding this technology from state dept. of agriculture (30.00%) followed by 24.00 per cent

Table 1: Distribution of respondents according to their first sources of information about paddy cultivation technologies during Covid-19 (n=150)

Paddy Cultivation Technologies	PAU Scientists	KVK Scientists	State Dept. of Agriculture and Farmers Welfare	Social Media	Relatives/ society/ Friends
Mechanical Transplanting (n=50)	4 (8.00)	11 (22.00)	11(22.00)	11 (22.00)	13(26.00)
Direct Seeded Rice (n=50)	9 (18.00)	12 (24.00)	15 (30.00)	5 (10.00)	10 (20.00)

Figures in parenthesis represent percentage

and 20.00 per cent from KVKs and relatives or society, respectively. Only 18 per cent of respondents getting first information from PAU scientists and 10.00 per cent of respondents from social media. The results are in agreement to those reported by Kaur (2015).

Different paddy cultivation technologies were adopted in different years. So, the data in the Table 2 revealed that conventional transplanting was practiced before 2017. Before 2017, four per cent of the respondents started direct seeded rice technology on nine acres of land. No respondent had starting mechanical transplanting before 2017.

Use of mechanical transplanting of paddy was first started by two per cent of the sampled respondents in 2017 on 10 acres. Upto 2019, number of adopters were very less because mechanical transplanting technology was still not popular among respondents. But due to Covid-19, labour was not available and getting high cost of labour results shows bright future of this technology as 40.00 per cent and 50.00 per cent of the respondents adopted mechanical transplanting in 2020 and 2021 respectively. In direct seeded rice, thirty per cent of respondents adopted in 2020 on 90 acres land and 40.00 per cent on 383 acres area in 2021. This was mainly due to the governmental initiatives to promote direct seeded rice in recent years.

Table 2: Distribution of respondent's according to year of adoption and area under different paddy cultivation technologies (n=100)

Technology→	Adoption		Area (Acres)	
Year↓	DSR (n=50)	MT (n=50)	DSR	MT
Before 2017	2 (4.00)	-	9	-
2017	3 (6.00)	1 (2.00)	21	10
2018	4 (8.00)	2 (4.00)	23	32
2019	6 (12.00)	2 (4.00)	32	35
2020	15 (30.00)	20 (40.00)	90	296
2021	20 (40.00)	25 (50.00)	123.5	383

Figures in parenthesis represent percentage

The data in the Table 3 showed the area covered under different paddy cultivation technologies in terms of the total area in acres and proportional area to the operational land holding under each paddy cultivation technologies.

Table 3: Average area under different paddy cultivation technologies during Covid-19 (n=150)

Categories	DSR (n=50)	MT (n=50)	CT (n=50)
Total area (acres)			
<5	9 (18)	-	5(10)
5 to 10	37(74)	17(34)	35(70)
> 10	4(8)	33(66)	10(20)
Average area (acres)	6.35	15.47	8.57
Proportional to operational landholding			
5-36%	4(8)	-	-
37-68%	30 (60)	12 (24)	1 (2)
69-100%	16 (32)	38 (76)	49 (98)
Average area (%)	65.50	88.80	93.78

Figures in parenthesis represents percentage

In case of direct seeded rice about third fourth (74.00%) of the respondents practiced direct seeding on five to ten acres of their farm and 18.00 per cent of the respondents grown paddy by direct seeding on less than five acres of land. Only eight per cent of the respondents sowing paddy by direct seeding on more than 10 acres of their land. The average area under direct seeded rice crop was 6.35 acre. On an average respondent practiced direct seeded rice on 65.50 per cent area of total operational land. Regarding mechanical transplanting two third (66.00%) of the respondents were using mechanical transplanting on

more than 10 acres of land and on an average respondents grow paddy through mechanical transplanting on 15.47 acres of their land. The reason behind it was that majority of the respondents were having large (>10 acres) land holdings. On the basis of proportional area to operational land holding, 76.00 per cent of the respondents were using mechanical transplanting on more than 68.00 per cent of their land. On an average, respondents used mechanical transplanting on 88.80 per cent of their total operational land holding. These results showed that the extent of adoption of mechanical transplanting was high in terms of area. Further, 70.00 per cent of the respondents using conventional transplanting in their fields between 5-10 acres of land. Conventional transplanting was used on an average of eight and half acre of land. Almost all respondents used conventional transplanting on more than 68.00 per cent of their total land. On an average 93.78 per cent of the land was covered under conventional transplanting. There are various modes to use farm machineries i.e., own, on custom hiring basis, etc. For the present study it also reflects the status of paddy cultivation technologies.

From the data placed in the Table 4 observed that 78.00 per cent of the respondents had their own drill of direct seeding (in group as well as individual). While ten per cent of the respondents operated drill on custom hiring basis. Regarding mechanical transplanting, about half of the respondents i.e., 36.00 per cent and eight per cent had their own paddy transplanter (in group as well as individual, respectively). Twenty eight per cent of respondents used paddy transplanter in their field on rent basis (custom hiring). Only 20 per cent of the respondents were demonstrated by KVKs and PAU.

The data in the Table 5 showed that on an average, per acre rent of paddy seed drill was Rs. 700.

The data in the Table 5 further depicted that the average rent of paddy transplanter was Rs. 1350 per acre. Thirty-six respondents bought paddy seed drill on an average of 45000 Rs per unit individually and four respondents get from Rs. 40000 in group.

Prospects for each paddy cultivation technology were presented separately and results were given from Table 6 to 8.

Table 4: Distribution of the respondents according to mode of acquiring of different paddy cultivation machineries during Covid-19 (n=150)

Mode of acquiring	Paddy Seed drill		Mechanical Transplanting	
	Frequency	Percentage	Frequency	Percentage
KVKs, PAU (For demonstration)	6	12.00	7	14.00
Owned (In Group)	4	8.00	4	8.00
Owned (Individual)	36	72.00	25	50.00
Custom hiring	4	8.00	14	28.00

Table 5: Average expenditure incurred by respondents on different machineries used for paddy cultivation during Covid-19 (n=150)

Paddy Cultivation Technologies	Mode of Acquiring	Aspects	n	Price(Rs. /unit)
Paddy Seed Drill (n=50)	Owned	In Group	4	40000
		Individually	36	45000
	On Rent	Per acre	10	700
Mechanical Transplanter (n=50)	Owned	In Group	4	375000
			4	150000
		Individually	2	500000
			3	375000
			16	175000
	On Rent	Per acre	21	1350

Table 6: Distribution of respondents on the basis of their prospects of direct seeded rice (n=50)

Prospects	f	%	Area	Percent Change (area)	Reasons	f*	%
Discontinue	9	18.00	51	NA	Yield loss	7	77.70
					More Weed infestation	7	77.70
					Poor germination	6	66.66
Increase	16	32.00	72	18.70	Incentive of Rs. 1500/acre by govt. for adoption of DSR	16	100.00
					Less labour cost	14	87.5
					Water saving	7	25.00
Constant	25	50.00	186	_	Already on maximum area	12	48.00
					Satisfied with current adoption	7	28.00
					Not dependent on labour	21	84.00

*Multiple Responses; NA= Not Applicable; Percent change from 2020; 2021 to 2022

The data presented in the Table 6 showed that half of the respondents (50.00%) were willing to continue direct seeded rice in coming years on the same acres of land as last year. A major reason behind it was that respondents grow direct seeded rice were not dependent on labour and satisfied with current adoption. A close look at data further revealed that less than one fourth (18.00%) of the respondents did not want to continue the direct seeded rice practice in the coming years.

The major reasons were more weed infestation (77.70 %). More than one fourth of the respondents (32.00%) wanted to increase our area under direct seeded rice crop. The major reasons behind this prospect were due to incentives of Rs. 1500/acre by govt. for adopting of direct seeded rice and less cost of production. These findings are in line with Kaur (2015) which reported that majority of the respondents were keep their area constant.

A glance at the data in the Table 7 indicated that more than half of the respondents (64.00%) wanted to continue mechanical transplanting on constant area due to the reasons that its adoption was already on their all holding (80.00%) and almost half (46.80%) of respondents feel that there is less dependent on manual labour in mechanical transplanting.

Table 7: Distribution of respondents on the basis of their prospects of mechanical transplanting (n=50)

Prospects	f	%	Area	Percent Change (area)	Reasons	f*	%
Discontinue	4	8.00	38	NA	Less knowledge of growing nursery (time consuming)	2	50.00
					Seedlings left in the paddy transplanter	2	50.00
					High Rent	3	75.00
Increase	9	18.00	48	6.34	Easy intercultural operations	3	33.30
					More yield	7	77.80
Decrease	5	10.00	47	6.21	More cost of production	3	60.00
					Shifted to DSR	2	40.00
					Shifted to other crops	3	60.00
Constant	32	64.00	626	--	Already on maximum area	25	80.65
					Satisfied with current adoption	12	37.50
					Less dependent on manual labour	15	46.80

*Multiple Responses; NA= Not Applicable; Percent change from 2020; 2021 to 2022

Table 8: Distribution of respondents on the basis of their prospects of conventional transplanting (n=50)

Prospects	f	%	Area	Percent Change (area)	Reasons	f*	%
Discontinue	12	24.00	80	NA	Incentive of Rs. 1500/acre by govt. for adoption of DSR	9	75.00
					Less yield	6	50.00
					High labour cost due to less availability	12	100.00
Decrease	7	14.00	26	6.05	Less labour availability	5	71.40
					Shifted to DSR	7	100.00
Constant	31	62.00	311.5	_	Already on maximum area	22	70.90
					Satisfied with current adoption	9	30.10
					Easy to handle all operations	12	38.70
					Don't want to take risk	28	90.30

*Multiple Responses; NA= Not Applicable; Percent change from 2020; 2021 to 2022

Only eight per cent of the respondents did not want to continue use of mechanical transplanting due to the less knowledge of growing nursery and seedlings left in the paddy transplanter. On the other hand, 18.00 per cent of the respondents were willing to increase our area in mechanical transplanting of paddy on about six per cent more area in coming year due to less labour requirement and high yield under mechanical transplanting. These findings are in line with Vatta *et al.* (2020) which revealed that the majority of farmers (31.70%) choose to use machinery when planting paddy. Ten per cent of the respondents reported that they will decrease about six per cent area due to more cost of production and shifted to other crops. Slightly less than two-third of respondents wants to constant our area in mechanical transplanting in future because of satisfied with current adoption and already on maximum area.

The Data in the Table 8 revealed the prospects regarding conventional transplanting technology among the respondents.

From the data, it can be observed that majority of the framers (62.00%) wanted to continue adoption of conventional transplanting on constant land due to the reason that maximum area was already covered under conventional transplanting. From that 30 per cent of respondents satisfied with current adoption and about 90 per cent of respondents don't want to take risk while constant our area. Moreover 24.00 per cent of the respondents did not want to continue use of conventional transplanting due to incentives of Rs. 1500/acre by govt for adopting DSR. Half of the respondents get less yield while discontinue. It can be concluded from the above finding that 14.00 per cent respondent reported that they will keep continue to adopt conventional transplanting in future but on six and half per cent less area because of more cost goes to crop production due to less availability of labour and shifted to DSR.

CONCLUSION

This study concluded that as farmers are more willing to adopt modern techniques such as (Direct seeded rice, mechanical transplanting), appropriate subsidies should be given to farmers and more number of the demonstrations cum training regarding use of these techniques needs to be organized.

REFFERENCES

Anonymous. 2021. *Package and practices for Kharif* crops. Punjab Agricultural University, Ludhiana, India: 3-5.

Anonymous. 2021a. *Handbook of agriculture*. Punjab Agricultural University, Ludhiana.

Chaba, A.A. and H. Damodara. 2020. *The Covid nudge: labour shortage makes Punjab and Haryana farmers switch from paddy to cotton*. The Indian Express (Retrieved from https://indianexpress.com/article/india/Covid-19-punjab-haryana-farmers-paddy-cotton6385600/. on 27-8-2021).

Chauhan, B.S. and D.E. Johnson. 2011. Row spacing and weed control timing affect yield of aerobic rice. *Field Crops Research,* 121: 226-331.

Das, M.; P. Rohit; G. Maheswarudu; B. Dash and P.V. Ramana. 2013. An overview of dry fish landings and trade at Visakhapatnam Fishing Harbour, Regional Centre of CMFRI. *Visakhapatnam Marine Fish Information of Sericulture,* 125: 3–7.

Kaur, J. and A. Singh. 2017. Direct seeded rice: Prospects, problems/constraints and researchable issues in India. *Current Agriculture Research,* 5(1): 13-32.

Kaur, K. 2015. *Problems and prospects of direct-seeded rice in Punjab*. M.Sc. Thesis, Punjab Agricultural University, Ludhiana, India.

Kaur, S. and A. Vikram. 2013. Economic impact of trade openness and exchange rate regimes: evidence from developing Asia. *International Journal of Business Emerging and Marketing,* 5(4): 341-370.

Kumar, V. and J.K. Ladha. 2011. Direct seeding of rice: recent developments and future research needs. *Advances in Agronomy,* 111: 297.

Mukhra, R.; K. Krishan and T. Kanchan. 2020. COVID-19 sets off mass migration in India. *Archieves Medical Research,* 51(7): 736-8.

Pandey, S. and L. Velasco. 2005. Trends in crop establishment methods in Asia and research issues International Rice Research Institute, Los Banos, Philippines Japan. *International Research Centre of Agricultural Science,* 10: 178-181.

Pathak, H.; A.N. Tewari; S. Sankhyan; D.S. Dubey; U. Mina; V.K. Singh and N. Jain. 2011. Direct-seeded rice: potential, performance and problems-A review. *Current Advances in Agriculture Sciences,* 3: 77–88.

Singhania, M. and N. Saini. 2020. Revisiting environmental degradation and economic growth nexus using autoregressive distributed lag approach. *International Journal of Productivity and Performance Management,* 69(8): 1765-1796.

Vatta, K.; S. Bhogal; A.C. Petrie; S.A. Greens and S. Dixit. 2020. *Impact of COVID-19- Lockdown on Punjab Agriculture*. Centre for Development Economics and Innovation Studies (CDEIS). Punjabi University, Patiala.

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Research Article

Training and Pruning Techniques for Desired Growth in Vegetables

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ABSTRACT

Protected cultivation technology is a technique in which plant microclimate is partially or fully controlled artificially as per the requirement of specific crops to improve the yield potential of crop. Pruning can encourage faster growth of new shoots, which has the potential to bloom. Training and Pruning technique deserve attention in yield and quality enhancement of vegetable crops. Study indicates that majority of respondents (94.74 and 76.92%) in capsicum and cucumber crop followed training and pruning at recommended time. Majority of respondents (68.75%) in tomato crop and more than five per cent respondents in capsicum did training and pruning after recommended time. Data further showed that 51.28 per cent of respondents in cucumber crop and 15.78 per cent of respondents in capsicum crop followed training and pruning with more than recommended branches. While, 33.34 per cent of respondents in cucumber followed training and pruning at recommended number of branches and only 15.38 per cent of respondents followed training and pruning less than recommended number of branches. Data further revealed that majority of respondents (73.68%) harvested the tomato crop before recommended time while 21.06 per cent of respondents harvested crop at recommended time. To ascertain training and pruning benefits of vegetable crops under protected vegetable cultivation technologies, this study has been planned.

Keywords: Desired, Growth, Pruning, Techniques, Training, Vegetable

INTRODUCTION

To feed the present population of the state, there is a need to double the total production of vegetables. Productivity of vegetables in India is quite low beside it is second largest producer of vegetables. Protected cultivation is one of the best technologies to enhance the production, quality and productivity of vegetable crops.

Protected cultivation technology is a technique in which plant microclimate is partially or fully controlled artificially as per the requirement of specific crops to improve the yield potential of crop and to alleviate one or more abiotic stress for optimum growth of crop plants. In cool season, farmers can raise early crops of better quality with high yield under protected structures to increase their income.

Pruning can encourage faster growth of new shoots, which has the potential to bloom. Training and Pruning technique deserve attention in yield and quality enhancement of vegetable crops. Through its effect on improved photosynthetic efficiency, plant growth, and optimization of vegetative and reproductive balance. Truss pruning is crucial for maximizing the distribution of dry matter (DM) to the fruit and increasing the marketable yield. Leaf pruning, on the other hand, primarily helps to reduce disease risks, speed up fruit ripening, and simplify the harvesting process (Heuvelink *et al.*, 2005). By lowering the vegetative sink strength, leaf pruning can also promote greater allocation of biomass to the fruit (Xiao *et al.*, 2004). Baki (1987) found that pruning had a significant impact on tomato plant height. Unpruned plants grew taller and had the highest number of inflorescences.

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Additionally, unpruned plants produced a greater number of fresh ripe fruits. However, the highest tomato yield (96.08 tons per hectare) was achieved from pruned plants with two stems at the closest spacing (75 x 75 cm). Hernandez and Sanchez (1992) observed that pruning to a single stem resulted in the longest fruit length, and these plants also produced a higher number of fruits. The goal of training and pruning is to eliminate non-productive growth, redirecting energy towards the parts of the plant that are most capable of producing fruit. To ascertain training and pruning benefits of vegetable crops under protected vegetable cultivation technologies, this study has been planned.

MATERIALS AND METHODS

The present study was conducted in Punjab state. Six districts i.e. Amritsar, Gurdaspur, Sangrur, Moga, Jalandhar and Kapurthala were selected purposively. A list of total vegetable growers in selected districts was prepared with the help of department of horticulture. From this list 150 farmers who have adopted protected vegetable cultivation were selected according to probability proportion of number of farmers doing protected vegetable cultivation in different districts. An interview schedule was designed by consulting relevant literature for data collection. It dealt with the statements to know the status of training and pruning of vegetables under protected vegetable cultivation. The data were collected personally by the researcher by visiting the study area and interviewing the respondents. For receiving the response of respondents, the investigator contacted them personally in their villages. The data were analyzed with the help of statistical tools such as frequencies, percentage methods.

RESULT AND DISCUSSION

Data in Table 1 indicate that 67.86 per cent of respondents from capsicum crop, 84.21 percent from tomato and 76.47 per cent from cucumber crop followed the training and pruning techniques in vegetable cultivation while 32.14 per cent of respondents of capsicum crop, 15.79 per cent respondents of tomato crop and 23.53 per cent respondents of cucumber crop did not followed training and pruning practices.

Data in Table 2 indicate that majority of respondents (94.74 and 76.92%) in capsicum and cucumber crop followed training and pruning at recommended time. Majority of respondents (68.75%) in tomato crop and more than five per cent respondents in capsicum did training and pruning after recommended time. Data further showed that 25 per cent of respondents in tomato crop did training and pruning at recommended time while about six per cent of respondents in tomato and 23.08 per cent in cucumber did it before recommended time.

Table 1: Distribution of respondents according to training and pruning under protected cultivation of vegetables

Training & pruning	Capsicum (n=56)	Tomato (n=19)	Cucumber (n=51)
	Frequency (%)	Frequency (%)	Frequency (%)
Yes	38 (67.86)	16 (84.21)	39 (76.47)
No	18 (32.14)	3 (15.79)	12 (23.53)

In capsicum and cucumber, maximum number of respondents follows training and pruning at recommended time under protected cultivation while in tomato majority of respondents follow the training and pruning practices after recommended time under protected cultivation.

Data in Table 3 reveal that similar number of respondents (42.11%) followed training and pruning at less than recommended as well as recommended number of branches in capsicum crop while in tomato crop 50 per cent of respondents followed it at recommended as well as more than recommended branches. Data further showed that 51.28 per cent of respondents in cucumber crop and 15.78 per cent of respondents in capsicum crop followed training and pruning with more than recommended branches. While, 33.34 per cent of respondents in cucumber followed training and pruning at recommended number of branches and only 15.38 per cent of respondents followed training and pruning less than recommended number of branches.

In capsicum and in tomato, maximum number of respondents follows training and pruning at recommended number of branches while in cucumber respondents follow training and pruning at more than recommended number of branches.

Data presented in Table 4 indicate that majority of the respondents (55.36%) from capsicum crop

Table 2: Distribution of respondents according to time of training and pruning under protected cultivation of vegetables

Time of training and pruning	Capsicum (n=38) Frequency (%)	Tomato (n=16) Frequency (%)	Cucumber (n=39) Frequency (%)
Before recommended time **Capsicum:** After 10-12 days of transplanting when lateral branches are 1-2 cm long. Remove all lateral branches and plant is 1.5 -2.0 feet in height **Tomato:** After 10-12 days of transplanting when lateral branches are 1-2 cm long. Remove all lateral branches and plant is 1.5 -2.0 feet in height **Cucumber:** After 15-20 days of sowing when lateral branches are 1-3 cm long. Remove all lateral branches and plant is 1.0-1.25 feet in height	-	1 (6.25)	9 (23.08)
At recommended time **Capsicum:** After 15-20 days of transplanting when lateral branches are 1-3 cm long. Remove all lateral branches and plant is 2 -2.5 feet in height **Tomato:** After 15-20 days of transplanting when lateral branches are 1-3 cm long. Remove all lateral branches and plant is 2 -2.5 feet in height **Cucumber:** Recommended after 20-25 days of sowing when lateral branches are 1-3 cm long. Remove all lateral branches and plant is 1.5-2.5 feet in height	36 (94.74)	4 (25.00)	30 (76.92)
After recommended time **Capsicum:** After 25-30 days of transplanting when lateral branches are 3-5 cm long. Remove all lateral branches and plant is 3-3.5 feet in height **Tomato:** After 25-30 days of transplanting when lateral branches are 3-5 cm long. Remove all lateral branches and plant is 3-3.5 feet in height **Cucumber:** After 30 days of sowing when lateral branches are 3-5 cm long. Remove all lateral branches and plant is 2.5-3.5 feet in height	2 (5.26)	11 (68.75)	-

Table 3: Distribution of respondents according to number of branches for training and pruning under protected cultivation of vegetables

Training and pruning	Number of branches for training and pruning	Capsicum (n=38) Frequency (%)	Tomato (n=16) Frequency (%)	Cucumber (n=39) Frequency (%)
Number of branches for training and pruning	Less than recommended branches **Capsicum:** 2-3 branches **Cucumber:** 1 branches	16 (42.11)	-	6 (15.38)
	Recommended branches **Capsicum:** 4 branches **Tomato:** 1 branch **Cucumber:** 2 branches	16 (42.11)	8 (50.00)	13 (33.34)
	More than recommended branches **Capsicum:** more than 4 branches **Tomato:** 3-4 branch **Cucumber:** 3-4 branches	6 (15.78)	8 (50.00)	20 (51.28)

harvested the crop at recommended time while, 30.36 per cent of respondents harvested the capsicum crop after the recommended time of harvesting under protected structures. Only 14.28 per cent of respondents harvested the crop before recommended time.

Data further revealed that majority of respondents (73.68%) harvested the tomato crop before recommended time while 21.06% of respondents harvested crop at recommended time. Whereas five per cent of respondents harvested the tomato crop after the recommended time of harvesting (Table 4).

Table 4: Distribution of respondents according to time of harvesting under protected cultivation of vegetables

Crop	Time of harvesting	Frequency	Percentage
Capsicum (n=56)	Before the recommended time (Green coloured capsicum: 50-55 days after transplanting, Red and yellow coloured: 70-75 DAT in poly house or net house).	8	14.28
	At recommended time (Green coloured capsicum: Mid November: 60-65 days after transplanting, Red and yellow coloured: Mid December: 80-85 DAT in poly house or net house).	31	55.36
	After recommended time (Green coloured capsicum: 70-75 days after transplanting, Red and yellow coloured: 90-100 DAT in poly house or net house).	17	30.36
Tomato	Before the recommended time (First week of February, 55-70 DAT).	14	73.68
(n=19)	At recommended time (Last week Of February, 70-80 DAT).	4	21.06
	After recommended time (mid March 85-90 DAT).	1	5.26
Cucumber	Before the recommended time (35-45 DAS in poly house or net house).	22	43.14
(n=51)	At recommended time (45-50 DAS in poly house or net house)	20	39.21
	After recommended time (55-65 DAS in poly house or net house)	9	17.65

Data given in Table 4 further revealed that cucumber crop was harvested before recommended time by more than 43 per cent of respondents while 39.21 per cent of respondents harvested cucumber at recommended time of harvesting and only 17.65 per cent of respondents harvested the cucumber crop after the recommended time of harvesting.

Cucumber and tomato crop was harvested before recommended time and capsicum crop was harvested at recommended time under protected structures by maximum number of respondents.

CONCLUSION

It can be concluded that majority of respondents in capsicum and cucumber crop followed training and pruning at recommended time. It is also notable that majority of respondents in tomato crop and more than five per cent respondents in capsicum did training and pruning after recommended time. Study also enlightened that majority of the respondents from capsicum crop harvested the crop at recommended time while a little per cent of respondents harvested the crop before recommended time. So, It can be concluded that training and pruning technique deserve attention in yield and quality enhancement of vegetable crops.

REFERENCES

Baki, A. 1987. Effects of spacing and pruning on the yield of tomato cultivar Oxheart. An MS thesis, Department of Horticulture, BAU, Mymensingh. p. 8.

Hernandez, C.V.M. and F.C.D. Sanches. 1992. Response to planting distance and pruning system in tomatoes growing in hydroponics culture in a basic green house. *Department of de Fifotecnia, Univerdad Aufonoma Chapingo,* 15(73-74): 23-25.

Heuvelink, E.; M.J. Bakker; A. Elings; R. Kaarsemaker and L.F.M. Marcelis. 2005. Effect of leaf area on tomato yield. *Acta Horticulturae,* 691: 43-50.

Xiao, S.; A. Van Der Ploeg; M. Bakker and E. Heuvelink. 2004. Two Instead of three leaves between tomato trusses: measured and simulated effects on partitioning and yield. *Acta Horticulturae,* 654: 303-308.

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Research Article

Entrepreneurial Behaviour of Women in Self Help Groups: An Indepth Analysis in Chittoor District of Andhra Pradesh

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ABSTRACT

This study was conducted to assess the entrepreneurial behaviour of SHG women in Chittoor district of Andhra Pradesh. This study utilized an *ex post facto* research design and employed a simple random sampling method to select the sample. Data collection was done using a pre-tested interview schedule. The findings of the study revealed that significant majority of the women entrepreneurs in Self Help Groups were found under medium level category with respect to components *viz.,* decision making ability (78.75%), innovativeness (76.25%), achievement motivation (77.50%), information seeking behavior (80.00%), leadership ability (87.50%), besides being found under low level of risk taking ability (42.50%) and low level of cosmopoliteness (73.75%). The overall entrepreneurial behavior of the respondents was also found to be medium (72.50%).

Keywords: Women entrepreneurs, Self help groups, Entrepreneurial behaviour, Components, Simple random sampling

INTRODUCTION

Promoting Entrepreneurship development and encouraging income generating activities presents a viable solution for empowering women. The imperative of our time is to secure economic and social independence for women. Involving women in income-generating activities makes a substantial contribution to their overall empowerment. Over the years, the landscape of women entrepreneurship witnessed a remarkable transformation through Self Help Groups (SHGs). This phenomenon represents a dynamic and inspiring aspect of entrepreneurial behaviour, one that has been gaining significant attention worldwide. Women, historically underrepresented in the entrepreneurial arena, are breaking through barriers and redefining the traditional notions of business ownership and leadership. As a result of advancements in education, urban development, industrialization, and the promotion of democratic principles, the roles of women have evolved (Dutta *et al.,* 2023).

Self Help Groups, aimed at empowering women through collective savings and microfinance, acting as catalyst for entrepreneurial innovation. Women, often marginalized and constrained by social and economic factors, are leveraging the collective strength of these groups to establish and scale their own enterprises. This not only leads to economic independence but also has profound societal and economic implications.

Entrepreneurial characteristics are shaped by a blend of social, psychological and economic factors to which individuals are exposed to right from childhood. While entrepreneurial talent is inherent in everyone, its manifestation varies from person to person. Recent efforts have focused on identifying factors linked to entrepreneurial success, yet the behaviour associated with success is not universally applicable. Hence, becoming a successful entrepreneur involves more than just starting a business; it hinges on the culture, degree, and extent of entrepreneurial behaviour an individual possesses, which often

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determine their level of success. This underscores the necessity for coordinated efforts to enhance the entrepreneurial ecosystem for women to reap the emerging demographic dividend (Binoo *et al.,* 2022). Therefore, the distinctive requirements of these small-scale rural entrepreneurs can be met by taking a comprehensive approach that combines high-quality training in small business and life skills with relevant technical training and sufficient funding (Sujay *et al.*, 2024).

This study focussed into the entrepreneurial behaviour of women entrepreneurs affiliated with Self Help Groups, examining their motivations, challenges and the traits associated with entrepreneurship. It is crucial to understand this SHG women entrepreneurship as it holds the potential to alleviate poverty, foster economic growth besides promoting gender equality.

MATERIALS AND METHODS

The research was conducted within the Chittoor district of Andhra Pradesh and it adhered to an *ex-post facto* research design. Four mandals from Chittoor district and two villages from each of these 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 selected purposively based on the presence of highest number of women Self Help Groups, from which a sample size of 80 women entrepreneurs were selected utilizing simple random sampling technique. The primary data collection involved utilizing a pre-tested interview schedule and various statistical techniques such as frequencies, percentages arithmetic mean, standard deviation etc. were applied. By using mean and standard deviation for the variables *viz.,* entrepreneurial behaviour and its components, the respondents were categorized into low, medium and high categories. Here, the entrepreneurial behaviour was calculated as summation of the scores of seven selected components. The results were then meaningfully interpreted and relevant conclusions were drawn.

RESULTS AND DISCUSSION

Below are the results showcasing the individual components of entrepreneurial behaviour as well as the overall entrepreneurial behaviour of women entrepreneurs within Self Help Groups.

Decision making ability: The results from Table 1 indicated that significant majority (78.75%) of the SHG women were found under medium level of decision making ability category followed by high (16.25%) and low (05.00%) levels of decision making ability categories.

The reason for the above findings might be attributed to the fact that historically women were assigned domestic roles and have had limited exposure to decision-making processes outside the household.

Innovativeness: The results from Table 1 revealed that significant majority (76.25%) of the SHG women entrepreneurs were found under medium level of innovativeness category followed by high (16.25%) and

Table 1. Distribution of the SHG women entrepreneurs based on the possession of level of traits of entrepreneurial behavior

Component	Category	Frequency	Percentage
Decision making ability	Low	04	05.00
Mean = 9.61	Medium	63	78.75
S.D. = 1.84	High	13	16.25
Innovativeness	Low	06	07.50
Mean = 30.49	Medium	61	76.25
S.D. =1.90	High	13	16.25
Achievement motivation	Low	08	10.00
Mean = 19.77	Medium	62	77.50
S.D. =1.89	High	10	12.50
Information seeking behaviour	Low	05	06.25
Mean = 7.81	Medium	64	80.00
S.D. =1.74	High	11	13.75
Risk taking ability	Low	34	42.50
Mean = 2.86	Medium	25	31.25
S.D. =0.85	High	21	26.25
Leadership ability	Low	03	03.75
Mean = 6.86	Medium	70	87.50
S.D. =1.22	High	07	08.75
Cosmopoliteness	Low	59	73.75
Mean = 1.22	Medium	17	21.25
S.D. =0.45	High	04	05.00

low (07.50%) levels of innovativeness categories in the study area.

This tendency could be attributed to the majority of SHG women having a low level of risk-taking ability, coupled with a lack of higher education.

Achievement motivation: The results from Table 1 indicated that significant majority (77.50%) of the SHG women were found under medium level of achievement motivation category followed by high (12.50%) and low (10.00%) levels of achievement motivation categories in the study area.

One potential reason for this pattern could be that increased competition motivated individuals to strive harder for consistent profits, aiming for a comfortable lifestyle. As a result, they opted for ventures that promised substantial profit and steady demand. Similar types of findings were also reported by Asha *et al.,* (2018).

Information seeking behaviour: The findings from Table 1 showed that significant majority (80.00%) of the SHG women were found under medium level of information seeking behaviour category followed by high (13.75%) and low (06.25%) levels of information seeking behavior categories.

The potential cause behind this trend could be attributed to factors such as limited literacy levels, lack of access to newspapers, magazines, and television in rural areas, as well as the lower financial capability of rural residents. These factors collectively hinder their ability to establish better connections with information channels. Similar types of findings were also reported by Mubeena *et al.* (2017).

Risk taking ability: The results from the Table 1 disclosed that majority (42.50%) of the SHG women were found having low level of risk taking ability category followed by medium (31.25%) and high (26.25%) of levels of risk taking ability categories.

The probable reason for this trend could be the low socio-economic status of the members, leading them to believe that taking risks wouldn't yield significant economic gains. Consequently, they were hesitant to introduce transformative changes unless they saw others trying and benefiting from those changes.

Leadership ability: It is found from Table 1 that significant majority (87.50%) of the SHG women were found under medium level of leadership ability category followed by high (8.75%) and low (03.75%) levels of leadership ability categories in the study area.

This trend might be attributed to the influential role of group leaders in assisting, guiding, and supporting members in problem-solving. Typically, these leaders play a significant role in identifying and forming groups, as well as maintaining cohesion for smooth functioning. A formal leader is essential for the success of a group, contributing to high member satisfaction and employing participatory leadership, which tends to be more effective than an autocratic style, in achieving the group's goals. Similar types of findings were reported by Basera and Bharadwaj (2017).

Cosmopliteness: The results from Table 1 revealed that significant majority (73.75%) of the SHG women were found under low level of cosmopoliteness category followed by medium (21.25%) and high (05.00%) levels of cosmopoliteness categories.

The reason for low level of cosmopoliteness might be due to societal norms or practical constraints that might restrict women's mobility, limiting their opportunities to travel or interact beyond their immediate surroundings. This confinement can limit exposure to broader, cosmopolitan experiences.

Overall Entrepreneurial behaviour of the respondents: The results from Table 2 revealed that significant majority (72.50%) of the SHG women were found under medium level of entrepreneurial behaviour category followed by high (16.25%) and low (11.25%) levels of entrepreneurial behavior categories in the study area.

The reason for this trend might be that majority of the SHG women were middle aged with matured

Table 2: Distribution of the SHG women entrepreneurs according to their level of entrepreneurial behavior

Category	Frequency	Percentage
Low	09	11.25
Medium	58	72.50
High	13	16.25
Total	80	100.00

Mean =84.51, S.D. =72.77

minds. Besides, most of them were found under medium category with respect to variables of extension contact, mass media exposure, economic motivation, management orientation and thus were aware of the benefits involved. Similar types of findings were also reported by Jaiswal and Patel (2012), Kumar and Tripathi (2012) and Inbam and Mohideen (2015).

CONCLUSION

The findings showed that significant majority of the SHG women entrepreneurs were found possessing medium level of entrepreneurial behaviour. The possible reasons might be that majority of the SHG women entrepreneurs had medium levels of decision making ability, innovativeness, information seeking behavior, achievement motivation, leadership ability which resulted in medium level of entrepreneurial behaviour. Efforts must be aimed at nurturing entrepreneurial skills and fostering an environment conducive to entrepreneurship that could potentially benefit the entire spectrum of SHG women entrepreneurs, besides aiming to elevate those with lower inclinations and further empower those demonstrating higher levels of entrepreneurial behaviour.

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REFERENCES

Asha, K.; D. Nanjappa; M.B. Shanabhoga and S. Dechamm. 2018. Socio economic and Psychological Profile of Members of Self Help Groups in Ramanagara district of Karnataka, India. *International Journal of Current Microbiology and Applied Sciences,* 7(9): 3438-3446.

Basera, N. and N. Bharadwaj. 2017. Entrepreneurial skills among women under Self Help Groups in Almora district of Uttarakhand. *International Journal of Development Research,* 7(1): 11226-11229.

Binoo, P.B.; S. Lokesh and S. Smitha. 2022. Determinants of Women's Entrepreneurial Performance in Kerala. *Indian Journal of Extension Education*, 58(1): 117-120.

Dutta, A.; P. Singh; A. Dobhal; D. Mannan; J. Singh and P. Goswami. 2023. Entrepreneurial Aptitude of Women of an Aspirational District of Uttarakhand. *Indian Journal of Extension Education*, 59(2): 103-107.

Inbam, R. and N.M. Mohideen. 2015. A study on the level of entrepreneurial behaviour among self help groups in Theni district, Tamil Nadu. *International Journal of Allied Practice Research and Review,* 2(8): 65-76.

Jaiswal, A. and M.M. Patel. 2012. Entrepreneurial Behaviour of Rural Women. *Indian Research Journal of Extension Education,* 12(1): 55-59.

Kumar, S. and H. Tripathi. 2012. Entrepreneurial Behaviour of SHGs Members towards Dairying in Eastern Uttar Pradesh: A Gender Analysis. *International Journal of Social and Economic Research,* 2(2): 312-321.

Mubeena, Md.; T. Lakshmi; S.V. Prasad and N. Sunitha. 2017. Entrepreneurial Behaviour Components of Rural Women of Podupu Laxmi Ikya Sangam. *International Journal of Pure and Applied Biosci*ence, 5(5): 816-820.

Sujay, K.; N.M. Singh; R. Singh and S.K. Roy. 2024. Analysis and Profiling of Agri Entrepreneurship Promoting Institutions. *Indian Journal of Extension Edu*cation, 60(1): 35-40.

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Research Article

The Trilogy of Hunger, Poverty, Silence and Cognitive Differential of Rural and Semi Urban Women

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ABSTRACT

The hunger, poverty and voicelessness are inter-related and integral parts of social stigma. People are hungry because they are poor and people are both hungry and poor because of their silence. This nexus is quite a bit stronger when it is put together with silence or lack of communication. Here in this paper, attempts have been made to find out the factors responsible for the deadly cobweb of hunger, poverty, voice and cognitive differential of two socio-ecological groups i.e. rural and semi-urban women selected from the district of South 24 parganas, West Bengal. The combination of three social decadents viz. hunger, poverty and voice has been inextricably tuned and efforts are being made to predict the dynamics of hunger, poverty, voice and cognitive differential of two social ecologies by plotting with multi-dimensional scaling technique**.** It is uniquely established that, there is markedly difference in terms of location, response to variables and cognitive behavioral disposition of women in the two different social ecologies.

Keywords: Multi dimensional scaling, Cognitive differential, Hunger, Poverty, Voice

INTRODUCTION

We have been suffering from the classical approach to poverty alleviation. The income, the wage, the cost of living the institutional access has so far dominated the poverty alleviation interventions. When the subaltern remains voiceless, poverty cripples deeper into the very existence to make survival more complex and non dealable. "When I die, don't build a monument on me. Don't bestow me degrees from great universities. Just clothe the naked. Say that I tried to house the homeless. Let people say that I tried to feed the hungry". Martin Luther King. The average international price of food had been predominantly stable for several decades until 2006. Starting in early 2006, global commodity prices, already moving upward, began rising at a faster pace as energy price increases accelerated (Dana *et al.,* 2006)[1]. In the closing months of 2006, however, prices began to rise at a galloping pace. By 2008, rice had tripled in price in some regions, and this severely affected the developing countries. Food prices fell in early 2009 [2,3], but rose to another record margin in 2011 [4, 5], and have since decreased slightly. The 2008 worldwide financial crisis further increased the number of people suffering from hunger, including dramatic increases even in advanced economies such as Great Britain, the Eurozone and the United States[6]. In this post- modern era, hunger is not only a failure of agriculture; rather it is a social, economic and political problem. To get rid of hunger, the socio-political models should be reconciled and re- organized, if necessary. On a broader spectrum, the policy generations and modifications should be based on the empirical researches, as well as should be realistic and broad based. Adding to this, the government should be complementary with a proper

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bureaucratic set up, a transparent and unbiased news media, voluntary non-governmental organizations, active public discussion systems etc. Hunger does not involve only food but there are much more interconnections of other social, economic and political aspects.

Beyond the curtain of hunger, there is another problem that is chronic hunger. India ranked 94 among 107 countries in the Global Hunger Index (GHI) 2020 and continues to be in the "serious" hunger category [7]. The scenario of chronic hunger is even worse and astoundingly it is worse than African nations as well. Martin Feldstein (1998)[8] in his paper "Income Poverty and Inequality" argues that income inequality is not a problem in need of remedy. The common practice of interpreting a rise in the gini-coefficient measure of inequality violates the Pareto principle and is equivalent to using a social welfare function that puts negative weight on increases in the income of high income individuals. To know the socio economic conditions of the people under study as well as to identify the strength and flaws of the area under study. The similar result was also occurred in the study (Chakraborty and Acharya, 2018)[9], where it was found that poverty and voice has certain interrelation in different socio-economic and socio-psychological parameters. Women are more vulnerable towards hunger. James Vernon, in his Hunger: A Modern History wrote that in Britain before the 20th century, it was generally only women and children suffering from hunger who could arouse compassion [10]. Men who failed to provide for themselves and their families were often regarded with contempt. This changed after World War I, where securing employment was a struggle for the thousands of men who had proved their manliness in combat. Similarly, female gender could be advantageous for those wishing to advocate for hunger relief, with Vernon writing that being a woman helped Emily Hobhouse draw the plight of hungry people to wider attention during the Second World War. Now as far as the poverty is concerned, there have many definitions of poverty where the most widely held, accepted and understood definition of absolute poverty measures poverty strictly in economic terms – earning less than $1.90 a day. But the World Bank goes beyond the economic definition of poverty, instead of this they expand the definition of poverty into different aspects. "Poverty is hunger. Poverty is lack of shelter. Poverty is being sick and not being able to see a doctor. Poverty is not having access to school and not knowing how to read. Poverty is not having a job, is fear for the future, living one day at a time. Poverty is losing a child to illness brought about by unclean water. Poverty is powerlessness, lack of representation and freedom." A survey (Ballard *et al.,* 2013) [11] was done by FAO in 2009. A key objective of the Voices of the Hungry project (VoH) is to estimate comparable prevalence rates of food insecurity in national populations for more than 140 countries every year. These estimates are based on conditions and behaviors reported by adults through the Food Insecurity Experience Scale survey module (FIES-SM). The data collected in nationally representative surveys of the adult population in each country are used to compute a measure of severity of the food insecurity status for each respondent, focusing on conditions reflecting limited access to food. Individual measures are then calibrated against a common global reference scale of severity, thus allowing classifications and estimates of prevalence rates that are comparable across countries and population groups. Indian agriculture is the largest but unorganized economic sector of the world. The farm entrepreneurs are suffering from both the vagaries of nature and market. The decelerating agricultural economy has thrown the growers into a vicious cycle of hunger, poverty and silence. Hunger here has been denoted by the level of food, calorie and nutrition intake by human bodies within the framework of minimum requirement set by World Health Organization (WHO). Poverty here has been measured in terms of per capita income per month from a unit of holding, which is 121 million in India [12].

Under the above back drop, the present study was undertaken with the following objectives: 1) to identify variables affecting different Social stigma (poverty, hunger, voiceless, Cognitive differential) and 2) to study the dynamics of poverty, hunger, voiceless, Cognitive differential of randomly selected rural and semi urban women of South 24 parganas districts of West Bengal.

MATERIALS AND METHODS

The present study was conducted in two different locales. The rural locale is Beraberi gram panchayate under Habra block II in the district of South 24

parganas, West Bengal, and the semi urban locale is Mondalpara village of Sodepur II block of south 24 parganas. Both the locales were selected purposively according to the convenience of the researcher. Then from these two locations, 70 from each, total of 140 respondents (all women) were selected randomly by following systematic random sampling method. The selected respondents were interviewed through a structured interview schedule. The statistical tools used in this study are correlation coefficient and multiple stepwise logistic forward regressions and multi-dimensional scaling technique.

RESULTS AND DISCUSSION

The post facto interrogation has been conducted for the rural and semi urban women to elicit expected responses. Since, these are two different social-ecologies, the time of interaction and mode of interaction has been different. The underlying purpose has been to see as to how and why the responses to selected variable narratives viz a viz stimuli bestow a differential characters and behavior as well.

Data were analyzed using multiple stepwise logistic forward regressions (PROC LOGISTIC; SAS, 2012)[13] to do the stepwise selection for identifying the prognostic factors for perceived score of social stigma (hunger, poverty, voice, cognitive differential) for the respondents in both rural and semi-urban areas. The model used was the logistic regression (LR) model:

$$\log\left[\frac{\theta(x)}{1-\theta(x)}\right] = \alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_i x_i$$

where, perceived hunger score is the dependent variable; age, educational qualification, family size, ….. etc. are the predictor variables that '*x*' represents; α= intercept of the model and β= the coefficient of predictor variables. LR enters predictor variables in a stepwise manner; it will also fit specified models or perform forward selection of variables. At each step in the stepping process, an attempt was made to remove any insignificant variables from the model before adding a significant variable to the model. A significance level of 0.25 was required to allow a variable to enter into the model, and a significance level of 0.30 was required for a variable to stay in the model. The step selection was based on the maximum likelihood ratio. The response variable perceived hunger score= 1 (when the perceived hunger score is above average) as against perceived hunger score= 0 (when the perceived hunger score is below average) so that the probability of perceived hunger score is modeled. From stepwise logistic regressions, some variables were emerged as the prognostic factors that could influence perceived hunger score significantly. The Hosmer and Lemeshow Goodness-of- Fit test was done for goodness of fit. The result of stepwise logistic regression analysis is presented in Table 1 that shows the factors influencing perceived hunger score. The similar procedure was used for the perceived poverty score, voice score and development cognitive score. The summary table for rural sector is presented in Table 1 whereas the same for semi-urban region is given in Table 2.

Table 2 and 4 lists the odds ratio estimates along with 95% Wald confidence limits found under stepwise logistic selection of different identified variables in rural and Semi urban sector. The factors where the Odds Ratio Estimates is >1 indicated the likelihood of

Table 1: Summary of stepwise logistic selection of various identified variables affecting different Social stigma in rural sector

Step	Effect entered	df	Score Chi-square	Pr.> Chi-square
Hunger				
1	Risk orientation	1	5.4861	0.0192
2	Size of holding	1	5.7822	0.0162
Poverty				
1	Marketed surplus	1	10.6494	0.0011
2	Pond and fish	1	5.4263	0.0198
3	Age	1	4.4597	0.0347
Voice				
1	Stress perception on poverty	1	5.6322	0.0176
2	Livestock yield	1	4.5708	0.0325
3	No. of fragments	1	6.3001	0.0121
4	Size of holding	1	5.7547	0.0164
Development cognitive				
1	Livestock yield	1	6.8684	0.0088
2	Cropping intensity	1	3.9131	0.0479

(The Pr.>Chi square is >0.05 for all cases as per Hosmer and Lemeshow Goodness-of- Fit test)

Table 2: Profile of Odds Ratio Estimates found under stepwise logistic selection of different identified variables in rural sector

Effect	Odds ratio estimate	95% Wald Confidence Limits	
		Lower	Upper
Hunger			
Risk orientation	0.002	<0.001	0.102
Size of holding	0.879	0.624	1.237
Poverty			
Marketed surplus	1.023	0.995	1.051
Pond and fish	>999.999	1.489	>999.999
Age	1.325	1.025	1.713
Voice			
Stress perception on poverty	1.636	1.188	2.254
Livestock yield	1.785	0.968	3.290
No. of fragments	2.363	1.378	4.052
Size of holding	0.490	0.281	0.853
Development cognitive			
Livestock yield	1.393	1.026	1.891
Cropping intensity	1.007	1.000	1.013

average hunger >1. The odd ratio (<1) indicated an inverse association of such factor with the likelihood of average hunger. It means Risk orientation, Size of holding in rural sector are inversely associated with the likelihood of average hunger as the odds ratio <1 The result depicts one of the important psycho-entrepreneurial barrier, lack of risk orientation in farm women, is responsible for slow and sluggish entrepreneurial growth in agriculture amongst the marginal land holders, which are fragmented too. The situation has further gone worse with the unpredictable behavior of agril-marketing system which is mostly not supportive for small and marginal growers. On the other hand, in case of semi-urban sector, energy consumption, age, marketed surplus indicated the likelihood of average hunger >1 but for Communication variables it is inversely associated with the likelihood of average hunger as the odds ratio <1. It implies that the women respondents from semi urban social ecology have been found to bestow a compounding effect of energy consumption, age and marketable surplus on hunger. Access to market has been so decisive on family income which in turn helps fight out poverty, hunger simultaneously. On the other hand, access to information through communication has contributed to curb hunger. It is through sharing and receiving to communication, the semi urban women have been able to know the benefits of different welfare projects, which are absolutely meant for them. For poverty consequence, both livestock and fishery enterprises are offering ray of hopes. To overcome rural poverty, our agriculture has to be more enterprising and to be supported by proper supply chain connectivity. In case of voice, the entrepreneurial agriculture in the forms of livestock yield, education, economic motivation and stress perceptions are operating in both isochronous and conjoint behavior, good enough to say that entrepreneurial characters of agriculture offers a key condition to improve economic motivation and well-being of rural women.

Table 3: Summary of stepwise logistic selection of various identified variables affecting different Social stigma in Semi Urban sector

Step	Effect entered	df	Score Chi-square	Pr.>Chi square
Hunger				
1	Energy consumption	1	8.0688	0.0045
2	Age	1	4.1767	0.0410
3	Marketed surplus	1	3.9325	0.0474
4	Communication variables	1	3.5188	0.0607
Poverty				
1	Livestock yield	1	16.7263	<.0001
2	Pond and fish	1	7.3699	0.0066
Voice				
1	Livestock yield	1	8.8001	0.0030
2	Education	1	8.3770	0.0038
3	Economic motivation	1	5.8549	0.0155
4	Stress perception on hunger	1	5.8594	0.0155
Development cognitive				
1	Marketed surplus	1	8.6266	0.0033
2	Stress perception on poverty	1	3.7734	0.0521
3	Management orientation	1	5.2000	0.0226
4	Economic motivation	1	5.6234	0.0177
5	Energy consumption	1	4.8590	0.0275

(The Pr.>Chi square is >0.05 for all cases as per Hosmer and Lemeshow Goodness-of- Fit test)

Table 4: Profile of Odds Ratio Estimates found under stepwise logistic selection of different identified variables in Semi urban sector

Effect	Odds ratio	95% Wald Confidence Limits	
	estimate	Lower	Upper
Hunger			
Energy consumption	28.928	0.384	>999.999
Age	1.291	0.943	1.767
Marketed surplus	2.347	1.084	5.082
Communication variables	0.446	0.186	1.068
Poverty			
Livestock yield	1.011	1.000	1.022
Pond and fish	1.026	0.975	1.079
Voice			
Livestock yield	1.307	0.878	1.946
Education	0.025	<0.001	4.855
Economic motivation	<0.001	<0.001	>999.999
Stress perception on hunger	>999.999	<0.001	>999.999
Development cognitive			
Marketed surplus	4.963	0.792	31.101
Stress perception on poverty	<0.001	<0.001	2.530
Management orientation	48.744	0.353	>999.999
Economic motivation	60.539	0.389	>999.999
Energy consumption	0.005	<0.001	4.572

As a sequel to rural women's behavioral dispositions, development cognitive play the pivotal and in this realm, marketed surplus, management orientation, economic motivation and energy consumptions can come up as important determinants. The entrepreneurial communication and behaviors are both exerting telling impact on dealing with the issues of cognitive differential and overall well-being of farm women in this fast changing rural ecology of India.

Multidimensional scaling (MDS) technique was employed to draw conclusions about the proximity/ closeness among the social constraints. By MDS a map was created displaying the relative positions of different variables like poverty, hunger, voice, and development cognitive causing social stigma in both rural and semi-urban areas using a distance matrix. The perceptual

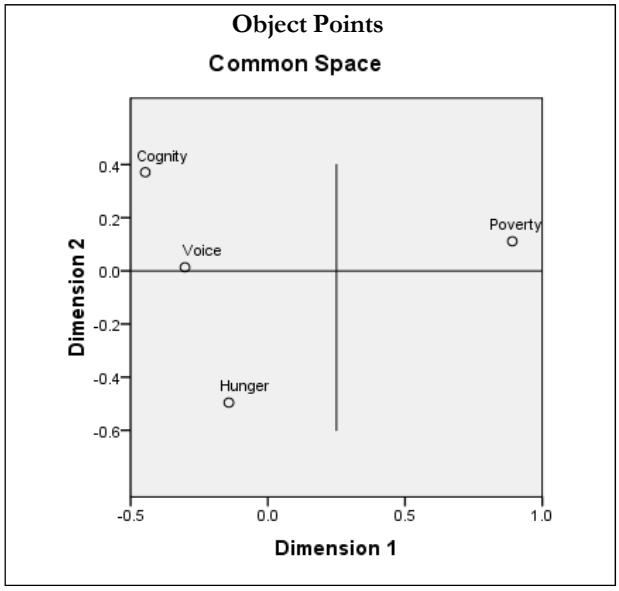

Figure 1: Perceptual mapping for rural sector

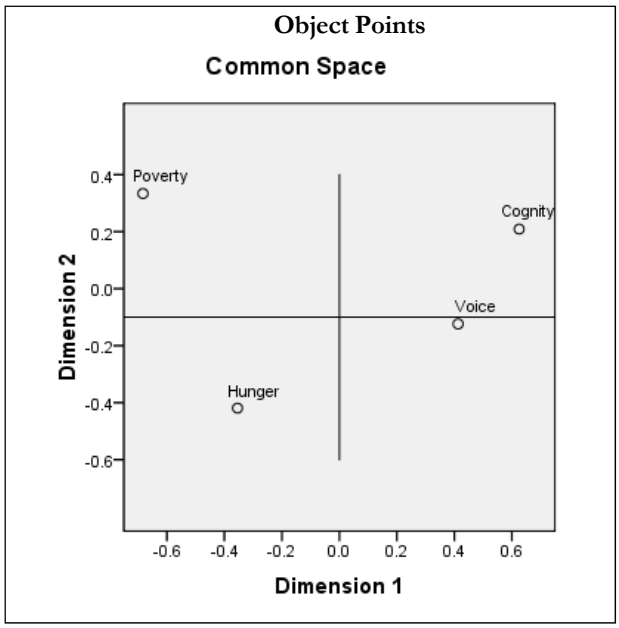

Figure 2: Perceptual mapping for Semi Urban sector

map consisted of two dimensions to interpret the dissimilarity matrix (lower triangular) of those variables on a two-dimensional scatter plot (Shepard diagram). The stress values in both the cases are found satisfactorily (0.00000) to do further analysis. Final Co-ordinates for perceptual mapping for both rural and semi-urban sector are given in Table 5 and 6. In this example, (in both Figure 1 and 2) it is evident that the respondents considered voice and cognitive development to be closer.

Table 5: Final Co-ordinates for perceptual mapping for rural sector

Final Coordinates	Dimension	
	1	2
Hunger	-0.142	-0.496
Poverty	0.891	0.111
Voice	-0.302	0.013
Cognity	-0.446	0.371

Table 6: Final Co-ordinates for perceptual mapping for Semi-urban sector

Final Coordinates	Dimension	
	1	2
Hunger	-0.355	-0.419
Poverty	-0.683	0.334
Voice	0.413	-0.124
Cognity	0.625	0.209

It also appears from MDS analysis the underlying factors that respondents used when they created these dissimilarities. In the Perceptual mapping for rural sector (Figure 1) identifies that voice and cognitive development are in the negative side of dimension 1 (implies the efforts to reduce the social stigma) where as voice and cognitive development are in positive side of dimension 1 in case of Perceptual mapping (Figure 2) for semi-urban areas. Dimension 2 implies the impact of social stigma that causes social entropy. It is clear that (From dimension 2) in case of rural sector, the combined effects of poverty, voice and cognitive development results hunger which is the driving force of social entropy in the region. But in case of semi-urban sector, the effect of poverty and cognitive development in mass scale cause the hunger.

The rural farm women have been the subject to the brunt of abject poverty and silence has added to their misery. Is it that they have accepted it as gifted by fate to them, or, raising voice involves lots of risk from political pressure group, and even from their own family members. In semi urban sector, it is not just access to communication but perceptual differences socialized into an effective stakeholder, rural woman, are offering potential barrier to curb both hunger and poverty. Development has or differential connotations and epistemological sense to executor and the receptors of any development project.

CONCLUSION

The study has been so unique, at the same time so universal, in inferring that poverty and hunger are the resultants of silence, less access to communication, difference of perception as to what and how the development would come to a reality. It offers huge micro sociological implication for having a gender specific and location specific development project with dovetailing micro ecological or Holon based approaches. We need to make rural women raising their voices to access benefits of projects, for urban, right at this moment, there should be more access to information. It uniquely evinces that, there is stark difference in terms of location, response to variable and cognitive behavioral disposition in different social ecologies viz rural vs semi -urban, nevertheless gender remains the same.

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REFERENCES

1. Dana, J.; C.L. Gilbert and E. Shim. 2006. Hedging grain price risk in the SADC: case studies of Malawi and Zambia. *Food Policy,* **31**: 357–371.
2. "How do Food Prices Affect Producers and Consumers in Developing Countries?, ICTSD, Information Note Number 10, September 2009.
3. UN Food and Agriculture Organization. The State of Food Insecurity in the World 2009. Rome.
4. "World Food Situation". *FAO.* Archived *from the original on 29 April 2011.* Retrieved 24 April 2011.
5. *Rahman, M. Mizanur.* "Food price inflation: Global and national problem". (11 August 2011). *The Daily Star.*
6. *World in grip of food crisis.* IANS*, Thaindian News. 7 April 2008.*
7. https://timesofindia.indiatimes.com/india/india-ranks-94/107-in-global-hunger-index/articleshow/78727057.cms
8. Felstein, M. Income Inequality and Poverty. NBER program(s): Public Economics. October issue, 1998. Paper no. 6770.

9. Chakraborty, A. and S. Acharya. 2018. Hunger poverty and voice: The impact and interrelation, Conference Proceedings. Kalyani, West Bengal, 14-15th August, 2018. Page No.-18-22

10. Vernon, James. Hunger: A Modern History. Cambridge, 2009. MA: Harvard University Press. ISBN 978-0-674-04467-8.

11. Ballard, T.J.; A.W. Kepple and C. Cafiero. 2013. The food insecurity experience scale: development of a global standard for monitoring hunger worldwide. 2013. Technical Paper. Rome, FAO. (http://www.fao.org/economic/ess/ess-fs/voices/en/).

12. Government of India, Key Indicators of Situation of Agricultural Households in India. Report no NSS KI (70/33), National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Govt. of India, New Delhi, 2014.

13. SAS 9.3., 2012. Foundation for Microsoft Windows, SAS Institute Inc., Cary, NC.

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Research Article

Changing Perception Regarding Medicinal Plants

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ABSTRACT

Environmental pollution is one of the most serious problems facing humanity and other life forms on our planet today. It affects the health of more than 100 million people worldwide. They play a significant role in social, economic, cultural, spiritual and health-related aspects of everyday life. In spite of the passive scenario, there had been some rays of hope particularly the growing awareness regarding a need to collect, validate and document ITK of medicinal plants and revival of yoga. Further, the COVID-19 epidemic led to increased attention to herbal medication both for preventive and curative purposes. In this context, the present study was planned to study the effectiveness of extension strategies which can help to change the perception to enhance the use of medicinal plants for health. The data revealed that change in perception regarding smell, taste, cost-effectiveness, standardization of products and ease of using medicinal plants for health increased in all experimental group groups after the intervention. Change in perception was significantly different in control and experimental groups. In terms of change in perception, strategy employing different approaches emerged at the top followed by strategy employing only group and mass approach. The third best strategy was the one in which individual and mass approach was used. Mass approach (ICT based) emerged as the most effective in view of the cost and its diffusion effect.

Keywords: Extension strategy, Indigenous traditional knowledge, Individual approach, Mass approach, Perception

INTRODUCTION

Plants have occupied an important status in all aspects of life since times immemorial. They play a significant role in social, economic, cultural, spiritual and health related aspects of everyday life. They not only fulfil basic human needs like food, clothing and shelter but also our luxurious requirements beside health care. Therapeutic value of plants had been explored and used since inception of human civilization. Across the world, they have great economic and medicinal importance. Use of plants for medicinal purposes in Indian traditional health care system is well known. The World Health Organization (WHO) has recently defined traditional medicine (including herbal drugs) as comprising of therapeutic practices that have been in existence, often for hundreds of years, before the development and spread of modern medicine and are still in use today. It has been estimated that more than one third of developing countries population still rely on traditional medicines. Most of these are plant drugs which are used to fulfil primary health needs Venkataswamy *et al.* (2010). Further, the turn of the century saw an increase in demand for natural products because of growing awareness regarding toxicity and side effects of chemical medication and other health products Affordability is another very important beside non-toxicity Ullah *et al.* (2010). This has resulted in higher demand of medicinal plants both in developing and developed countries.

Jain (2022) reported that remedies from herbal plants have the advantages of being less likely to cause allergic reactions having a less intense therapeutic impact and being safe. Three main factors are taken into consideration when selecting herbal raw materials as a

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source of pharmacologically active substances: a high concentration of active agents, easy growing techniques and ready supply of raw materials in the wild. It should come as no surprise that the COVID-19 pandemic has prompted people to try more home remedies. Radhika *et al.* (2021) found more than half (66.8%) of the respondents in her study on use of medicinal plants using traditional herbs and spices during COVID pandemic.

People believed in the effectiveness of medicinal plants and this belief was passed through generations. The passage was either through direct communication or observation. People interacting one to one socially or in group was the major source of dissemination and further diffusion. However, contemporary times are represented by generation which rely and trust information from electronic modes. At one end is a long-printed text and other a crisp message delivered in printed or an electronic mode or on an online platform. In this context, a comprehensive extension strategy is required which is suitable to ensure the passage of traditional knowledge along with making it popular among future generation to ensure its continuity in modern times. Such a strategy can be used by extension functionaries across the state not only to transfer traditional knowledge on health but also ensure their availability through planting them at household and commercial level.

Sidhu *et al.* (2012) recommended documentation to all available traditional knowledge and its validation as this knowledge is vanishing at a very fast rate and sincere efforts are required to transfer this knowledge to the younger generations. Sharma and Sidhu (2016) suggested for a planned approach for passage of indigenous knowledge of medicinal plants among masses. Understanding of basic properties and changing of perception can contribute to adoption of medicinal plants and their usage in a daily life particularly in preventing and curing health related issues. Therefore, there is a need for an in-depth analysis of different extension strategies comprising of both traditional and contemporary approaches for their popularizing potential.

MATERIALS AND METHODS

Experimental research design was used to implement the planned extension strategies for improving the perception regarding medicinal plants.

Locale: The study was conducted in Ludhiana district of Punjab. Five blocks namely Pakhowal, Doraha, Sudhar, Samrala and Jagraon were selected out of 13 blocks for convenience of strategy implementation. Keeping in view the nature of the design one village was randomly selected from each of these blocks. Hence a total of five villages namely Mansuran from Pakhowal, Rampur from Doraha, Bopa Rai Kalan from Sudhar, Bhagwanpura from Samrala and Pabian from Jagraon block were selected.

Sampling: Out of each of the village, a sample of 30 households having space for plantation with or outside the house were selected randomly for implementation of the strategy. Each household represented one unit for data collection and implementation of the selected strategy. Hence, a total of 150 households were selected as sample of the study and the female working head of the selected family was considered as the main target for implementation of the strategy and the sample of the study.

Designing and implementation of extension strategies: They refer to the combination of extension approaches developed for purpose of the study. Approach for the present study referred to the way or method in which information regarding medicinal plants was disseminated to the respondent. Combination of different approaches (individual, group and mass approach) were designed and implemented in form of a strategy to study their effectiveness in bringing about positive change in perception.

Combinations of strategy design has been given in Table 1.

Data collection tool and collection of data: In case of present study, perception referred to views of the respondents regarding medicinal plants and their use in terms of relative advantage compatibility, simplicity, trial ability, observability of medicinal plants and their use, based upon their knowledge and experiences. Perception was studied using a developed perception scale which consisted of twenty two statements. The responses were studied on five-point continuum scale for each item and total of the response was commuted and mean perception score regarding medicinal plants was worked out.

Table 1: Extension strategies and their implementation

Group	Approaches used
	1. Individual approach : Personal visit
	2. Group approach : Group meeting
	3. Mass approach : ICT- WhatsApp messages
Control group (CG)	No intervention /strategy used
Experimental group I (EGI)	Strategy I: Individual approach + Group approach
Experimental group II (EGII)	Strategy II: Individual approach + Mass approach
Experimental group III (EGIII)	Strategy III: Group approach + Mass approach
Experimental group IV (EGIV)	Strategy IV: Individual approach + Group approach + Mass approach

Scoring of statements	**Range**	**Categorization**
Positive statements:	Mean score range	Percentage of respondents were categorized as those
Strongly agree: 5	1-5	having the following mean perception score
Agree : 4		perception:
Undecided : 3		Negative perception: >3
Disagree : 2		Undecided: 3
Strongly disagree: 1		Positive perception: < 3
Scores were reversed for negative statements.		

Data was collected by personally interviewing the working female head of the before and after the intervention at a gap of one month of completion of intervention. Difference in pre and post intervention score determined the effectiveness of the strategy in bringing about change in perception regarding medicinal plants.

The respondents were also profiled for selected variables. One score was assigned to each year lived whereas education was scored according to its level. The annual income was scored as number of rupee earned annually by the family as a whole. Media exposure was calculated by taking into account the number of media used and frequency of their use.

Analysis of the data: Data related to profile of the respondents and perception was subjected to and interpreted in terms of mean score. Tukey's test was used for analysis of variance. Relationship was determined using Karl Pearson's Coefficient of Correlation (r).

RESULTS AND DISCUSSION

Age: Age ranged between 38.6 years to 44.9 years in different groups with the control group having an average age of 38.6 against slightly higher mean age of experimental group (42.4years). However this different was not found to be statistically significant. Among the experimental group, EGIV emerged as youngest with mean age of 39.9 years and EGI as oldest with 44.9 years of mean age. However, this difference was not statistically significant.

Hence it can be concluded that there was no significant difference in mean age of different groups.

Education: Comparison of educational level of control (3.7) and experimental groups (3.6) revealed that there was no significant difference between their educational levels. Experimental group I was the highest educated group with a mean education of 3.8 followed by experimental group II (3.7) and experimental group IV (3.5) even though the difference was not statistically significant.

Family size: The mean family size of the control group (3.6) and the experimental groups (4.02) on the whole was not found to be statistically different but was not the case within the experimental groups. Among experimental groups, EG II had highest mean of 4.3 members against lowest of 3.8 members in

Table 2: Distribution of respondents according to their profile (n=150)

Variable and its categories	CG	Experimental group				
	(n^c=30)	EGI (n^1=30)	EGII (n^2=30)	EIII (n^3=30)	EGIV (n^4=30)	EG (n^{eg}=120)
Mean age (in years 21-75)	38.6^A	44.9^a	40.3^a	44.7^a	39.9^a	42.4^A
Mean Education (in levels 1-7)	3.7^A	3.8^a	3.7^a	3.3^a	3.5^a	3.6^A
Mean family size (in numbers 2- 7)	3.6^A	3.8^{ab}	4.3^a	4.0^{ab}	4.0^{ab}	4.02^A
Mean family income (annual in rupees 1,00000-6,00000)	281667^A	306666^a	2916667^a	273333^a	290000^a	290417^A
Media exposure (Frequency of use 1-3)						
Print media	1.23^A	1.62^a	1.42^{ab}	1.45^{ab}	1.25^b	1.43^A
Electronic media	3.0	3.0	3.0	3.0	3.0	3.0
Social media	2.17^A	2.15^a	2.14^a	2.11^a	2.16^a	2.14^A
Mean media exposure (Frequency of use 1-3)	1.89^A	2.04^a	1.95^a	1.95^a	1.89^a	1.96^A

Mean values followed with same superscript are non-significant ($p>0.05$) using Tukey's test.

experimental group I. Both other groups were found to have on an average 4.0 family member families.

Annual family income: Family income ranged between rupees 1,00,000 lakh to rupees 6,00,000 lakh and it was nearly same in control and experimental groups with overall mean of 290417 in experimental group against 281667 in control group. There was non-significant difference in income of the experimental groups. Similar was the case in income of the control group and experimental groups.

Media exposure: Analysis of data pertaining to each type of media revealed that use of print media was significantly higher in experimental group I (1.62) against that of 1.45 in EG III and 1.42 in EGII. Least use was found among members of EGIV (1.25)

However, statistically the difference between the control (1.23) and experimental groups as a whole (1.43) was not statistically significant. The use of electronic media was only limited to television and there was no difference within experimental groups or between control and experimental groups.

As far as social media was concerned, the use was very high as compared to print media and there was no significant difference in its use between any type of groups even though the use was higher in CG (2.17) as compared to EG (2.14). Within experimental groups, EG IV was found to be using social media (2.16) more than other groups. Its use was least in EGIII (2.11).

The data was analyzed for overall use of media. It revealed that media exposure of control group (1.89) was lower than that of experimental groups (1.96). Only experimental group I had mean score higher than 2.0. This was not statistically different from lower scores of EG I, EGII (1.95) and EGIV (1.89). Perception regarding medicinal plants was studied before and after the intervention which revealed a major shift or change in perception. The difference between the pre and post perception score has been presented in Table 2.

There was major change in mean perception score for all items in control group and experimental groups. Regard to the individual items difference was observed in each of the case. Comparative data between experimental groups shows that change in perception was highest in experimental group I in case of items pertaining to safety of use of medicinal plants as compared to allopathic medicine (mean value = 1.57) followed by their use for animals experimental group II scored lesser for all items than other groups except perception that ancestors also used medicinal plants for health (mean value = 2.94). Experimental group III however had highest mean difference score on items pertaining to perception that medicinal plants have healing properties (mean value = 1.87) and can be added easily into our daily diet (mean value = 1.87). Experimental group III also scored highest on change in perception with regard to use of plants in prevention of health problems (mean value = 1.83).

Table 3: Change in perception regarding different aspects of medicinal plants for health care before and after intervention (Range 1-5)

Perception items	CG	Experimental Group				
		EGI	EGII	EGIII	EGIV	EG
Medicinal plants help in prevention ofhealth problems	0.23	1.47	1.56	1.83	1.37	1.55
Medicinal plants are used for their healing properties	0	1.25	1.57	1.87	1.55	1.56
Taste of herbal medicines acceptable to users	0	2.16	2.1	2.16	2.55	2.23
People like the smell of medicinal plants	0	2.08	2.2	2.3	2.73	2.33
Medicinal plants provide eco-friendlyhealth products at household level	0	1.38	1.24	1.33	1.68	1.37
Medicinal plants can be part of our daily diet	0.67	1.61	1.4	1.87	1.45	1.58
Medicinal plants are safer than allopathic medicines.	0	1.57	1.42	1.53	1.38	1.47
Use of medicinal plant-based remedies keep us free from side effects of allopathic medication	0	1.31	1.24	1.13	1.45	1.26
Medicinal plants remedies are time tested	0.03	1.49	1.27	1.4	1.37	1.37
Medicinal remedies can be used for animals	0	1.57	1.55	1.47	1.57	1.53
Medicinal plants are cost effective	0	2.11	2.1	2.16	2.55	2.23
Intake of medicinal plant-based products is standardized	0.1	2.31	2.27	2.33	2.62	2.38
Routine use of medicinal plants saves our time by preventing health problems	0	1.4	1.37	1.2	1.63	1.4
Allopathic medicines are as readily available medicinal plants	0	1.14	1	1.07	1.38	1.09
Growing medicinal plants can be a goodsource of income for the farmers	0	1.51	1.31	1.27	1.4	1.36
Medicinal plant-based enterprises can help to generate employments	0	1.37	1.41	1.64	1.45	1.47
Medicinal plants are easy to use in present day lifestyle	0.2	2.29	2.37	2.1	2.52	2.34
Our ancestors had been using medicinalplants for health	0	1.63	2.94	1.2	1.13	1.27
Medicinal plants are used in religious rituals	0	1.43	1.2	1.34	1.33	1.25
Medicinal plants- based products had always been part of our daily diet	0.1	1.13	1.29	2.1	1.77	1.6
Medicinal plants can be grown easily	0	1.09	1.16	1.2	1.17	1.2
Use of medicinal plants at household level is easy	0	1.09	0.83	1.2	1.15	1.11

Respondents in experimental group IV had highest perception shift in half of the items. Highest among these items was for people liking the smell of the plants (mean value = 2.73) followed by standardization of medicinal plants-based products intake (mean value = 2.62) and acceptability of taste (mean value = 2.55). Perception regarding cost effectiveness (mean value = 2.55) and easy of using them in present lifestyle (mean value = 2.52) also saw highest mean change in perception in experimental group IV.

Highest mean score among the experimental groups can also be seen in experimental group III as far as perception regarding the medicinal plants being part of our daily diet (mean value = 2.1), medicinal plants based enterprises helping in set generations employment (mean value = 1.64), these being part of daily diet (mean value = 2.1), easy of growing (mean value = 1.2) and their easy use at household level (mean value = 1.2). Highest change in experimental groups was observed in aspects such as intake of medicinal based products is standardized (mean value = 2.38) followed by easy of using medicinal plants in present lifestyle (mean value = 2.34), liking the smell of medicinal plants (mean value = 2.33) taste (mean value = 2.23) and cost of medicinal plants (mean value = 2.23). Least change was found in readily available of allopathic medicines in easy using of medicinal plants at household level (mean value = 1.11) and easy of growing medicinal plants (mean value = 1.2).

In spite of no intervention in control group, change in perception was observed in perception in few aspects. These aspects were their being part of daily

Table 4: Change in perception regarding medicinal plants for health care before and after intervention

Perception level (Range 1-5)	Control group	Experimental groups				
	CG	EGI	EGII	EGIII	EGIV	EGV
Pre intervention	2.71	2.65	2.65	2.75	2.72	2.32
Post intervention	2.77	4.21	4.14	4.38	4.39	3.43
Difference	0.06	1.56^{B}	1.49^{B}	1.63^{AB}	1.67^{A}	1.11
't' value	9.10**	26.58**	42.78**	55.47**	55.53**	76.18**
't' valueCG and EG	36.43**					

Mean values followed with different superscripts are significant different ($p<0.05$) using Tukey's test
**significant at 0.01 level

diet (mean value = 0.67), help in prevention of health problem (mean value = 0.23), easy of using in present day lifestyle (mean value = 0.2) followed by standardization of plant products and plant based products been part of our daily diet (mean value = 0.1) along with they being time tested (mean value=0.03).

Data in Table 4 shows the perception score before and after the intervention and the difference in these scores. Score in all groups increased irrespective of the intervention. Least difference among experimental groups was observed in experimental group II (mean value = 1.49) followed by the experimental group I (mean value = 1.56) experimental group III (mean value = 1.63) and experimental group IV (mean value = 1.67). This difference in pre intervention and post intervention perception score was found to be highly significant at in all the experimental groups (1% level of significance). In all experimental groups taken together, the increase in score from 2.32 to 3.34 was significantly different at 1% level of significance. Change in perception in CG was also evident (difference mean value = 0.06) and was found to be significant. Further, mean perception difference between experimental group and control group was also significant at 1% level of significance (t value =36.43**). Data was further analyzed to determine the statistical significance of pre-intervention and post-intervention change in perception between four experimental groups. Results shows that the mean difference was statistically significant. Hence, showing that all four groups were significantly different as far as the change in perception of respondents was concerned after the intervention except group experimental group I and experimental group II as there was no significant difference between these two groups.

Data pertaining to characteristics of the respondents and their families was analysed to study their relationship with change in perception of medicinal plants for health care after the intervention. It was found that none of the characteristics was related to change in perception except for one variation.

Table 5: Relationship of respondent profile and change in perception

Variables	Perception
Age	0.0560^{NS}
Education	0.0872^{NS}
Family size	-0.0055^{NS}
Annual Income	0.21146*
Media exposure	0.0169^{NS}

**significant at the 0.01 level; *significant at the 0.05 level
NS: Non-significant

Significant and positive relationship was found between annual income of the family and perception of the respondents. This shows that only annual income was positively and significantly related to perception. The relationship between all other variables was however positive although non-significant.

Hence, it can be concluded the profile characteristics of control and experimental group were mostly at par. There was non-significant difference in their age and education. Respondents in different groups were having similar level of media exposure. It can be concluded that all groups were at par as far as the profile of the respondents was concerned with only an exception of family size which varied significantly within the experimental groups but was not found to be related to change in perception. Findings regarding the profile characteristics of rural women were

consistent with the results of findings of research studies conducted in Punjab by Batra *et al.* (2018); Kaur (2022); Ginwal (2019); Kaur *et al.* (2023) and Kaur (2023). Therefore, any change in perception after the intervention can be attributed to the intervention and not to the profile of the respondents.

Change in perception regarding smell, taste, cost effectiveness, standardization of products and ease of using medicinal plants for health was maximum in all experimental groups after the intervention. Change in perception was significantly different in control and experimental groups. Change in perception was evident in all aspects and was very much evident in some aspects particularly the smell, taste, cost, standardization, eco-friendly and easy of using medicinal plants. In some other aspects, the change was less evident as respondents were already having positive perception as in case of ability of medicinal plants to prevent health issues, they having healing properties, safer to use, having no side effects, use by ancestors and during religious rituals.

However, perception change was not very high as far as availability and ease of growing was concerned. Hence, there is a need to focus more on these aspects while designing and implementing extension strategies. Creating more awareness and imparting knowledge is the key to bringing change in perception. Sharma and Sidhu (2016) also found women to be aware of very few properties of medicinal plants. They also found that some plants were used more than other because women were more aware of their properties Sharma and Sidhu (2017) suggested that use of medicinal plants is only possible in health care if people become aware of their properties, plants are easily available and people know the standardized method of using them for different purpose. Foo *et al.* (2016) found perception regarding medicinal plants to be positive as was not the case for different aspects of the present study where perception was neutral before the intervention. Perception towards medicinal plants improved during Covid-19 and so was its use. Khadka (2021) and Radhika *et al.* (2021) found increased use of medicinal plants to fight against Covid-19.

Hence, it can be concluded that the intervention had a very significant impact leading to change in perception. This was more so in light of similarity of most of the profile characteristics. None of the characteristics were related to this change in perception other than the annual income of the family. Annual income might be having an impact because higher income families may be having more space to plant, time to prepare home based remedies and use medicinal and even have more exposure due to more movement outside the village. Sharma and Sidhu (2016); Jyoti and Kaur (2016) recommended planned extension strategies and the capacitation of extension workers to ensure passage of indigenous knowledge for health care through use of medicinal plants.

Even through all the strategies brought about positive change in perception but change was significantly different within each of the experimental groups, clearly pointing towards variation in effect of each strategy on perception. Keeping in view the mean difference score, strategy IV was found to be the best strategy to change perception regarding medicinal plants for health care. The second-best strategy was strategy III and least effectiveness was strategy II (Individual + Mass approach). Analysis of the strategies in light of perception score can be justified as experimental group IV (Individual + Group + Mass) was exposed to all three approaches (Individual + Group + Mass). But in experimental group III, only group and mass approach was used but even through perception was statically different but mean score difference between experimental group III and IV was of only 0.04 (1.63 and 1.67 respectively). Experimental group III had much lower resource input as compared to that used during intervention in experimental group IV in terms of time and effort spent in individually contacting and visiting the families.

Comparison of experimental group II (Individual and groups) and III again proves that efforts involved in personal approach paid lesser dividends as compared to use of ICT in experimental group II. Past studies also suggest that media use can effectively make desired impact. Use of media package for enhancing the domestic use of *Neem* was also found to be very effective by Sidhu as early as 2009. Later, many studies have substantiated the point.

Hence, it can be concluded that use of ICT/mass approach along with group approach was predominantly effective in bringing change in

perception regarding medicinal plants. Its use along with group approach can be more useful taking into account the time spend on individual personal contacts. Use of medicinal plants for health being mostly based upon Indigenous Traditional Knowledge (ITK), the group approach where people interact among each other was found effective. Mass approach in form of use of ICT in groups which have potential of mass diffusion effect and has an inbuilt mechanism for group discussions can be very useful. ICT based solutions were also recommended by Beebwa *et al.* (2009). Mittal (2018) also found extensive use of different mobile applications for varied purposes which included information seeking also as was found in the present study. Maniar and Modi (2014) found that there were several social networking applications used by people according to their interest. Among these, WhatsApp is an application which is being used by people for many functions such as communication.

CONCLUSION

The gradual transfer of information about medicinal plants and their properties from generation to generation has been hampered. Results point out that transfer from past to present contemporary generation is necessary for sustaining and enhancing the use of medicinal plants. Understanding of basic properties and changing of perception can contribute to adoption of medicinal plants and their usage in a daily life particularly in preventing and curing health related issues. Therefore, there is a need for selecting suitable extension strategies according to their popularizing potential.

RECOMMENDATION

All approaches used together generate very positive change in perception but group and mass approach combined together is the best strategy among those strategies in which only two approaches are used. It is more so in view of rationalisation of both human and non-human resources in extension.

REFERENCES

Batra, A.; K. Sudhu and S. Sharma. 2018. Characteristics of women WhatsApp users and use pattern. *Journal of Education, Society and Behavioural Science,* 28(4): 1-7.

Beebwa, I.E.; J.C. Marwa and M. S. Dida. 2019. Stakeholders attitude on the use of ICT tools for sustainable propagation of Indignous Knowledge in Tanzania:a case of traditional medicinal knowledge of medicinal plants. *Information Technology and Computer Science,* 11(4): 34-43.

Foo, J.; A. Latiff; M. Omar and A.A. Amir. 2016. Women's perception on medicinal plants in traditional tamu west coast sabah Malaysia, *Malayan. National Journal,* 68(3): 95-104.

Ginwal, P. 2021. Effectiveness of extension methods for disseminating knowledge on household waste management. M.Sc. Thesis. Punjab Agricultural University, Ludhiana, India.

Jain, B.V.; R.M. Usman; R.S. Pati and K.D. Baviskar. 2022. Medicinal plants and herbal concoctions on the rise post covid-19 pandemic threat – an exploratory study. *Journal of Coastal Life Medicine,* 11(1): 913-919.

Jyoti, J. and S. Kaur. 2016. Indigenous use of medicinal plants for digestive problems in Punjab. *International Journal of Home Science,* 3(1): 230-235.

Kaur, J. 2022. Development of video modules for creating awareness on safe and judicious use of chemicals at household level, (MSc. Thesis, Punjab Agricultural University, Ludhiana, Punjab, India).

Kaur, L. 2023. Effectiveness of extension strategies for disseminating household water management practices, (Ph.D. dissertation. Punjab Agricultural University, Ludhiana, Punjab).

Khadka, D.; M.K. Dhamala; P. C. Aryal; P.P. Magar; S. Bhatta; M.S. Thakur; A. Basnet; D. Cui and S. Shi. 2021. The use of medicinal plants to prevent COVID-19 in Nepal. *Journal of Ethnobiology and Ethnomedicine,* 17(26): 1-17.

Maniar, A. and A. Modi. 2014. Educating WhatsApp generation through "WhatsApp". *International Journal of Multidisciplinary Research,* 4(8): 23-38.

Mittal, P. 2018. Usage pattern of mobile phone applications, (M.Sc. thesis, Punjab Agricultural University, Ludhiana, India).

Sharma, S. and K. Sidhu. 2016. Awareness of rural women regarding medicinal plants for respiratory problems. *International Journal of Home Science,* 2(1): 144-149.

Sharma, S. and K. Sidhu. 2016. Create awareness to enhance the use of medicinal plants. *International Journal of Medicinal Plants,* 110(1): 752-763.

Sharma, S. and K. Sidhu. 2017. Indigenous knowledge of medicinal plants for respiratory problems. *Journal of Community Mobilization and Sustainable Development,* 12(1): 146-153.

Sidhu, K. 2009.Designing and Development of Media on Versatility of Neem. *Kamla Rajasthan,* 2(1): 47-50.

Ullah, R.; Z. Hussain; Z. Iqbal; J. Hussain; F.U. Khan; N. Khan; Z. Muhammad; S. Ayaz; S. Ahmad; N.R. Rehman and I. Hussain. 2010 Traditional uses of medicinal plants in Darra Adam Khel NWFP Pakistan. *Journal of Medicinal Plants Research,* 4(17): 1815-1821.

Venkataswamy, R.; A. Doss; M. Sukumar and H.M. Mubarack. 2010 Preliminary phytochemical screening and antimicrobial studies of *Lantana indica* roxb. *Indian Journal of Pharmaceutical Sciences,* 72(2): 229-231.

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Research Article

Assessment of Knowledge and Relationship Regarding Improved Turmeric (*Curcuma Longa* L.) Cultivation Practices

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ABSTRACT

This paper examines farmers' knowledge of improved turmeric cultivation practices and their relationship with personal profiles in the Udaipur district, Rajasthan. Known as the "Goldmine of India," turmeric is widely cultivated there. The study encompassed 100 turmeric growers from the Jhadol and Gogunda panchayat samities, using a pre-structured interview schedule for data collection. The results indicated that 71 per cent of respondents possessed a medium level of knowledge regarding improved cultivation practices. Additionally, no significant difference was found between the two panchayat families regarding knowledge levels. The analysis further revealed a significant positive correlation between knowledge levels and factors such as age, landholding size, education level, and annual income.

Keywords: Spices, Turmeric, Growers, Knowledge, Relationship, Cultivation, Practices

INTRODUCTION

Turmeric (*Curcuma longa* L.), often called "Indian saffron," is an ancient and sacred spice native to India and widely cultivated in Southeast Asia. It is an essential commercial spice crop, with India having over 45.28 lakh hectares devoted to various spices and condiments, producing approximately 106.79 lakh tonnes annually (Ministry of Agriculture & Farmers Welfare, 2021). The significant production growth has led to enhanced availability of quality spices for export.

In Rajasthan, Udaipur district ranks as the second-largest producer of turmeric, with a cultivation area of 55 hectares and a production of 102 metric tonnes in the year 2020-21. The climate in Udaipur district is particularly favourable for turmeric cultivation; however, the area dedicated to this crop is relatively small and has declined rapidly over the years.

With this context in mind, the present study titled "Knowledge and Adoption of Improved Turmeric Cultivation Practices by Farmers in Udaipur District of Rajasthan" was initiated to explore this critical topic in the region.

MATERIALS AND METHODS

The present study was conducted in the Udaipur district of Rajasthan, as it has the largest area under turmeric cultivation in the MPUAT service area during 2020-21, and its climatic conditions are most suitable for turmeric cultivation. Two panchayat samiti, Jhadol and Gogunda, which have the most significant areas of turmeric cultivation, were selected for this study. From each panchayat samiti, five villages were identified based on their maximum turmeric farming areas, resulting in ten villages being included in the investigation. Ten farmers were randomly selected from each town, leading to 100 turmeric growers participating in the study. An ex-post-facto research design was employed for this investigation. A personal interview technique was employed to collect data from

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the selected respondents. The data were analyzed using the mean, standard deviation, rank, Z test, and Pearson correlation coefficient to interpret the results.

RESULTS AND DISCUSSION

Knowledge as a body of understood information an individual possesses is an essential component of behaviour and plays a vital role in adopting an innovation. Keeping this view in mind, the farmers' level of knowledge about improved turmeric cultivation practices was assessed. The data in Table 1 indicates that out of 100 respondents, the majority (71.00%) of respondents fell in the medium-level knowledge group. Meanwhile, 17.00 per cent of respondents possessed a high level of knowledge about improved turmeric cultivation practices, and the remaining 12.00 per cent of turmeric growers were observed in the low-level knowledge group. The findings are supported by the findings of Kumar *et al.* (2014) and Bheemudada and Natikar (2016).

Further examination of data from Table 1 reveals that 14.00 per cent of respondents of Jhadol panchayat samiti and 12.00 per cent of respondents of Gogunda panchayat samiti had little knowledge about improved turmeric cultivation practices. Whereas 64.00 and 76.00 per cent of respondents of Jhadol and Gogunda panchayat samities possessed a medium level of knowledge about improved turmeric cultivation practices, respectively. The findings are in line with Narinder Paul *et al.* (2021) and Kumar and Bairathi (2016). On the other hand, 22.00 per cent of respondents of Jhadol panchayat samiti and 12.00 per cent of respondents of Gogunda panchayat samiti had a high level of knowledge about improved turmeric cultivation practices.

To get a clear picture of knowledge possessed by turmeric growers, aspect-wise knowledge of turmeric growers was worked out. The results of the same have been presented in Table 2.

The data presented in Table 2 shows that "Knowledge about the harvesting of the crop" was ranked first with a total MPS 72.00. Meanwhile, MPS for respondents of Jhadol panchayat samiti was 71.00 and ranked second. MPS for respondents of Gogunda panchayat samiti was 73.00 and was ranked first. "Knowledge about soil and field preparation" was at second place with a total MPS of 70.00 and in respondents of Jhadol panchayat samiti, it stands at first with an MPS 73.00 and in respondents of Gogunda panchayat samiti, it stands at third place with MPS 67.00.

The data presented in Table 2 also shows that the "Knowledge about irrigation schedule" aspect was ranked third with a total MPS 69.00. While, in respondents of Jhadol panchayat samiti, it has 68.00 MPS with third rank, and in respondents of Gogunda panchayat samiti, it has 70.00 MPS with second rank. "Knowledge about seed and sowing" ranked fourth with a total MPS of 63.87. While in respondents of Jhadol and Gogunda panchayat samities with MPS 62.75 and 65.00, respectively. It stands fourth among respondents of both panchayat samities.

Further analysis of Table 2 reveals that "Knowledge about seed storage" with a total MPS of 51.50 and was ranked fifth. Also, MPS 51.00 was for respondents of Jhadol panchayat samiti, and MPS 52.00 was for respondents of Gogunda panchayat samiti with fifth rank for respondents of both panchayat samiti. "Knowledge about manures and fertiliser application" with a total MPS of 49.87, standing at sixth position. Whereas respondents of Jhadol and Gogunda panchayat samities stand at sixth position with MPS 50.75 and 49.00, respectively.

Table 1: Distribution of respondents according to their knowledge about improved turmeric cultivation practices

Knowledge Level	Jhadol Panchayat Samiti (n_1=50)		Gogunda Panchayat Samiti (n_2=50)		Total (n=100)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Low (< 24.57)	7	14.00	6	12.00	12	12.00
Medium (24.57-31.58)	32	64.00	38	76.00	71	71.00
High (> 31.58)	11	22.00	6	12.00	17	17.00
Total	50	100	50	100	100	100

Table 2: Aspect-wise knowledge of respondents about improved turmeric cultivation practices

Knowledge level	Jhadol Panchayat Samiti (n_1=50)		Gogunda Panchayat Samiti (n_2=50)		Total (n=100)	
	MPS	Rank	MPS	Rank	MPS	Rank
Improved varieties	34.53	8	32.40	8	33.46	8
Soil and field preparation	73.00	1	67.00	3	70.00	2
Seed and Sowing	62.75	4	65.00	4	63.87	4
Manures and Fertilizer application	50.75	6	49.00	6	49.87	6
Irrigation schedule	68.00	3	70.00	2	69.00	3
Plant protection measures	25.16	9	26.00	9	25.58	9
Harvesting of crop	71.00	2	73.00	1	72.00	1
Curing and Marketing of crop	50.66	7	46.66	7	48.66	7
Seed storage	51.00	5	52.00	5	51.5	5

MPS = Mean per cent score

Table 2 shows that "Knowledge about curing and Marketing of crop" ranked seventh with a total MPS of 48.66. While in respondents of Jhadol and Gogunda panchayat samities with MPS of 50.66 and 46.66, respectively. It stands at seventh rank for respondents of both panchayat samities.

"Knowledge about improved varieties" with a total MPS of 33.46 and was ranked eighth. Also, MPS 34.53 was for respondents of Jhadol panchayat samiti, and MPS 32.40 was for respondents of Gogunda panchayat samiti with eighth rank for respondents of both panchayat samities.

Last, "Knowledge about plant protection measures" with a total MPS of 25.58 and stands at ninth position. Whereas respondents of Jhadol and Gogunda panchayat amenities stands at ninth position with MPS 25.16 and 26.00, respectively. The results are in line with Avdhesh Kumar *et al.* (2024).

To find out the significance of the difference between the farmers of selected panchayat samiti with respect to their knowledge, the 'Z' test was applied. Table 3 shows that the calculated value of 'Z' (0.74) is less than its tabulated value at a 5 per cent significance level. Thus, the null hypothesis (NH_{01}) is accepted, and the research hypothesis is rejected. So, we conclude that there is no significant difference between the turmeric growers of two selected panchayat samiti with respect to the knowledge of improved turmeric cultivation practices.

To determine the correlation between farmers' profiles and their knowledge levels, a t-test was used, and the interpretation was made based on the r value.

The result in Table 4 indicated that age was highly significantly related to knowledge having a r-value of 0.25718 at 1% significance level. A possible reason for this significant relationship between the age of turmeric growers and their knowledge level of improved turmeric cultivation practices and age increase there is an increase in the knowledge of respondents. Therefore, the null hypothesis was rejected, stating that there was no significant relation between the age of respondents and their knowledge.

Type of house had a non-significant relationship with the knowledge of respondents about improved turmeric cultivation practices with an R-value of 0.125778. Thus, the null hypothesis was accepted,

Table 3: Comparison of knowledge between turmeric growers of selected Panchayat Samiti

Category of sample	Mean	S.D.	'Z' Value
Respondents of Jhadol Panchayat Samiti	28.34	3.80	0.74
Respondents of Gogunda Panchayat Samiti	27.82	3.18	

NS- non-significant

Table 4: Relationship between personal characteristics of turmeric growers with their knowledge (n=100)

Variables	Correlation Coefficient (r - value)
Age	0.25718**
Type of house	0.125778^{NS}
Family type	0.173163*
Annual income of farmers	0.204552*
Caste	0.148519^{NS}
Land holding	0.236078**
Education level	0.247773**
Source of information	0.167731*

'*' Significance at 5% level, '**' significance at 1% level, 'NS' Non-significant

stating that there was no significant relation between the type of house and knowledge.

Table 4 also depicts that farmers' family type and annual income are significant related to their knowledge at 5 % significance with r-values of 0.173163 and 0.204552, respectively. So, the null hypothesis for both was rejected.

Caste had a non-significant relationship with the knowledge of respondents about improved turmeric cultivation practices, with an r-value of 0.148519. Thus, the null hypothesis was accepted, stating that there was no significant relation between caste and knowledge.

The result in Table 4 indicated that land holding and education level had a significant relation with respondents' knowledge at a 1% significance level with r-values of 0.236075 and 0.247773, respectively. Therefore, the null hypothesis was rejected for both variables. The findings were in conformity with the research findings of Kumari *et. al.* (2017).

The result in Table 4 indicated that sources of information were found to have a significant relation with knowledge at a 5% significance level with r-value of 0.167731, respectively. So, the null hypothesis was rejected.

CONCLUSION

The study showed that most farmers had limited knowledge of improved turmeric cultivation practices. In Gogunda, more farmers had medium knowledge, while Jhadol had slightly more high knowledge. Knowledge about harvesting was highest, while plant protection measures were the lowest. No significant difference existed in knowledge levels between the two regions. Factors influencing knowledge included age, education, landholding size, income, and information sources, while caste and housing type did not matter. To improve knowledge in low-ranking areas like plant protection and improved varieties, targeted training programs are recommended, focusing on education and access to information relevant to the needs of Jhadol and Gogunda. Strengthening information dissemination and farmer support systems will help boost the adoption of better practices.

REFERENCES

Bheemudada, A.B. and K.V. Natikar. 2016. A study on the knowledge level of farmers about the ginger cultivation practices and constraints in adoption of improved practices. *Journal of Farm Sciences*, 29(1): 133-134.

Bhupenchandra, I.; S.K. Chongtham; Y.P. Devi; G. Kamei; S. Sinyorita and E.L. Devi. 2023. Yield Gap Analysis, Performance and Productivity Evaluation of Turmeric (*Curcuma longa*) as Impacted by Induction of Integrated Nutrient Management Under Frontline Demonstration in North East India. *Journal of Community Mobilization and Sustainable Development,* 18(2): 547-554.

Biradar, G.S.; H.V. Kumar and S.B. Nagaraj. 2013. Knowledge Level of Farmers about Improved Chilli Cultivation Practices. *Environment & Ecology*, 31(2B): 828-831.

Chavai, A.M.; A.S. Yamgar and P.K. Barange. 2015. Knowledge and adoption of turmeric growers about post-harvest technology. *Journal of Agriculture Research and Technology*, 40(3): 476.

Choudhary, R. and N.K. Punjabi. 2012. Knowledge of farmers about coriander production technology. *Rajasthan Journal of Extension Education*, 20: 233-237.

Kumar, A.; M. Kumar; V. Kumar and R. Shanker. 2024. The Constraints Face by the Respondent in Adoption of Sugarcane Cultivation Practices in Khumbi Block of Lakhimpur Kheri District of Uttar Pradesh. *Journal of Community Mobilization and Sustainable Development,* 19(2): 315-318.

Kumar, S.; H. Lal and H.S. Bunkar. 2014. Extent of adoption of recommended coriander production technology by the farmers. *Indian Journal of Extension Education and Rural Development*, 22: 177-179.

Kumar, V. and R. Bairathi. 2016. Knowledge of tribal beneficiaries about Employment generation activities of KVK. *Indian Journal of Extension Education and Rural Development*, 24(1): 129-133.

Kumari, B.; S.V. Prasad; V. Sailaja; B. Aparna and M.G. Naidu. 2017. Relationship Between Profile Characteristics of the Farmers with Extent of Adoption of Indigenous Agricultural Practices in Rayalaseema Region of Andhra Pradesh. *Bull. Env. Pharmacol. Life Science*, 6(1).

Morwal, B.R.; P. Pagaria and S. Das. 2020. Knowledge and adoption of recommended cumin production technology by the farmers in Barmer district of Western Rajasthan. *Journal of Pharmacognosy and Phytochemistry*, 9(4): 620-623.

Olajide-Taiwo, F.B.; I.B. Adeoye; T.A. Fariyike; O.M. Adewale; S.O. Babalola and S.O. Afolayan. 2018. Effect of Capacity Building Training Workshop on Participants' Knowledge of Production Techniques in Ginger and Turmeric in Ibadan Metropolis, Oyo State, Nigeria. *Growth*, 18: 797-802.

Paul, N.; R.K. Arora; A.S. Charak; G.N. Jha and R. Kour. 2021. Commodity Village Approach for Enhancing Knowledge and Adoption of Garlic (*Allium sativum* L.) Production Technology. *Journal of Community Mobilization and Sustainable Development*, 16(1): 59-64.

Singh, R.K.; S. Verma; V. Mittoliya and S.K. Tyagi. 2015. Impact of KVK training programme on socio-economic status and knowledge of farmers in Khargone district of Madhya Pradesh. *Journal of Community Mobilization and Sustainable Development*, 10(1): 43-45.

Singh, S.; M.A. Khan and M.L. Sharma. 2021. Impact of farmers training programme on Knowledge and adoption of scientific production techniques of major spices in Chhattisgarh. *The Pharma Innovation Journal*, 10(9): 210-213.

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Research Article

Introduction to the Morphological Characterization of Star Apple (*Chrysophyllum cainito*)

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ABSTRACT

Star apple (*Chrysophyllum cainito*), a tropical fruit from the Sapotaceae family, is valued for its fruit, ornamental appeal, and medicinal potential. This study evaluated nine genotypes from Kerala, showing variability in tree height, yield, and shelf life. Tree height ranged from 2.54 m to 9.36 m, with larger trees like Collection 09 yielding more. Shelf life ranged from 3 to 6 days, with Collection 08 having the longest shelf life. PCA and correlation analysis showed tree height and age were positively correlation with yield. High-yielding genotypes like Collection 09 and those with superior shelf life, like Collection 08, are promising for breeding and commercial use.

Keywords: Star apple, Variability, PCA, Genotypes, Shelf life, Correlation

INTRODUCTION

The star apple (*Chrysophyllum cainito*), a semi-domesticated member of the Sapotaceae family, is a tropical fruit tree cultivated widely for its edible fruits, ornamental value, and medicinal properties. Native to the neotropics, particularly Mesoamerica and the Antilles, it has adapted to diverse environments through both natural dispersal and human-mediated cultivation (Petersen *et al.*, 2012). This species is valued for its rich phenotypic diversity, which includes variations in leaf, flower, and fruit morphology (Mbagwu *et al.*, 2015; Ekeke *et al.*, 2021).

The star apple has been widely studied for its impressive range of health benefits, thanks to its rich composition of bioactive compounds. The fruit's antioxidant properties, primarily attributed to its high polyphenol content, help combat oxidative stress and may reduce the risk of chronic diseases such as cardiovascular disease, diabetes, and cancer (Rosa *et al.*, 2021). In addition, *C. cainito* has demonstrated anti-inflammatory effects that could play a role in alleviating inflammatory conditions such as arthritis and asthma (Adebayo *et al.*, 2020). The leaves of the star apple have been shown to possess hepatoprotective effects, suggesting its usefulness in preventing liver damage caused by toxins (Almeida *et al.*, 2016). Additionally, *C. cainito* has exhibited hypoglycemic effects, making it a promising candidate for managing diabetes by lowering blood sugar levels. Beyond its medicinal properties, the fruit is a valuable source of vitamins and minerals. Collectively, these findings suggest that *Chrysophyllum cainito* could be a potent natural resource for improving human health, particularly in the areas of inflammation, infection control, liver health, and blood sugar regulation. Morphologically, *C. cainito* is characterized by its tall stature (8–30 meters), symmetrical branching, and leaves with a glossy green upper surface and golden-brown pubescence beneath (Morton, 1987). The fruits are notable for their leathery skin, sweet milky

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pulp, and star-shaped pattern when cut transversely, which has inspired its common name (Morton, 1987). Variations in fruit color, size, and internal structure further underscore its phenotypic plasticity (Mbagwu *et al.*, 2015; Prasawang and Srinual, 2020).

Leaf anatomical studies have revealed diagnostic traits such as paracytic stomata, T-shaped trichomes, and unique vascular bundle arrangements, which are instrumental in distinguishing *C. cainito* within the genus *Chrysophyllum* (Ekeke *et al.*, 2021). These features not only facilitate taxonomic identification but also reflect adaptations to its tropical environment (Prasawang and Srinual, 2020).

The species' phenology, including flowering and fruiting cycles, has significant implications for cultivation and breeding programs. Moreover, its high antioxidant content and potential health benefits enhance its agricultural and medicinal importance (Williams and Benkeblia, 2018; Luo *et al.,* 2002). Efforts to document the morphological and genetic diversity of *C. cainito* contribute to understanding its domestication history, ecological adaptation, and potential for crop improvement (Petersen *et al.,* 2012; Zheng *et al.,* 2020).

This study focuses on the detailed morphological characterization of *Chrysophyllum cainito*, exploring its structural, anatomical, and phenotypic diversity. Such research forms the foundation for sustainable utilization, conservation, and genetic enhancement of this versatile tropical species.

MATERIALS AND METHODS

A survey was conducted to collect nine genotypes of star apple (*Chrysophyllum cainito*) from farmers' fields across Kerala during 2023-24. The collections included eight genotypes from different locations in Thrissur district and one from Kozhikode district. Details of the collected genotypes are provided in Table 1.

Morphological observations of the collected genotypes were recorded directly in the field using descriptors specified in the NBPGR minimal descriptor (Mahajan *et al.*, 2002). These descriptors were used to document traits such as leaf, stem, and fruit characteristics, ensuring uniformity and standardization in data collection. Leaf color was assessed using the Royal Horticultural Society (RHS) color chart for precise and consistent measurement.

Table 1: List of genotypes and their collection places

Genotypes	Place of collection
Collection 01	Nadathara, Thrissur
Collection 02	Nadathara, Thrissur
Collection 03	Nadathara, Thrissur
Collection 04	Nadathara, Thrissur
Collection 05	Vellanikkara, Thrissur
Collection 06	Vellanikkara, Thrissur
Collection 07	Vellanikkara, Thrissur
Collection 08	Vellanikkara, Thrissur
Collection 09	Kozhikode, Mukkam

The collected morphological data were analyzed statistically using Grapes software. Principal component analysis (PCA) was conducted to identify and rank the traits contributing most significantly to variability among the genotypes. A biplot was generated to visualize the inter-relationships among traits and genotypes.

RESULTS AND DISCUSSION

The morphological characterization of the star apple genotypes revealed significant variability in quantitative traits while qualitative traits showed notable uniformity. Tree height ranged from 2.54 m in Collection 07 to 9.36 m in Collection 09, showcasing a wide spectrum of growth habits. Larger trees, such as those in Collection 09, may indicate greater canopy development and potential for higher productivity, while smaller trees, such as Collection 07, suggest suitability for compact planting systems or regions with space constraints. These differences are likely due to variations in genetic factors and resource utilization efficiency.

Tree age ranged from 3 to 6 years, providing a uniform baseline for comparison of other traits. Although age did not correlate significantly with yield or morphological characteristics, it offered consistency for assessing trait variability without developmental bias. The flowering duration was uniform across all genotypes, lasting two months, ensuring synchronized fruiting periods, which is beneficial for commercial harvesting and marketing strategies.

Shelf life varied notably among genotypes, with Collection 08 exhibiting the longest shelf life of 6 days, making it a standout candidate for commercial and

post-harvest applications. Other genotypes showed shelf lives of 3 to 5 days, sufficient for typical supply chains but less desirable for extended storage needs. This trait highlights genetic potential for enhancing post-harvest durability through selective breeding.

Qualitative traits demonstrated notable uniformity. Leaf colour across all genotypes was consistently dark green on the upper surface and dark brown on the lower surface. Similarly, the position of the inflorescence was terminal and axillary in all genotypes, and the flower colour remained greenish-white throughout the population. Fruit shape was consistently round across all genotypes, which aligns well with market preferences but limits the potential for diversifying fruit morphology through breeding programs. Such uniformity in key qualitative traits suggests a stable genetic makeup and selective advantage for these characteristics.

Branching pattern and crown shape, although less emphasized, displayed subtle yet important variations among genotypes. Branching patterns was seen as irregular branching in genotypes crown shape was consistently spreading across all genotypes, reflecting a uniform canopy architecture. This spreading crown structure facilitates greater lateral spread, maximizing the fruit-bearing surface area and promoting efficient light interception throughout the canopy. While spreading crowns may require more space between trees in dense planting systems, they offer the advantage of enhanced fruit distribution and accessibility, making them suitable for cultivation systems prioritizing high fruit yields and quality.

Seasonal traits, including time of flushing and fruiting season, were highly uniform among genotypes. All genotypes flushed in June, coinciding with the onset of the rainy season, and fruited predominantly in February. This synchronization suggests a strong genetic predisposition or adaptation to specific environmental conditions. Such predictable phenological patterns are advantageous for management practices and optimizing harvest schedules.

These findings highlight the significant diversity in key quantitative traits such as tree height, yield, and shelf life, while maintaining uniformity in essential qualitative traits like leaf color, inflorescence position, and fruit shape. The observed variations in quantitative traits are

Table 2: Correlation of studied traits Pearson correlation analysis

Traits	**Tree height (m)**	**Tree age (years)**	**Length of Inflore-scence (cm)**	**Width of inflore-scence (cm)**	**No of flowers per inflore-scence**	**Days to anthesis from bud (days)**	**No. of days from flowering to fruit set (days)**	**No. of days from fruit set to harvest (days)**	**No. of fruits**	**Yield (kg/tree)**
Tree height (m)	1									
Tree age (years)	0.596	1								
Length of Inflorescence (cm)	0.526	0.009	1							
Width of inflorescence (cm)	0.495	-0.084	0.681*	1						
No of flowers per inflorescence	0.027	-0.297	0.153	0.333	1					
Days to anthesis from bud (days)	-0.066	0.298	-0.744*	-0.63	-0.405	1				
No. of days from flowering to fruit set (days)	-0.458	0.129	-0.882**	-0.837**	-0.443	0.894**	1			
No. of days from fruit set to harvest (days)	-0.074	0.133	-0.527	-0.756*	-0.334	0.812**	0.756*	1		
No. of fruit per tree	0.745*	0.788*	0.398	0.383	-0.18	0.074	-0.227	-0.082	1	
Yield (kg/tree)	0.736*	0.648	0.466	0.549	-0.083	-0.047	-0.364	-0.225	0.969***	1

complemented by the consistent presence of irregular branching patterns and spreading crown shapes across all genotypes, showcasing their adaptability to various cultivation systems. Notably, Collection 09 stood out for its high yield and adaptability, while Collection 08 demonstrated superior shelf life. These genotypes hold considerable potential for commercial exploitation and breeding programs aimed at enhancing specific agronomic and market traits. These results provide a robust foundation for future research on star apple characterization and genetic improvement.

Pearson's correlation analysis revealed significant relationships between tree traits and yield. Tree height had a strong positive correlation with yield ($r = 0.736^*$, $p < 0.05$), suggesting taller trees produce higher yields due to better light interception and photosynthetic efficiency. Similar findings in sapota (*Manilkara achras*) emphasize tree height as a key factor in productivity (Saraswathy *et al.*, 2010). Tree age also correlated positively with yield ($r = 0.648$), reflecting how maturity supports better resource allocation for higher productivity, as observed in *Pouteria sapota* (Pinto *et al.*, 2016).

Inflorescence traits showed complex relationships with yield. Inflorescence length was positively correlated with yield ($r = 0.466$), but negatively with flower diameter ($r = -0.744^*$, $p < 0.05$) and fruit conversion ($r = -0.882^{**}$, $p < 0.01$), while inflorescence width positively influenced yield ($r = 0.549$) but negatively with flower diameter ($r = -0.63$) and fruit retention ($r = -0.837^{**}$, $p < 0.01$). These results suggest a trade-off between resource allocation to inflorescence size and fruit conversion efficiency, similar to findings in sapota (Parmar *et al.*, 2020).

The number of fruits per tree was the strongest yield determinant ($r = 0.969^{***}$, $p < 0.001$), confirming its direct impact on productivity. This aligns with studies on sapota genotypes, where fruit number and weight were key yield contributors (Saraswathy *et al.*, 2010). Conversely, the number of flowers translating to fruit had a weak negative correlation with yield ($r = -0.364$), indicating inefficiencies in resource allocation.

Overall, vegetative traits like tree height and age, along with reproductive traits like fruit count, play critical roles in yield. The trade-offs in inflorescence traits suggest the need for optimization in breeding programs to enhance yield efficiency. These relationships, supported by studies on sapota, provide a solid framework for selecting high-yielding genotypes through targeted breeding strategies.

Scree plot: The scree plot from the PCA analysis of star apple morphological traits shows eigenvalues ranked from highest to lowest (Figure 1). The sharp decline from PC1 to PC2 indicates that PC1 explains over 60% of the variance, with subsequent components contributing less. The curve flattens after the second or third component, suggesting that only a few components capture the main morphological diversity in the star apple population. This pattern simplifies further analysis and highlights key traits for breeding and selection.

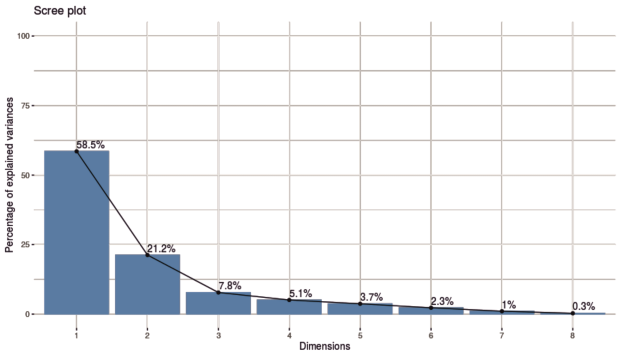

Figure 1: Scree plot of studied traits

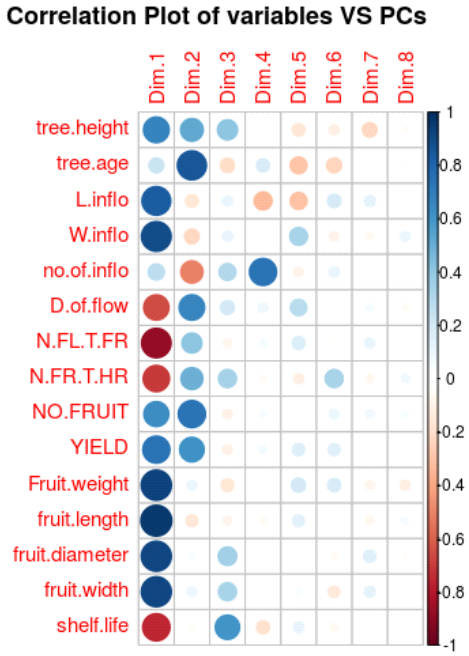

Figure 2: Correlation vs PCA

The correlation plot shows the relationships between star apple morphological traits and their contributions to principal components (PCs) from PCA (Figure 2). PC1 explains much of the variability, with strong positive correlations to traits like tree height, age, number of fruits, yield, fruit weight, length, and diameter, reflecting the link between growth and productivity in perennial crops (Saraswathy *et al.*, 2010). PC2 captures reproductive traits such as inflorescence length, flower diameter, and the number of flowers, with negative correlations to traits like lower anthesis duration and days from flowering to fruit set, indicating a separation between vegetative growth and reproductive efficiency (Parmar *et al.*, 2020). Traits like shelf life, fruit width, and number of fruits per tree show weak correlations across all PCs, suggesting limited variability or environmental influence on these secondary traits (Pinto *et al.*, 2016). In summary, PCA highlights the dominance of growth-related traits like tree height and fruit characteristics in driving variability, while reproductive traits play a specialized role in reproductive success. These findings align with broader studies in tree crops, where morphological and reproductive traits are distinct but complementary in overall plant performance.

CONCLUSION

The star apple (*Chrysophyllum cainito*) genotypes in this study showed significant variation in quantitative traits like tree height, yield, and shelf life, while qualitative traits such as leaf color, inflorescence position, and fruit shape remained consistent. Tree height ranged from 2.54 m to 9.36 m, with larger genotypes like Collection 09 showing higher productivity potential, while smaller genotypes like Collection 07 were suitable for high-density planting. Collection 08 had the longest shelf life (6 days), making it ideal for post-harvest and commercial use. Uniform phenological traits, such as crown architecture and branching patterns, suggest adaptability to various cultivation systems.

This morphological diversity underscores the role of genetic factors in shaping productivity traits. Genotypes like Collection 09 (high yield) and Collection 08 (extended shelf life) are promising candidates for breeding programs focused on agronomic and market traits. The uniform fruiting and flushing periods reflect strong environmental adaptation, beneficial for commercial production planning.

These findings provide a foundation for further research on star apple genetic improvement. Future studies should focus on biochemical and molecular characterization to identify genetic markers for desirable traits. Multilocation trials will be essential to assess genotype stability across different environments, guiding the development of superior varieties suited to specific agronomic practices and market demands.

REFERENCES

Adebayo, O.O.; B.E. Oyinloye and I.A. Olorunfemi. 2020. Antioxidant, anti-inflammatory, and antimicrobial properties of *Chrysophyllum cainito*. *Journal of Medicinal Plants Research,* 14(4): 124-130.

Almeida, C.A.; M.D. Souza and P.R. Ribeiro. 2016. Anti-inflammatory and hepatoprotective properties of *Chrysophyllum cainito* leaves. *Phytomedicine,* 23(11): 1220-1227.

Almeida, C.A.; M.D. Souza and P.R. Ribeiro. 2016. Hypoglycemic effects of *Chrysophyllum cainito* and its potential for diabetes management. *Phytotherapy Research,* 30(4): 345-352.

Ekeke, C.; J. Ariwaodo and S. Odeyemi. 2021. Epidermal and anatomical studies on *Chrysophyllum* L. (Sapotaceae) species of South-Eastern Nigeria. *Scientia Africana,* 20(2): 107-118.

Gopinath, P.P.; R. Parsad; B. Joseph and V.S. Adarsh. 2020. GRAPES: General Rshiny Based Analysis Platform Empowered by Statistics. https://www.kaugrapes.com/home. version 1.0.0

Luo, X.; M.J. Basile and E.J. Kennelly. 2002. Polyphenolic antioxidants from the fruits of *Chrysophyllum cainito* L. *Phytochemistry,* 59(6): 715-718.

Mahajan, R.K.; K.K. Gangopadhyay; G. Kumar; V.K. Dobhal; U. Srivastava; P.N. Gupta and S.K. Pareek. 2002. *Minimal descriptors of agri-horticultural crops. Part III: fruit crops* (No. C042. 018). National Bureau of Plant Genetic Resources.

Mbagwu, F.N. and C.M. Duru. 2015. Morphological relationship among three *Chrysophyllum* species and their taxonomic implication. *International Journal of Plant Research,* 5(3): 48-55.

Morton, J. 1987. *Star apple*. In J. F. Morton (Ed.), *Fruits of warm climates* (pp. 287-289). Miami, FL: Julia F. Morton.

Parmar, A.; Y.N. Tandel; B. Parmar; A.I. Patel and A. Pandey. 2020. Correlation and path coefficient analysis studies in Sapota (*Manilkara achras* (Mill.) Fosberg) genotypes. *Journal of Pharmacognosy and Phytochemistry*, 9(4): 2158-2162.

Parmar, A.; Y.N. Tandel; B. Parmar; A.I. Patel and A. Pandey. 2020. Correlation and path coefficient analysis studies in Sapota (*Manilkara achras* (Mill.) Fosberg) genotypes. *Journal of Pharmacognosy and Phytochemistry,* 9(4): 2158-2162.

Pereira, M.A.; A.L. Lima and J.F. Andrade. 2019. Nutritional and pharmacological properties of *Chrysophyllum cainito. Journal of Food Science and Technology,* 56(12): 5540-5546.

Petersen, J.J.; I. Parker and D. Potter. 2012. Origins and close relatives of a semi-domesticated neotropical fruit tree: *Chrysophyllum cainito* (Sapotaceae). *American Journal of Botany,* 99(9): 1555-1564.

Pinto, R.M.; L.R. Nakamura; T. Ramires; E. Bautista and C. Dias. 2016. Genotype selection of *Pouteria sapota* (*Jacq.*) H.E. Moore and Stearn, under a multivariate framework. *Acta Agronómica,* 65(4): 312-317.

Pinto, R.M.; L.R. Nakamura; T. Ramires; E. Bautista and C. Dias. 2016. Genotype selection of Pouteria sapota (Jacq.) H.E. Moore and Stearn, under a multivariate framework. *Acta Agronómica,* 65(4): 312-317.

Prasawang, S. and A. Srinual. 2020. Comparative leaf and wood anatomical characteristics of *Chrysophyllum* (Sapotaceae) relate to taxonomy of the species in Thailand. *Journal of Plant Biology,* 63(3): 151-160.

Rosa, R.; J. Santos and A.L. Silva. 2021. Antioxidant properties of *Chrysophyllum cainito*: A review of its potential health benefits. *Antioxidants,* 10(5): 82-89.

Saraswathy, S.; C. Parameswari; S. Parthiban; M. Selvarajan and V. Ponnuswami. 2010. Evaluation of Sapota genotypes for growth, yield, and quality attributes. *Electronic Journal of Plant Breeding,* 1(4): 441-446.

Saraswathy, S.; C. Parameswari; S. Parthiban; M. Selvarajan and V. Ponnuswami. 2010. Evaluation of Sapota genotypes for growth, yield, and quality attributes. *Electronic Journal of Plant Breeding,* 1(4): 441-446.

Williams, M. and N. Benkeblia. 2018. Antioxidant and nutritional properties of tropical fruits. *Food Research International,* 105: 109-123.

Zheng, C.; Z. Liu and J. Liu. 2020. The complete chloroplast genome sequence of *Chrysophyllum cainito*, a semidomesticated species. *Molecular Biology Reports,* 47(5): 4029-4039.

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Research Article

Can *Krishi Vigyan Kendra* Influence the Farmer Income of Canal Command Region, Western India Through Different Extension Services?

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ABSTRACT

The aim of study to measures the changes of convention practices of crop production and livestock management for income generation of farmers through facilitate by the *Krishi Vigyan Kendra* (KVK). For this purpose, the details questionnaire was used for data collection through personal qualitative interview of the randomly selected 110 farmers from Sriganagnagar district of Western Rajasthan, India. Study revealed that the cotton and wheat crop area were improved whereas, green gram and mustard area shown declining trend. The productivity of all field crops was improved. In horticulture crops, farmers were started vegetables cultivation in some area instead of field crops. In livestock production, milk production of cow and buffalo were shown increasing trend and farmers were also adopted goat rearing in post intervention scenario. The overall impact was that the highest numbers of farmers were also started improved technologies which improved better use of available limited resources and final output higher income. So, the conclusion of the study was revealed that the different activities conducted by the KVK helpful for adoption of improved management practices as well as income generation techniques in limited available resources of canal command areas' farmers of western Rajasthan.

Keywords: Extension services, Socio-economic status, Productivity, Economic, *Krishi Vigyan Kendra*

INTRODUCTION

In developing nation, Agriculture system is highly based on knowledge and information of new technology (Mittal and Mehar, 2015). In India, agriculture extension system is one of the ways to reduce the knowledge gap. In spite of, adoption level of innovative technologies or information are remains poor in developing nations (Takahashi *et al.,* 2020). KVK is nationwide agricultural extension model lunched by the government of India for spreading the new technologies from Indian farmers in limited time. The first KVK (previously known as Farm Science Center) was established in 1974 in the Pondicherry district of India by the Indian Council of Agriculture Research (ICAR), for the purpose to assess, refine and demonstrate trials of location-specific technologies. KVKs are unique to deliver agricultural advisory services through the scientists of agricultural and allied sector. According to government of India, the mandated of KVK is provide different type of service to farmer as it such as (a) on-farm testing, (b) front line demonstration, (c) capacity building of farmers, farm

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women and rural youth through training, (d) advisory service of frontier technologies for uplifting of agricultural economy production.

Rajasthan geographical area is constituting 10.4 per cent of country geographical area and comes in 1st rank while the population of Rajasthan state is 5.67 per cent of country population according to Census 2011. The vast Indian desert, also known as the Thar or Great Indian Desert, is mostly enclosed by sand dunes, barren land, and gravelly pavement.

The Indira Gandhi Nahar Project (IGNP) is the largest man-made water resources projects in the world, objective to improve the agriculture area in the desert. However, the Indira Gandhi Canal Command Area only makes up 4.7 per cent of India's arid zone. The total allocated amount of the water from Ravi-Beas is 10608 MCM to Rajasthan under IGNP (Kumar *et al.,* 2008). It could be irrigated approx. 8.33 per cent area of Rajasthan state (Hussain *et al.,* 2018).

The highest area is irrigated by IGNP Canal in Sriganganagar district than other districts of Rajasthan, due to which Sriganganagar is the highest food grain producer, hence Sriganganagar district is called "Food Basket of Rajasthan". However, the crop productivity of this area is low as compared to the canal irrigated regions in India due to lack of knowledge about the new technology or research innovation. With this background, the key objectives of the study were (1) To study the demographic status of selected famers, (2) to analyze the impact of extension activities suggested or demonstrated by the KVK in selected respondent.

MATERIALS AND METHODS

Study area: This study was conducted in Sriganganagar district of western Rajasthan, India. The total geographical area of distinct is 11,154.66 km^2 which is spared from 72.2º and 75.3º E longitude and 28.4º and 30.6º N latitude. According to the 2011 census, the population of Sriganganagar had 237,780 with male female ratio of 1000: 859. The economy is majorly based on agriculture. The net cultivated area is 911.6 thousand hectares whereas the gross cropped area 1054 thousand hectares. The climate is arid with average annual rainfall is 261 and average maximum and minimum temperatures are 42 and 12°C, respectively. The soil types of district is irrigated alluvial soil (60%), sandy Soil (35%) and flood plain soil (05%).

Data collection: The KVK situated Padampur block of Sriganganagar district. The 110 farmers were randomly selected from the 16 village of 4 tehsil of Sriganganagar district from 2019. The questionnaire was prepared for the door-to-door data collection of the selected respondent. The pre scenario data was collected through interview as a socio-economic status, cropping situation, livelihood, etc. The KVK provided several services to the respondent mainly on-farm testing, frontline demonstrations of frontier technologies at farmers' fields and discipline wise training *viz.* crop production, nutrient management, plant protection, fruit & vegetable production and livestock management etc. The quantitative data was collected every six-month interval. Whereas, after time lapse of 2 years, examine the overall changes in the cropping situation, crop production, livestock production of selected respondent as a post scenario and converted in per farmer basis. The percent change in collected crop data during pre and post scenario were calculated the following equation.

$$Per\ cent\ change = \frac{\overline{X} - \bar{x}}{\bar{x}} \times 100$$

Whereas, $\overline{X}$ = mean value of field crops data like area (ha), yield (t/ha), Net return ('0000 INR/ha) and B:C ratio in post scenario, $\bar{x}$ = mean value of field crops data like area, yield, Net return and B:C ratio in pre scenario.

The respondents were cultivated vegetable in mixed manner in very less area. So, it could be converted in equivalent yield in respect to okra equivalent yield by given equation (Sharma *et al.,* 2017; Dhara and Sharma 2015).

$$Okra\ equivalent\ yield = \frac{Y_V \times P_V}{P_O}$$

Whereas, Y_V = yield of different vegetable cultivated by the respondent (t/ha), P_V = selling price of different vegetable cultivated by the respondent (INR/ha), P_O = selling price of okra (INR. ha^{-1}).

Statistical analysis: The collected data were analyzed by the using of descriptive statistics (frequency and percentage) and inferential statistics (standard deviation).

RESULTS AND DISCUSSION

The selected farmers were classified on the basis of their age, education, land holding and annual income and presented in Table 1. Based on age, the maximum farmers (65.46%) were belonged to 35-60 years followed by below 35 years age group (26.36%). To develop an understanding about the level of education of selected respondents, they were classified into four categories i.e. primary level, high school, intermediate and higher education. The highest and lowest frequencies of the farmers' belonged high school (50.91%) and higher education level, respectively. Based on land holding, the marginal famers were scored 4.55 per cent followed by small farmers (26.36%). The annual income of the selected respondents was highest 65 farmers under 1-5 lac per annum.

Table 1: Demographic study of selected farmers (n=110)

Category	Frequency	Percentage
Age group		
Below 35 Years	29	26.36
35-60 years	72	65.45
Above 60 years	9	8.18
Education level		
Primary school	27	24.55
High school	56	50.91
Intermediate	18	16.36
Higher education	9	8.18
Land holding		
Marginal (<1 ha)	5	4.55
Small (1-2 ha)	29	26.36
Large (>2 ha)	76	69.09
Annual Income (INR)*		
Below 1 lac	25	22.73
1-5 lakh	65	59.09
Above 5 lakh	20	18.18

* INR is Indian rupees

The major crops are cotton, groundnut, green gram, sesame and other during *kharif* season (rainy season) and wheat, barley, chick pea and rapeseed & mustard during *rabi* season (winter season). Pre scenario, the average maximum area advocated under 1.64 ha in green gram and 1.80 ha in rapeseed & mustard, respectively during *kharif* and *rabi* season crops. The productivity of *rabi* crops were recorded 8.07, 2.02, 2.87 and 0.67 t/ha in wheat, chick pea, rapeseed & mustard and barley, respectively while 1.26, 1.96, 0.39, 0.13 and 2.09 t/ha yield of green gram, cotton, sesame, groundnut and other, respectively during *kharif* crops (Figure 1). Overall, the most profitable crop was wheat because its net realization was found INR. 50673.42/ ha with 3.21 B:C ratio as compared to other crops. Post scenario, the maximum crop sown area was improved under cotton crop (127.14%) followed by wheat (48.14%) as compared to pre intervention. Whereas, the highest percent change in crop sown area

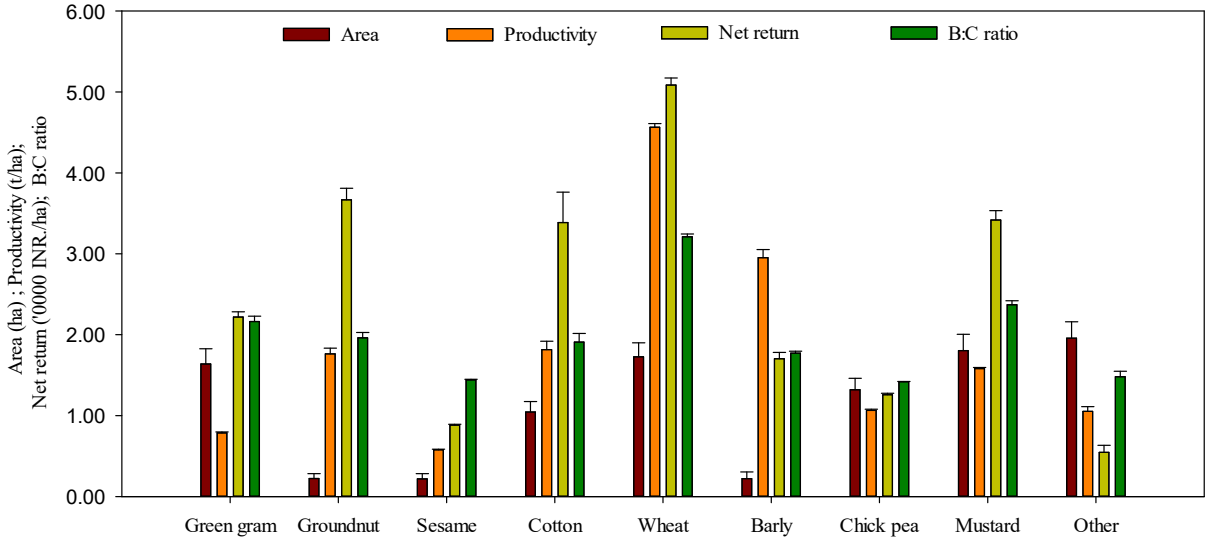

Figure 1: Crop area, productivity, economic of field crops grown by farmer during pre-scenario (Bar symbol denote the SD value)

was recorded negative under minor crops (-43.11%), green gram (-35.72%) and sesame (-17.77%) during *kharif* crops and mustard (-28.12%) and chickpea (-25.63%) during *rabi* as compared to pre scenario (Figure 2). The productivity of crops was improved and it was observed 28.54, 25.19, 8.80 and 7.36% higher in cotton, green gram, sesame and groundnut during *kharif* season and 59.16, 18.39, 16.14 and 15.82% in chickpea, mustard, wheat, and barley during *rabi* season as compared to pre scenario, respectively. The land use system was change as well as the productivity of crops were improved due to improvement of farmers knowledge of farmers by the different activities conducted by the KVK like as training, demonstration, on farm trails, etc. The enhancement of productivity is directly affected the net realization and B:C ratio. So, the highest net realization was found in cotton crop (INR 86762.30/ha) followed by wheat (INR 74114.36/ha). While, the B:C ratio recorded highest 3.37 in wheat crop followed by mustard (3.07). The change in cropped area, productivity and profitability could be recognized due to most effective extension work conducted by the KVK at field level and it could be adopted by the selected farmers. Joshi and Narayan (2019) reported that the 87 and 75 per cent of farmers are not satisfied with the information access from the advance information technology like ICT and good quality agricultural inputs like propagation materials, fertilizers & pesticides, respectively. They are also supported that the 42 per cent of the farmers are agreed and adopted good quality seeds demonstrated by the extension department which could be help to enhance crop productivity and return.

In horticulture crops, Kinnow is the dominated fruit tree in the study area. The average area and productivity of kinnow were 0.37 ha and 11580.00 kg/ha, respectively, which were given net return INR. 224430.30/ ha with 3.40 B:C ratio. Post scenario, farmers were also grown kinnow and vegetable crops. The kinnow area was constant but productivity was improved (18201.67 kg/ha) and directly reflected to B:C ratio (8.83). The area was covered 0.85 ha in vegetables (Figure 3). The okra equivalent productivity and net realization were recorded 4728.00 kg/ha and INR. 88329.08/ha, respectively. The benefit cost ratio of vegetable production was recoded 2.55. The farmers started the vegetable production might be

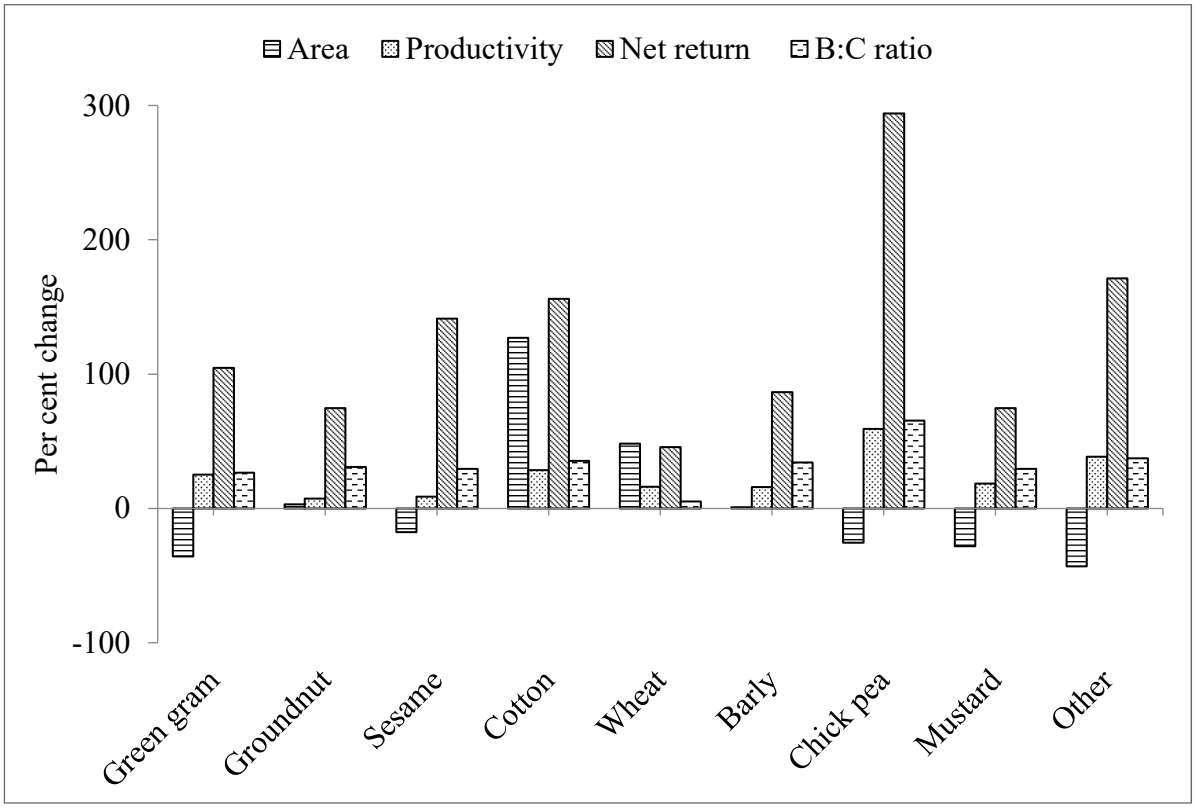

Figure 2: Post-scenario of crop area, productivity, economic of field crops in study area

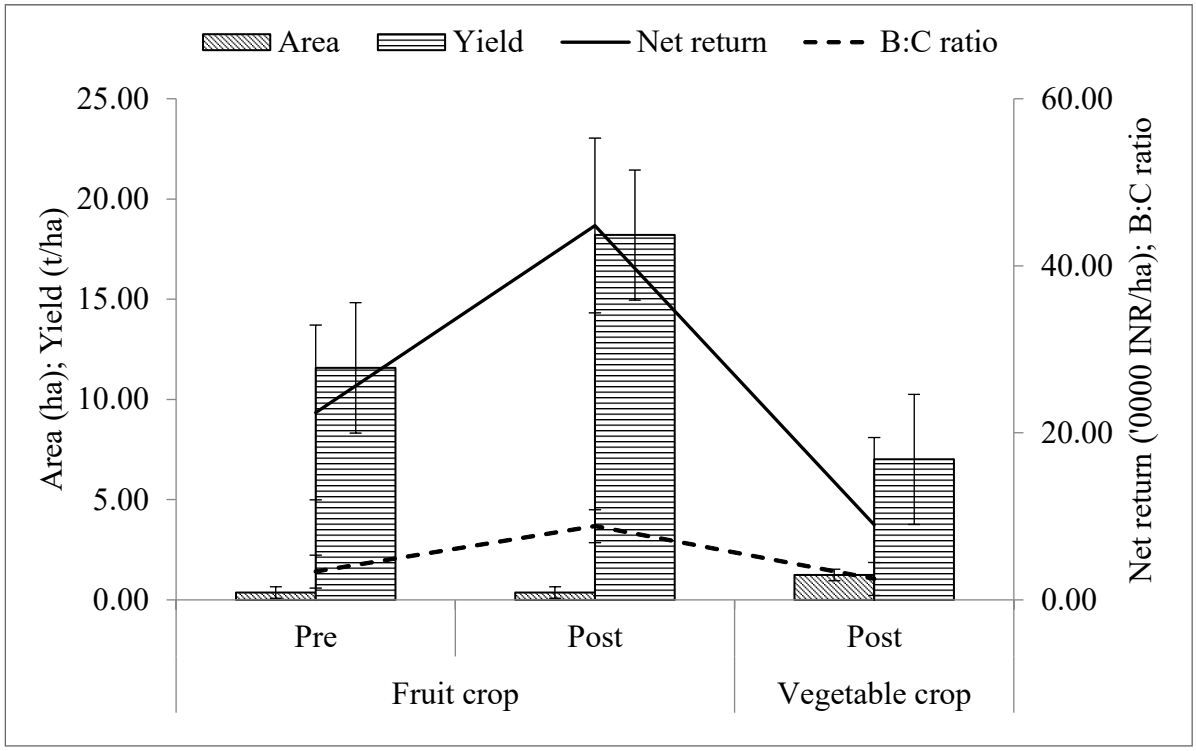

Figure 3: Changes in productivity and profitability of fruit and vegetable crops (Bar symbol denote the SD value)

occur due to aware about the vegetable cultivation and improved technologies of vegetable production which help to grow vegetables in some area instead the field crops.

Pre intervention scenario, the cow (Sahiwal & Rathi) and buffalo (Murrah) were the dominated milch animal in the study area. The average number of cow and buffalo were 1.86, 1.65 and their productivity were 893.10 and 974.88 l/animal, respectively, which were generated net return INR. 15242 and 13778.63/animal/year (Figure 4). The B:C ratio was observed 2.34 and 1.85 in cow and buffalo. Post scenario, some farmers were also adopted goat rearing. In dairy animal, the average number of cow, buffalo and goat were enhanced 2.99, 2.29 and 25, respectively. The average milk production was observed 973.50, 1051.80 and 200 lit/animal/year. The highest B:C ratio was obtained under goatary production (3.98) followed by cow rearing (2.81). The increase in net income can be occurred due to increase in livestock population and package of management practices which were given by the KVK to the farmers. Jena *et al.* (2022) also suggested that production and productivity of livestock were improved through scientific training organized by the extension personals which help to better adoption of scientific livestock production practices. The findings are agreement and supported by Sharma *et al.* (2014) who reported that improved management at dairy farms-based trainings were help to enhancement in average milk production from 6.76 to 6.93 l/ animal/day.

In this study, the impact of different activities conducted by the KVK showed that the highest change was recoded under the horticultural crops *i.e.* 300 and 212.1 per cent in number of respondent and average annual income, respectively after intervention conducted by the KVK. Followed by the livestock production, it could be changed 27.9 and 183.6% (Table 2). The farmers were enhanced 112.4 per cent average income through crop production after post intervention as compared to pre intervention. The overall mean changes shown that average annual income of selected respondents was increased 193 per cent in post scenario as compared to pre scenario. The results could be obtained due to the adoption of innovative approaches in horticulture and livestock production by the farmers which provided additional income. In general, in this study we show that KVK

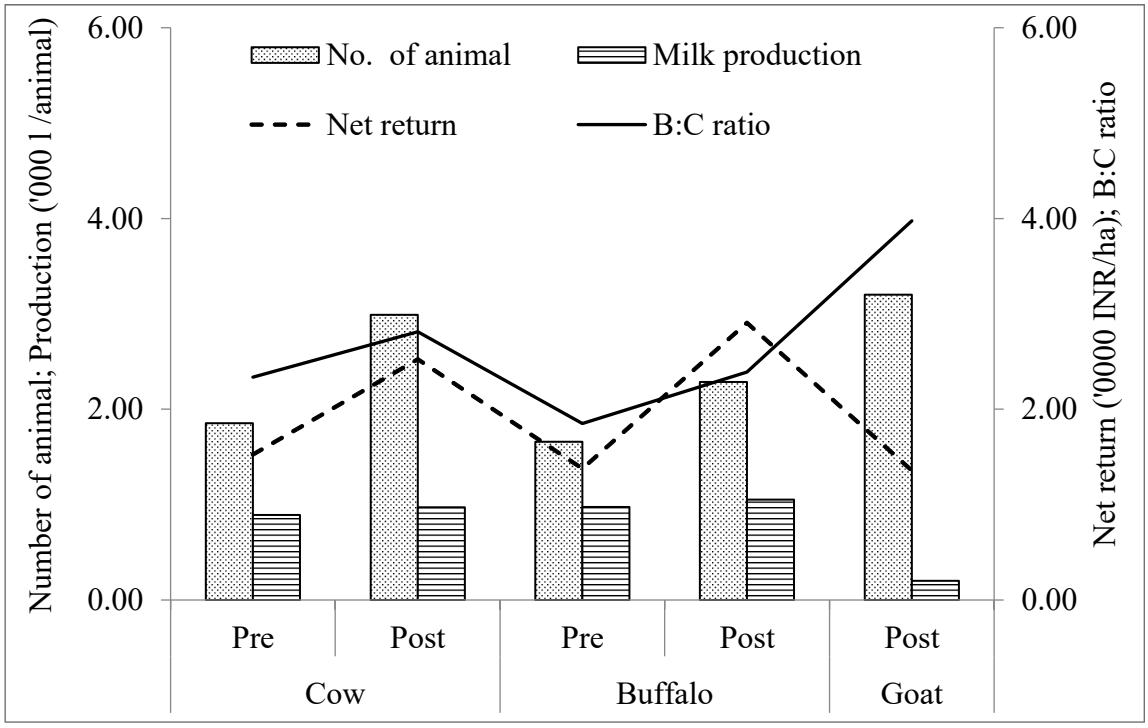

Figure 4: Change in milk production and net return of livestock production influenced through KVK intervention

Table 2: Impact of KVK interventions on enhancing overall income of the farmers.

Particulars	No of respondent		Total Net return	
	Pre	Post	Pre	Post
Crop production	110	110	1633.51 (±1.547)	3468.88 (±2.365)
Horticulture	4	16	112.22 (±11.20)	350.18 (±18.033)
Livestock production	86	110	172.34 (±0.156)	488.69 (±0.321)

based intervention has a positive impact on farm income. The major role of extension personals is to provide information to farmers and resolve their problems timely which make economical use of available resources through adoption of improve technology and organizational skills that will help to take more significant production (AESE, 2017). Behaghel *et al.* (2018) who reported and conformity that trained farmer were used slightly more improve technologies and improved their farm production than untrained farmers.

CONCLUSION

This study assessed KVK's outreach initiatives. In particularly, the study estimated changes in farmers' income by transfer of improved technology and management practices through KVK in the farmers' fields and livestock production. The respondents were adopted the mixed farming which improved their income under limited resources and reduces the risk of crop failure. The farmers of IGNP command area were started the new income generation enterprises like as vegetable production and goat rearing alongwith crop cultivation. The impact of intensive activates conducted by the KVK improve the earning and uplift over double as compared to pre scenario. For policy developers, it is need to improved extension advisories model through the develop a complex interlink network in between the education, research and extension system as well as allied departments, private sector and non-profitable organization for diffusivity of advanced and improved technology to farmers.

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REFERENCES

AESE. 2017. Agricultural Extension Strategy of Ethiopia. https://faolex.fao.org/docs/pdf/eth205099.pdf

Behaghel, L.; G. Jeremei; K. Rick; K. Jane; M. Karen and N.M. Margaret. 2018. The Impact of Farmer-to-Farmer Training on Agricultural Productivity in Uganda. Dissemination of new agricultural technologies in Africa: making extension work, Final project report, J-PAL.

Dhara, P.K. and B. Sharma. 2015. Evaluation of mango-based agroforestry is an ideal model for sustainable agriculture in red & laterite soil. *Journal of Pure and Applied Microbiology,* 9: 265-272.

Hussain A.; M. Tayyab and Asif. 2018. Indira Gandhi Canal Project Environment and Changing Scenario of Western Rajasthan: A Case Study. *International Journal of Academic Research and Development*, 3(4): 15-19.

Jena, A.; M. Chander and D. Bardhan. 2022. Assessing the Impact of Training Programmes for Dairy Farmers by *Krishi Vigyan Kendra*, Farm Science Centre, India. *Journal of Animal & Plant Sciences,* 32(6): 1569-1579.

Joshi, R. and A. Narayan. 2019. Performance Measurement Model for Agriculture Extension Services for Sustainable Livelihood of the Farmers: Evidences from India. *Theoretical Economics Letters,* 9: 1259-1283

Kumar, M. Dinesh; S. Rajvanshi and S. K. Dash. 2008. Social costs and benefits of micro irrigation system adoption in canal commands: a study from IGNP command area of Bikaner in Rajasthan. In Kumar, M. Dinesh (Ed.). Managing water in the face of growing scarcity, inequity and declining returns: exploring fresh approaches. Proceedings of the 7th Annual Partners Meet, IWMI TATA Water Policy Research Program, ICRISAT, Patancheru, Hyderabad, India, 2-4 April 2008. Vol.1. Hyderabad, India: International Water Management Institute (IWMI), South Asia Sub Regional Office. pp. 67-82.

Mittal, S. and M. Mehar. 2015. Socio-economic Factors Affecting Adoption of Modern Information and Communication Technology by Farmers in India: Analysis Using Multivariate Probit Model. *Journal of Agricultural Education and Extension*, 2015: 1–14.

Sharma, B.; S.K. Tripathi; P.K. Dhara; P. Kumari; S.K. Meena; R. Kumari and A. Kumar. 2017. Comparative Study of Mango Based Agroforestry and Mono-Cropping System under Rainfed Condition of West Bengal. *International Journal of Plant and Soil Science,* 15: 1-7. DOI: 10.9734/IJPSS/2017/32283.

Sharma, M.; G. Singh and Kesava. 2014. Impact Evaluation of Training Programmes on Dairy Farming in Punjab State. *Indian Research Journal of Extension Education*, 14(1): 106-108.

Takahashi, K.; R., Muraoka and K. Otsuka. 2020. Technology adoption, impact, and extension in developing countries' agriculture: A review of the recent literature. *Agricultural Economics*, 51(1): 31–45.

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Research Article

Impact of Goat Breeds on the Milk Composition under Climatic Conditions of Sainthal Tahsil of Dausa District Rajasthan

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ABSTRACT

Milk is often rightly described as a near-complete food in nature. It contains all five major nutrients: fat, protein, lactose (milk sugar), vitamins, and minerals (salts). The research was conducted at the Rukmani Devi College of Agriculture, Dausa district of Rajasthan during 2021-23. The specific gravity of the Sirohi goat milk was greater than that of Jakhrana animals. The overall fat percent in both breeds during 2021-23 of all the 1200 samples was found to be 4.61±0.021, Solids Not Fat (SNF) 8.44±0.030 percent, and total solids percentage was found to be 13.32±0.035. The protein percent during 2021-22 conditions was significantly ($p < 0.01$) greater than that of farm-rearing goat milk in both breeds. The statistical analysis also revealed that the lactose content in 2021-22 has significantly higher than that of 2022 -23 in Jakhrana as well as Sirohi goat breeds at $p < 0.05$. The average ash content in both breeds' milk during 2021-23 of all samples was found to be 0.814±0.007 percent. Breed had conspicuous effects on milk quality of goats under study

Keywords: Goat breeds, Milk composition, Dausa, Rajasthan

INTRODUCTION

The Jakhrana breed is found in the north-west arid and semi-arid regions mainly in eastern Rajasthan. The breed derives its name from the Jakhrana village in Alwar district where it is found in its purest form. They are large animals. The coat is predominantly black with white spots on the ears and the muzzle is short and lustrous. The face line is straight, with a narrow and slightly bulging forehead. The breed looks similar to the Beetal, the major difference being that the Jakhrana is taller. The ear length is medium and the udder is large, with conical teats. Does are reared for milk. A majority of the bucks are sold for meat, with a small number retained for breeding (Verma *et al.,* 2004).

Goat population of our country increased from 47.14 million in the year 1951 to 124.5 million in 2005 (Singh and Sharma, 2013). The Gir breed which is rated as a relatively better milk producer of indigenous breed's needs exploration of its production potentiality to know its further prospects. Improvement can be made through proper management, feeding, handling, and other environmental conditions which will influence the expression of characters but a limit of which is set by the heredity of the individual (Singh *et al.,* 2013). Goats are an integral part of livestock production and play a vital role in the socio-economic structure of rural poor. This study aimed to project the importance and significance of goat milk with special reference to Indian fields and farm-rearing conditions. There are

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adverse ecological and physiological constraints in the Indian system of goat farming. Goat population of our country increased from 47.14 million in the year 1951 to 124.5 million in 2005 (Singh and Sharma, 2014).

The global goat population currently stands at 921 million, of which over 90 per cent are found in developing countries. Asia is home to about 60 per cent of the total world goat population and has the largest goat breed share of 26 per cent. Goats play a vital socio-economic role in Asian agriculture, particularly for resource-poor people living in harsh environments. Non-cattle milk accounts for approximately 15 per cent of the total milk consumption by humans worldwide (Singh *et al.,* 2014). India today, stands first in the area of milk production at the world level, with an annual growth rate of about 4 per cent. The country's milk production in 2010 was estimated to be 110 million tonnes. A large quantity of milk produced in the country amounting to over 46 per cent is being consumed as liquid milk. The production and use of animal products in the use of human diet is receiving tremendous attention. With this object in view, the need for developing Animal Husbandry is recognized very well. The other objects are to provide animal power for farming and adoption of better land use patterns (Singh *et al.,* 2012). The productive improvements among dairying animals can be made through proper management, feeding and handling, etc. which may influence the expression of productive characters as per its heritability nature. Before, identifying the animals for breeding and production purposes screening of animals shall be performed based on physical traits (Singh *et al.,* 2013). Various government and non-government organizations have also recognized the importance of poultry farming as employment generating enterprise and are engaged in motivating more and more entrepreneurs to take up this enterprise (Singh *et al.,* 2014). Goats play a vital socio-economic role in Asian agriculture, particularly for resource-poor people living in harsh environments (Singh *et al.,* 2014).

Goats are more often poorly managed and this is attributed to their ability to survive under harsh conditions and also because most people in rural areas rear goats for their subsistence purposes to support their families. This benefit is often not shown in national statistics because of informal trading and slaughtering (Singh *et al.,* 2014). Goat milk contains less lactose than cow's milk, so is less likely to trigger lactose intolerance (Singh *et al.,* 2014). Goat meat is a high-quality protein source is the choicest meat in the domestic market (Singh *et al.,* 2014).

Major population of India primarily depends on the agricultural-based system for their daily life including goat keeping which constitutes an important rural business of small marginal farmers and landless laborers (Singh *et al.,* 2014). Reproductive management of an animal is governed by several parameters, viz. age at first conception, age at first calving, and first gestation length, etc. (Singh *et al.,* 2014). Goat milk contains less lactose than cow's milk, so it is less likely to trigger lactose intolerance (Singh and Sharma, 2015). It has since played a significant socioeconomic role in the evolvement of human civilization around the world (Singh and Sharma, 2015). Farmers felt that grass is more useful to fill the animals' stomachs and would therefore come before crop stover as feed. Farmers preferred Deda over Kona because it has more biomass (Singh and Sharma, 2015).

A very important aspect in this regard is the awareness of risk by resource-poor farmers and their emphasis on minimizing it (Singh and Sharma, 2016). The country is endowed with a large and biologically diverse population of goats. (Singh and Sharma, 2016).

The nutritional value of milk is closely related to its composition, which is affected by factors such as breed, diet, stage of lactation, season etc. Goat milk has more calcium (Ca), phosphorus (P), potassium (K), magnesium (Mg), and chloride (Cl) and less sodium (Na) and sulfur (S) content than cow milk (Singh and Sharma, 2016). Livestock production is the backbone of Indian agriculture contributing 7% to the national GDP and source of employment and livelihood for 70% population in rural areas. India ranks first in terms of milk production (129.7 million tons) (Singh *et al.,* 2017). Animals reared in intensive production systems consume a considerable amount of protein and other nitrogen-containing substances in their diets (Singh *et al.,* 2017). This benefit is often not shown in national statistics because of informal trading and slaughtering (Singh and Sharma, 2017).

Goats play a vital socioeconomic role in Asian agriculture, particularly for resource-poor people living

in harsh environments (Singh *et al.,* 2018). Jamnapari (or Jamunapari) is a breed of goat originating from the Indian subcontinent. Since 1953 they have been imported to Indonesia (popular as Etawa goat, and its mixture with a local goat called "PE", Peranakan Etawa or Etawa mix) where they have been a great success (Singh *et al.,* 2017).

These breeds or types were distributed across the world as a result of the migration and translocation of humans, usually due to changing climatic conditions and natural resources (Singh and Sharma, 2017). Milk-secreting tissues and various ducts throughout the udder can be damaged by bacterial toxins, and sometimes permanent damage to the udder occurs (Singh and Singh, 2020). Livestock has become an integral part of all interventions aimed at reducing rural poverty and enhancing food and nutrition security (Singh and Somvanshi, 2020). India is endowed with a significant share of the world's livestock population growing steadily and continuously (Singh,. 2019). The goat is thought to have been the earliest domesticated ruminant and of all the species of domesticated animals except the dog, has the widest ecological range (Singh, 2024). Man, Animal, and Nature are in a symbiotic relationship for their survival and sustenance (Singh *et al*., 2024).

MATERIALS AND METHODS

The research has conducted at the Rukmani Devi College of Agriculture, Dausa district of Rajasthan with a broad objective, as 'Effect of goat breeds on the milk composition under climatic conditions of Sainthal tahsil of Dausa district Rajasthan during 2021-23. 05 milk samples of Sirohi goat and 05 milk samples were collected from the Jakhrana goat breed during the lactation at different villages of Sainthal tahsil of the Dausa district throughout two years. A total of 1200 (600 and 600) samples were collected from both goat breeds of Sainthal tahsil. All samples were analyzed by an electronic milk analyzer.

RESULTS AND DISCUSSION

The data obtained on specific gravity in the present study of Jakhrana and Sirohi goat breed milk are presented in Table 1.

It is observed from Table 1. that the specific gravity of Jakhrana and Sirohi goat breeds has found to be 1.0123±0.0003 and 1.0196±0.0004, respectively with an average of 1.0179±0.0004. It is observed from above table that specific gravity of Sirohi goat breed's milk has greater than that of Jakhrana animals.

The result obtained for the fat percentage of milk of Jakhrana and Sirohi goat breed are presented in Table 2.

The average percentage of fat in the milk of Jakhrana and Sirohi goat breeds has found to be 4.41±0.034 and 4.81±0.087 respectively with an average value of 4.61±0.060 per cent during 2021-22 Similarly, fat content in 2022-23 of Jakhrana and Sirohi goat breeds has found to be 4.71±0.033 and 4.81±0.023, respectively with an average value of 4.71±0.046 per cent. The overall fat per cent in the both breeds during

Table 1: Effect of Goat breeds on Specific gravity of milk

Breeds	2021-22	2022 -23	Overall average	Test of significance	Table value (t)	
					5%	1%
Jakhrana	1.0121±0.0003	1.0132±0.0003	1.012±0.0003	3.51^{+}	1.540	2.145
Sirohi	1.0195±0.0004	1.0163±0.0003	1.0179±0.0004	3.20^{+}		
Overall mean	1.0179±0.0004	1.0147±0.0004	1.0240±0.0004			

Note: + = Significant at 5% level of significance

Table 2: Effect of Goat breeds on Fat % of milk

Breeds	2021-22	2022 -23	Overall average	Test of significance	Table value (t)	
					5%	1%
Jakhrana	4.41±0.034	4.71±0.033	4.51±0.032	2.987^{+}	1.547	2.321
Sirohi	4.81±0.087	4.81±0.023	4.81±0.011	2.354^{++}		
Overall mean	4.61±0.060	4.71±0.046	4.61±0.021			

Note: + = Significant at $p < 0.05$; ++=Significant at $p < 0.01$

2021- 23 of all the 1200 samples has found to be 4.61±0.021. The results of the present investigation on fat content of Jakhrana and Sirohi goat breeds are in consonance with the observation of Singh and Sharma (2015); Prasad *et al.* (2005) has reported higher value for fat percentage of goat milk. Lower values have been reported by Agnihotri *et al.* (2002).

The data on Protein percentage in the present investigation of Jakhrana and Sirohi goat breed's milk during 2021-23 are recorded in Table 3.

It is observed from the Table 3 that the protein percentage in the Jakhrana and Sirohi goat breeds during 20-21 has found to 3.18±0.028 and 3.11±0.034, respectively with an average of 3.13±0.028 per cent. The protein content of aforesaid breeds during 2022-23 found to be 3.11±0.034 and 3.13±0.036 per cent respectively with an average value of 3.12±0.035 per cent. It is clear from the above table that protein per cent during 2021-22 has significantly ($p < 0.01$) greater than that of 2022-23 goat milk in both the breeds. The statistical analysis revealed that protein content of Jakhrana goat breed has significantly higher than that of Sirohi goat breed during 2021-22. The analysis of variance of these data (Table 3) reveled that protein content variation either Jakhrana or Sirohi goat breeds had significant ($p < 0.05$) effect during 2021-23.

The lactose per cent in the milk of Jakhrana and Sirohi goat breeds during 2021-23 in the present investigation are presented in Table 4.

It is clear from Table 4 that the lactose content in Jakhrana and Sirohi goat breed's milk during 2021-22 has found 4.29 ±0.021 and 4.27 ±0.020 per cent, respectively. Similarly the lactose content in above both breed milk during 2022-23 has found 4.20±0.022 and 4.23±0.025 per cent, respectively. The overall average lactose per cent in Jakhrana and Sirohi goat breed's milk during 2021-23 also calculated and found to be 4.23±0.014 for all 1200 samples. The statistical analysis also revealed that the lactose content in 2021-22 has significantly higher than that of 2022 -23 in Jakhrana as well as Sirohi goat breeds at $p < 0.05$. Our results on lactose percentage in above goat breed's milk are in fair agreement with those reported by Prasad *et al.* (2002) and Agnihotri (2002) have reported higher values on it.

The results obtained for ash content of Jhakarana as well as Sirohi goat milk during 2021-23 are presented in Table 5.

The average percentage of ash during 2021-22 Jakhrana and Sirohi goat breed's milk has found to be 0.80±0.008 and 0.82±0.008, respectively with an average value of 0.81±0.008 per cent. Similarly ash content in 2022-23 of aforesaid breed's milk has found to be 0.82±0.007 and 0.84±0.005, per cent with an average of 0.82±0.006 per cent. The overall average ash content in both breed's milk during 2021-23 of all samples has found to be 0.815±0.007 per cent. It is also clear from the above table that ash content in the

Table 3: Effect of Goat breeds on Protein % of milk

Breeds	2021-22	2022 -23	Overall average	Test of significance	Table value (t)	
					5%	1%
Jakhrana	3.18±0.028	3.11±0.034	3.14±0.032	5.875^{++}	1.960	2.576
Sirohi	3.19±0.027	3.13±0.036	3.11±0.032	4.51^{++}		
Overall mean	3.13±0.028	3.12±0.035	3.15±0.32			

Note: ++ = Significant at $p < 0.01$

Table 4: Effect of Goat breeds on Lactose % of milk

Breeds	2021-22	2022 -23	Overall average	Test of significance	Table value (t)	
					5%	1%
Jakhrana	4.29 ±0.021	4.20±0.022	4.25±0.021	1.859^{+}	1.960	2.576
Sirohi	4.27 ±0.020	4.23±0.025	4.21±0.022	1.243^{+}		
Overall mean	4.23±0.0205	4.215±0.0235	4.23±0.014			

Note: + = Significant at $p < 0.05$

Table 5: Effect of Goat breeds on Ash % of milk

Breeds	2021-22	2022 -23	Overall average	Test of significance	Table value (t)	
					5%	1%
Jakhrana	0.80±0.008	0.82±0.007	0.81±0.008	3.879^{+}	1.960	2.576
Sirohi	0.82±0.008	0.84±0.005	0.82±0.006	3.654^{++}		
Overall mean	0.81±0.008	0.82±0.006	0.814±0.007			

Note: + = Significant at $p < 0.05$; ++ = Significant at $p < 0.01$

milk of Jakhrana or Sirohi goat breed 2022-23 has significantly greater than that of 2021-22. The analysis of variance table showed that ash content of Jakhrana goat breed's milk during 2022- 23 has significantly more than that of Sirohi goat breed milk. The results of present investigation on the level of ash in Jakhrana and Sirohi goats' milk during 2021-23 are slightly higher by the findings (0.78 ± 0.01) of Agnihotri *et al.* (2002) and Singh and Sharma (2015).

The results obtained for total solids percentage in milk of Jakhrana and Sirohi goat breed during 2021-23 are presented in Table 6.

According to above Table 6, the average total solids percentage in milk of Jakhrana and Sirohi goat breed during 2021-22 has found to be 13.03±0.030 and 13.23±0.036, respectively with an average value of 13.13±0.033. Similarly the total solids percentage in the milk of above goat breeds during 2022-23 has found to be 13.16±0.035 and 13.87±0.039, respectively with an average value of 13.13±0.037 per cent. The overall average total solids percentage of all 1200 samples has found to be 13.32 ± 0.035. It has observed from above table that Jakhrana goat breed's milk total solids were significantly ($p < 0.050$) higher in 2021-22 than 2022-23 whereas in case of Sirohi goat breed an insignificant difference has observed in total solids content. The analysis of variance in the table revealed that the breed variation during 2021-22 has non-significant but it has significant during 2022 -23 at 5% level of significance.

The level of total solids percentage in the milk of above goat's breeds as obtained in the present study, Compared favorably with the results of Pal *et al.* (2011) and Agnihotri (2002). Prasad *et al.* (2005) have, however, reported higher values of Singh and Sharma (2015).

The data on solids-not-fat percentage in Jakhrana and Sirohi goat breed's milk during 2021-23 are recorded in Table 7.

It is observed from Table 7 that the solids-not-fat percentage in the milk of Jakhrana and Sirohi goat breeds during 2020-21 has been found to be

Table 6: Effect of Goat breeds on Total solids % of milk

Breeds	2021-22	2022 -23	Overall average	Test of significance	Table value (t)	
					5%	1%
Jakhrana	13.03±0.030	13.16±0.035	13.09±0.032	1.21^{+}	1.960	2.576
Sirohi	13.23±0.036	13.87±0.039	13.55±0.037	1.985^{NS}		
Overall mean	13.13±0.033	13.51±0.037	13.32 ± 0.035			

Note: NS = Non Significant; + = Significant at $p < 0.05$

Table 7: Effect of Goat breeds on Solids-Not-Fat % of milk.

Breeds	2021-22	2022 -23	Overall average	Test of significance	Table value (t)	
					5%	1%
Jakhrana	8.39±0.036	8.45±0.024	8.43±0.030	3.659^{++}	1.960	2.576
Sirohi	8.46±0.034	8.48±0.026	8.47±0.030	3.854^{++}		
Overall mean	8.42±0.035	8.46±0.025	8.44±0.030			

Note: ++ = Significant at $p < 0.01$

8.39±0.036 and 8.46±0.034, respectively with an average value of 8.42±0.035 percent. The solids-not-fat content of the above breeds during 2022-23 samples has also been calculated and found to be 8.45±0.024 and 8.48±0.026 percent, respectively with an average of 8.46±0.025 percent. The overall average solids-not-fat percentage of the above samples in 2021-22 and 2022-23 of all 1200 samples has 8.44±0.030 per cent. The statistical analysis showed that the solids-not-fat percentage has significantly ($p < 0.01$) higher in 2022-23 either the Jakhrana or Sirohi goat breed than that of 2021-22. It is due to higher fat percentage and lower percentage of protein, lactose, and ash in 2022-23 of Jakhrana as well as Sirohi goat breeds. The analysis of the variance table on these data also revealed that significant breed variation on solids-not-fat content has been observed either 2021-22 or 2022-23. The results of the present investigation on solids-not-fat content of Jakhrana and Sirohi goat breed's milk 2021-23 align with the slightly higher observations of Singh and Sharma (2015).

CONCLUSION

The Breed had conspicuous effects on the milk composition of goats. The specific gravity and fat percentage in the milk of Sirohi has significantly higher than the milk of Jakhrana goat breeds.

REFERENCES

Agnihotri, M.K.; N. Singh and Y. Babji. 2002. Milk composition of goat reared under field condition. *Indian Journal of Animal Sciences,* 72(11): 1019-1921.

Pal, U.K.; P.K. Mandal; V.K. Rao and C.D. Das. 2011. Quality and Utility of Goat Milk with Special Reference to India: An Overview. *Asian Journal of Animal Sciences,* 5: 56-63.

Prasad, H.; H.A. Tiwari and O.P.S. Sengar. 2005. Milk yield and their crosses with Jamunapari, Barbari and Black Bengal breeds of goat. *Small Ruminant Research,* 58(2): 195-199.

Singh, G. 2019. Analytical study of Front Line Demonstration (FLD) of Kadaknath poultry farming under climatic conditions of Tonk district of Rajasthan. *The Journal of Rural and Agricultural Research*, 19(2): 49-52.

Singh, G. 2024. Nutrition and feeding management of goats for chevon production. *International Journal of Science, Environment and Technology*, 13(5): 334-349.

Singh, G. and R.B. Sharma. 2013. Influence of breeds on goat milk composition under field and farm rearing conditions. *Indian Research. Journal of Genetics & Biotechnology,* 5(4): 258-261

Singh, G. and R.B. Sharma. 2014. Effect of season on the milk quality of Jamunapari goats under field and farm rearing condition. *Indian Research Journal of Genetics & Biotechnology,* 6(1): 335-339

Singh, G. and R.B. Sharma. 2015. Effect of multiple births on Jakhrana goat milk minerals under field and farm rearing Conditions. *Indian Research Journal of Genetics & Biotechnology,* 7(2): 227-234.

Singh, G. and R.B. Sharma. 2016. Effect of rearing systems on mineral contents of milk during lactation in Jamunapari goats. *Indian Journal of Small Ruminants*, 22(2): 270-271.

Singh, G. and R.B. Sharma. 2016. Impact of stages of lactation on the minerals of Jakhrana goat milk under field and farm rearing condition. *Research Journal of Animal Husbandry and Dairy Science,* 7(1): 28-34.

Singh, G. and R.B. Sharma. 2017. Effect of field and farm rearing conditions on the sensory quality of goat meat. *Journal of Community Mobilization and Sustainable Development,* 11(2): 188-192.

Singh, G. and R.P. Singh. 2020. An analytical study on mastitis in cows under climatic conditions of Tonk district. *The Journal of Rural and Agricultural Research*, 20(1): 18-21.

Singh, G. and S.K. Sharma. 2015. On Farm Trial (OFT) of pearl millet green fodder at Tonk district. *The Journal of Rural and Agricultural Research,* 15(2): 28-29.

Singh, G. and S.P.S. Somvanshi. 2020. Study on animal rearing practices by dairy owners of district Jaipur Rajasthan. *The Journal of Rural and Agricultural Research*, 20(1): 61-64.

Singh, G.; G. Dutt and S. Rajput. 2014. Study of age at first calving in Gir cows. *Indian Research Journal of Genetics & Biotechnology,* 6(1): 362-365.

Singh, G.; G. Dutt; R.B. Sharma; A. Fatima and R.P. Singh. 2012. Study of first gestation length in Gir cows. *The Journal of Rural and Agricultural Research*, 12(1): 64-65.

Singh, G.; G. Dutt; R.B. Sharma; S.K. Singh; A. Fatima and S.V.S. Chauhan. 2012. An analytical study of reproductive performance in Gir cows. *Indian Research Journal of Extension Education, Special Issue,* 2: 203-206.

Singh, G.; G. Dutt; S. Rajput and R.S. Chauhan. 2013. Study of age at first service period in Gir cows, *Indian Research. Journal of Genetics & Biotechnology,* 5(4): 270-273

Singh, G.; G.N. Thorat; M.S. Trivedi; R. Mishra and S.K. Sharma. 2014. A test to measure knowledge about poultry management practices. *The Journal of Rural and Agricultural Research,* 14(2): 44-47.

Singh, G.; R.B. Sharma and M. Singh. 2017. Green fodder production potential of Oat cv. Kent under semi-arid climatic conditions of Tonk-Rajasthan in Frontline Demonstration. *International Journal of Current Microbiology and Applied Science,* 6(3): 2228-2232.

Singh, G.; R.B. Sharma and R. Mishra. 2014. Effect of multiple births on Jamunapari goat milk quality under field and farm rearing conditions. *Indian Research Journal of Genetics & Biotechnology,* 6(2): 453-458.

Singh, G.; R.B. Sharma and R. Mishra. 2014. Seasonal variations in the milk minerals of Jakhrana goats under field and farm rearing conditions. *Journals of Community Mobilizations and Sustainable Development,* 9(2): 120-123.

Singh, G.; R.B. Sharma; A. Kumar and A. Chauhan. 2014. Effect of Stages of Lactation on Goat Milk Composition under Field and Farm Rearing Condition. *Advances in Animal and Veterinary Sciences,* 2(5): 287-291.

Singh, G.; R.B. Sharma; B.P. Chahal; M. Singh and S.K. Sharma. 2018. Effect of multiple births on Jamunapari goat milk minerals under field and farm rearing conditions. *Indian Journal of Animal Research*, 52(4): 628-631.

Singh, G.; R.B. Sharma; M. Singh and R. Choudhary. 2017. Effect of Season on Jamunapari Goat Meat Composition under Field and Farm Rearing Condition. *International Journal Pure and Applied Bioscience,* 5(2): 563-568.

Singh, G.; R.B. Sharma; M. Singh and S.K. Sharma. 2017. Utilisation of agricultural wastes in participatory poultry farming with women under climatic conditions of Tonk district of Rajasthan. *Agriculture Science Digest*, 37(1): 60-63.

Singh, G.; R.B. Sharma; R. Mishra and S. Rajput. 2014. Effect of multiple births on Jakhrana goat milk quality under field and farm rearing conditions. *Indian Research. Journal of Genetics & Biotechnology,* 6(4): 629-635.

Singh, G.; R.B. Sharma; R. Mishra and S. Rjput. 2014. Effect of season on goat meat composition under field and farm rearing conditions. *Indian Research Journal of Genetics & Biotechnology,* 6(3): 511-517

Singh, G.; S. Singh; K. Sharma; L.K. Sharma and A. Kumar. 2024. Effect of goat rearing on environment and rural prosperity in India. *International Journal of Science, Environment and Technology*, 13(6): 421-433.

Verma, N.K.; S.P. Dixit and S.P.S. Ahlawat. 2004. Goat germplasm of India: its conservation and management. *Livestock International,* 12(2): 16-22.

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Research Article

Women's Psychological Empowerment Through Floriculture: A Case Study of Dinapur Village in Chiraigaon Block, Varanasi

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ABSTRACT

The study was conducted in 2020, in Dinapur village (Chiraigaon block) Varanasi, Uttar-Pradesh among the Self-Help Group women who were involved in floriculture activities. An attempt was made to study their psychological empowerment through floriculture. The floricultural activity generates many employments in rural area. The rural women are engaged in floriculture and garlanding works which gives self-empowerment among them. In present study empowerment is measured through assessment of one's dominant thoughts and tendencies. Two dimensions of Empowerment were taken Autonomy and Self-esteem. The data was collected from 150 women respondents by random sampling method with the help of pretested interview schedule followed by ex-post-facto research design. The findings revealed that majority of the respondents (43.33%) were having medium level of empowerment followed by 35.34 per cent were having high and 21.33 per cent were having low level of empowerment. It was also found that farm size had positive and significant relationship with empowerment of women in floricultural activities. Step-wise regression model revealed that farm size contributed 31.00 per cent of total of variance in empowerment of women in floricultural activities. With floriculture and involvement in SHG they are psychologically getting more empowered which is good sign for our society and Nation.

Keywords: Empowerment, Floriculture, Autonomy, Sel-help group, Self-esteem, Self-depreciation

INTRODUCTION

Since ancient times, flowers have been an indispensable component of the social fabric, their essence and fragrance playing vital roles in various social, cultural, and religious gatherings across all societies (Chaubey, 2020). Floriculture, a division of horticulture, focuses on the profitable cultivation of flowering and decorative plants for both outdoor gardens and for use in floristry (Basnayake, 2022). Floriculture creates numerous job opportunities in rural areas, particularly for women who are involved in both floriculture and garlanding tasks (Chaubey, 2020). Research conducted in Nagaland highlights the rapid expansion of the floriculture industry within horticulture, providing opportunities for women and unemployed young women to secure employment (Pusa and Giribabu, 2016). Similarly, a separate study conducted in Himachal Pradesh, India, underscores how floriculture development serves as a sustainable source of livelihood and income generation for women (Singh, 2017). Empowerment of women would mean equipping women to be economically independent, self-reliant, have a positive self-esteem to enable them to face any difficult situation and they should be able to participate in developmental activities (Olaniran and Perumal, 2021). Psychological empowerment is an individual's ability to make decisions and have control over his or her personal life and characterized by a

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sense of perceived control, competence and goal internalization. It combines personal efficacy and competence, a sense of mastery and control, and a process of participation to influence decisions and institutions (Masi *et al*., 2003). Women's role is of multi-dimensional in nature; agricultural fields need sowing, transplanting, weeding, irrigation, fertilizer application, plant protection, harvesting, winnowing, storing etc. Floriculture is one of the branches of agriculture, which is an intensive type of agriculture & income per unit area from floriculture is much higher than any other branch of agriculture (Thakur, *et al.,* 2018). Woman plays a significant and crucial role in floriculture as a manager, decision maker and skilled farm worker from preparatory stage to harvesting, storage and marketing of the flowers. (Mankar, 2013). The rural women are engaged in floriculture and garlanding works (Bharane, 2007). This work gives self-empowerment. Floriculture provides daily source of income which provides optimistic behaviour. among the rural women. They start realizing their self worth and contribution in the family income which increases their self-esteem. Woman plays a significant and crucial role in agricultural development, livestock production, horticulture, and floriculture post-harvest operation, agro-social forestry and fisheries etc. as a manager, decision maker and skilled farm worker from preparatory stage to harvesting, storage and marketing of the flowers. Although, the rural women play an important role in agriculture production but not much attention has been paid by the social researcher worker in studying the empowerment of women through floriculture. Intensified efforts are needed to study the empowerment status of women by involving in floriculture activities. The central idea to conduct a study on women empowerment through floriculture is to answer the following research question- Are they psychologically empowered in terms of self-esteem and autonomy? To answer the above research questions and realizing the importance and magnitude of the problem, a study entitled "Women Empowerment through Floriculture in Dinapur village, Chiraigaon block, Varanasi, Uttar Pradesh" has been planned with following specific objective: To study the empowerment of the of the respondents in relation to autonomy vs dependency, self-esteem vs self – depreciation.

MATERIALS AND METHODS

The research was conducted in 2020, in Dinapur village of Chiraigaon block in Varanasi. The sample consist of 150 women respondents of Self-Help Group. Random sampling method was used for the selection of respondents and data was collected using interview schedule. The methodology used is ex-post-facto research design. Empowerment of women through Floriculture was measured on Likert five-point Continuum based on agreement-disagreement on 10 statements under two dimensions Autonomy and Self-esteem. Each dimension having five statements. Respondents expressed their level of agreement or disagreement, with scores ranging as follows: Strongly agree - 5, Agree - 4, Undecided - 3, Disagree - 2, and Strongly disagree - 1 for positive statements. Conversely, for negative statements, the scoring was reversed, with Strongly agree receiving 1, Agree receiving 2, Undecided receiving 3, Disagree receiving 4, and Strongly disagree receiving 5. The highest score assigned was 5, while the lowest score assigned was 1. Collected data subjected to statistical analysis by computing frequency, percentage and Cumulative square root frequency (CSRF) Method allows greater efficiency for setting stratum boundaries as well as Correlation & regression were used to saw the relationship between independent variables with empowerment of women through Floriculture.

RESULTS AND DISCUSSION

Autonomy includes initiative, hope of success and problem solving. Table 1 reveals that majority of the respondents (42%) were observed in the high category of Autonomy followed by 41.33 per cent medium level of autonomy and 16.67 per cent were having low level of Autonomy. Thus, it can be concluded that the respondents show high Autonomy, they have faith in themselves and they are quite optimistic because they have much knowledge of the farm activities related to floriculture and they are playing major role

Table 1: Distribution of respondents according to level of Autonomy (n=150)

Category	Strata	Frequency	Percentage
Low	< 12.6	25	16.67
Medium	12.6 to 16.39	62	41.33
High	>16.39	63	42.00

in garland making and daily they have source of income which adds value to their optimistic behaviour.

Self-esteem includes innovativeness and creativity. Table 2 reveals that majority of the respondents (45.33%) fall in high level of Self-esteem followed by 36.67 per cent. They have confidence in their own worth and abilities and floriculture is playing the major role as involvement of women in floriculture giving them the feeling of Self-respect.

Table 2: Distribution of respondents according to level of Self–esteem (n=150)

Category	Strata	Frequency	Percentage
Low	<14.59	27	18.00
Medium	14.59 to 18.93	55	36.67
High	>18.93	68	45.33

Empowerment of women was studied by combining Autonomy and Self –esteem and the total score were converted into percentage. Table 3 reveals that majority of the respondents (43.33%) were observed in medium level of empowerment followed by 35.34 per cent were having high level of empowerment and 21.33 per cent were having low level of empowerment. The Table 3 further reveals that respondents were found in medium level of percentage of empowerment, followed by High and low level respectively. This shows that empowerment of women increases toward higher category. Similar result found by Chaubey (2020).

Table 3: Distribution of women farmers based on their overall level of Empowerment (n=150)

Category	Strata	Frequency	Percentage
Low	< 58.90	32	21.33
Medium	58.90 to 71.432	65	43.33
High	71.43 to 86.2048	53	35.34

An attempt has been made to elucidate the prediction of selected socio-economic profile with Empowerment of women in Floricultural activities. The coefficient of correlation between the selected independent variables and Empowerment of women was worked out and tested for its significance. An attempt was made in the present investigation to ascertain the relationship between selected independent variables and the empowerment of women. The findings in this regard are presented in Table 4. The variable Farm size only showed significant and positive relationship with Empowerment of women at 0.05 level of significance. This means that this variable exerts their influence positively on empowerment of women. Similar finding was reported by Kiran (2009) and Debnath (2015).

Step-wise regression was utilized to assess the extent to which specific independent variables influenced the

Table 4: Relationship of the socio-economic profile with Empowerment of women in Floricultural activities

Selected Independent Variable	Value of correlation coefficient (r)	Significant (p value)
Age	.043	.605
Education	.067	.415
Family type	-.028	.38
Family size	-.081	.322
Farm size	.175*	.032
Socio-political participation	.118	.151
Daily income	.152	.084
Information utilization pattern	.057	.488
Self confidence	.130	.144
Risk taking ability	-.054	.513

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 5: Regression Analysis of independent variables with empowerment of women

Model Summary[b]										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.175a	.031	.024	10.31714	.031	4.673	1	148	.032	1.626

a. Predictors: (Constant), Farm Size
b. Dependent Variable: Empowerment

empowerment of women in floricultural activities. The analysis revealed that only one variable, namely farm size, accounted for 31.00 per cent of the variance in empowerment of women in floricultural activities. The regression model demonstrated significance within an acceptable range of multicollinearity (p-value = .000). This suggests that the farm size, as examined in the study, contributed a modest 31.00 per cent, leaving approximately 69.00 per cent of variance unaccounted for the research. Similar result found by Chaubey (2020).

CONCLUSION

The study found that respondents exhibited a medium level of empowerment, followed by high and low levels respectively, indicating that women's empowerment tends to increase with higher categorization. Farm size was the only variable showing a significant and positive relationship with women's empowerment, suggesting that it exerts a beneficial influence. This could be attributed to the increased involvement of women in floricultural activities as farm size expands, whether through owning land or working on leased land, leading to greater income and self-worth, thus fostering empowerment. Membership in Self-Help Groups (SHGs) enhances women's sense of public participation, broadens their social activities, boosts self-esteem, and enriches their lives, thereby elevating their status as active participants, decision-makers, and beneficiaries across various spheres of life. Genuine empowerment occurs when women gain increased access to economic resources, confidence, self-motivation, recognition, and decision-making power within the family, as evidenced in the present study.

REFERENCES

Basnayake. 2022. Women Entrepreneurs and Poverty Alleviation in Floriculture of Colombo District in Sri Lanka. *Colombo Journal of Multi-Disciplinary Research,* 7(01&02): 84-110.

Bharane, S.B. 2007. Role Performance of Rural Women In Vermiculture enterprise : A case study. *Thesis*, M.Sc. Dr. Panjab Rao Deshmukh Krishi Vidyapeeth, Akola.

Chaubey, S. 2020. *Women Empowerment through Floriculture in Dinapur Village, Varanasi, Uttar-Pradesh*. Thesis, M. Sc., Department of Extension Education, Institute of Agricultural Sciences, BHU, Varanasi.

Kiran, De D. 2009. *Empowerment of women in agriculture in Sultanpur district of Uttar Pradesh*. Thesis, Ph.D., Department of Extension Education, Institute of Agricultural Sciences, BHU, Varanasi.

Mankar, D.M.; Y.B. Shambharkar and K. Khade. 2013. Role performance of farm women engaged in floriculture. *Karnataka journal of Agriculture Science*, 26(1): 161-163.

Masi, C.M.; Y. Suarez-Balcazar; M.Z. Cassey; L. Kinney and H. Piotrowski. 2003. Internet access and empowerment: a community-based health initiative. *Journal of General Internal Medicine*, 18(7): 525-530.

Olaniran, S.O. and J. Perumal. 2021. Enacting community development principles in women empowerment projects: a case study in Ondo State, Nigeria. *Global Social Welfare*, 8(2): 151-158.

Pusa, K. and M. Giribabu. 2016. Floriculture and role of women in Nagaland: A case study. *Arthshastra: Indian Journal of Economics & Research*, 5(6): 42. Retrieved from https://doi.org/10.17010/aijer/2016/v5i6/107524.

Rao, S.; P.S. Varsha and L. D'Souza. 2018. Psychological Empowerment through SHGs: Influence of Selected Demographic Factors. *International Journal of Indian Psychology*, 6(4): 145-153.

Singh, P. 2017. A Global Conference on Diaspora and Politics. In Floriculture as An Emerging Tool for Women Empowerment: A Case Study of Himachal Pradesh. Hague. Retrieved from https://www.researchgate.net/ publication/352180279.

Sisir, D. 2015. The Impact of Household Structure on Female Autonomy in Developing Countries. *The Journal of Development Studies*, 51(5): 485-502.

Thakur, R.; A.I. Nahvi; V. Sharma and S. Khan. 2018. Multi-Dimensional Role of Rural Women in Agricultural: A Review. *International Journal of Pure and Applied Bioscience*, 6(5): 510-515. doi: http://dx.doi.org/10.18782/2320-7051.6558.

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Research Article

Marketing Behaviour of Farmers of Arajiline and Cholapur Block in Varanasi

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ABSTRACT

The research was conducted in 2022 in two blocks of Varanasi district of Eastern Uttar- Pradesh. The pretested interviewing method used for data collection and descriptive research design to analyze the Marketing Behaviour of Farmers in Varanasi. A total of 120 respondents were chosen for the study. Marketing Behaviour of farmers was measured by using a 3-point continuum on Likert scale with the help of 14 statements. The finding revealed that majority of (43.33%) respondents were having medium of marketing behavior followed by 41.66 per cent and 15.00 per cent of respondents were having low and high level of marketing behavior, respectively. In correlation analysis it was found that land holding size, Number of crops grown by farmers, Area under irrigation, Cost of irrigation, Price related information through cosmopolite, Price related information through mass media, Agri- related information through cosmopolite and Agri related information through mass media had strong and meaningful relationship with marketing behaviour at 1 percent level of significance while in Chi- Square analysis education, occupational details and Status of Scheme beneficiary had strong and meaningful relationship with marketing behaviour at 5 percent level of significance. Consequently, farmers in these blocks may benefit from enhanced marketing behavior to optimize their agricultural activities effectively.

Keywords: Marketing behavior, Education, Descriptive research design, Correlation and multiple linear

INTRODUCTION

Agriculture and allied sectors constitute the backbone of the Indian economy playing a pivotal role in its sustenance and growth trajectory (Singh *et al.*, 2023 and Singh *et al.,* 2021). Over the years, India's agricultural landscape has evolved significantly, transitioning from a state of food scarcity to becoming a grain powerhouse, attaining self-sufficiency in both production and productivity (Pradhan, 2022). Despite its historical significance, the proportion of agriculture in India's Gross Value Added (GVA) has witnessed a decline, dwindling from 35% in 1990-91 to 15% in 2022-23 (https://m.economictimes.com/news/economy/agriculture/share-of-agriculture-in-indias-gdp-declined-to-15-in-fy23-govt/articleshow/106124466.cms). In this globalized era, the success of any sector, including agriculture, hinges not merely on production capabilities but also on effective marketing strategies (Raina *et al.*, 2011; Varadarajan, 2010; Roy and Ghosh, 2022a). Understanding the constraints faced by farmers and formulating tailored strategies to alleviate them are imperative for enhancing efficiency in the agricultural marketing system (Das *et al.*, 2014; Roy and Ghosh, 2022b). Consequently, there has been a paradigm shift in the focus of capacity building initiatives, moving beyond production-centric approaches towards agribusiness development, with a keen emphasis on market-led integration and value chain enhancement (Nain *et al.*, 2019). Entrepreneurial education and training play a pivotal role in empowering individuals to identify and capitalize on business opportunities, thereby fostering self-confidence and enhancing market participation (Kumari *et al.*, 2024). In line with this, recent governmental initiatives have sought to promote and establish agri-enterprises within the agricultural sector, with the overarching goal of augmenting farmers' incomes. Furthermore, there

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exists an urgent need for the processing industry to engage in value addition, thereby facilitating global market expansion and improving food accessibility and availability worldwide (Gupta *et al.*, 2022). The state of Uttar Pradesh (UP) stands out as a key player in India's agricultural landscape, emerging as the largest producer of food grains (https://apeda.gov.in/milletportal/files/Uttar_Pradesh_Millet_Value_Added_Products_Catalogue.pdf) and the second-largest producer of sugarcane nationally. However, despite these accolades, the average annual income of farmers in UP ranks among the lowest in the country (Gulati, *et al.*, 2021). This disparity underscores the pressing need to address the challenges plaguing the agricultural marketing system, particularly in regions such as Arajiline and Cholapur Block in Varanasi which were adopted villages of DST project planned executed by the second author. Against this backdrop, the research problem titled "Study of the Marketing Behavior of Farmers in Arajiline and Cholapur Block, Varanasi" has been formulated. This study aims to investigate the marketing behavior of farmers in these regions. In essence, this research endeavors to contribute to a deeper understanding of the marketing dynamics within India's agricultural sector, with a specific focus on grassroots realities in Arajiline and Cholapur Block, Varanasi. By addressing these research questions, 1. What is the marketing behaviour of farmers? 2. What is the relationship between the socio -economic profile and marketing behaviour of farmers? This study seeks to offer actionable insights aimed at fostering sustainable agricultural development and improving the livelihoods of farmers in the region.

MATERIALS AND METHODS

The research was conducted in 2022 within the Arajiline and Cholapur blocks of Varanasi. These blocks were chosen purposefully due to their higher concentration of SC population and consideration of time and resource availability for the study. From each selected block, Gram Panchayats were selected purposively for the present study. As it has a greater number of Scheduled caste population so the total number of Gram Panchayat that have been selected for the study was six i.e., Sahanshapur, Parajanpur, Sajoi, Cholapur, Paranapatti, Katari. From each selected Gram Panchayat, the Villages are selected purposively for the present study. As it has a greater number of Scheduled Caste population, so the total number of villages are six.i.e., Sahanshapur, Parajanpur, Sajoi, Cholapur, Paranapatti, Katari. The main objective of the study was to know the marketing behaviour of Farmers in Arajiline and Cholapur block. The data collected through pretested interview schedule followed by descriptive research design. Total 120 respondents selected by Proportionate Random Sampling with 2% equal allocation was done. Socio- economic variables viz, age, gender, family type, education, electrification, occupation, land ownership, land holding size, no. of crops grown by farmers, Cropping pattern followed by individual household, Irrigation Facilities, Area under irrigation, Source of irrigation, Type of irrigation, Area under Drip/sprinkler Cost of irrigation, Area un-irrigated, Livestock Possession, Status of beneficiary of Government Schemes, Extension Connectivity, Participation in Farmers Organization, Loan and borrowing and Preferred source of Information were the independent variables for the study and Marketing behaviour of farmers was the dependent variable. Marketing behaviour studied in terms of farmers visit to market for buying, selling of produce, Consult with market experts and awareness about market. The components that are studied in the marketing behaviour of farmer are cognitive behaviour, Cognitive behaviour and Affective behaviour. It was measured on the three-point continuum of Always, sometimes and never having the weightage of 3, 2 and 1 respectively. The respondents had given their level of agreement and disagreement on 14 statements. The responder was categorized into three levels of marketing behaviour based on the cumulative square root frequency (CSRF) method: low, medium, and high. Collected data were analyzed with the help of percentage, frequency, mean and square root frequency, and relational statistics like correlation analysis and Chi- Square analysis.

RESULTS

Marketing behavior of farmers refers to the actions, strategies, and decisions made by agricultural producers in promoting, selling, and distributing their agricultural products. This encompasses a range of activities, including but not limited to, determining pricing strategies, selecting distribution channels, advertising and promotion efforts, and engaging with potential buyers or markets. Table 1 illustrates that the majority of farmers (43.33%) exhibited a medium level of marketing behavior, with 41.67 per cent displaying a low level and 15 per cent demonstrating a high level of marketing behavior. It is evident that a considerable proportion of farmers, approximately 43.33 per cent, exhibit a medium level of marketing behavior. This suggests that these farmers possess a moderate degree of engagement and proficiency in marketing their agricultural products. They are likely to employ a mix of traditional and modern marketing techniques, demonstrating a balanced approach towards selling their produce. The results align with the findings of

Table 1: Distribution of Respondents according to their Overall Marketing Behaviour (n=120)

Category	Frequency	Percentage
Low level of Marketing Behaviour (Up to 19)	50	41.667
Medium level of Marketing behaviour (20 to 23)	52	43.333
High Level of Marketing Behaviour (24 and above)	18	15

Maratha and Badodiya (2017) in his study entitled "Study on Marketing Behaviour and Other Attributes of Vegetable Growers at Kota Block of Kota District in Rajasthan" revealed that most of respondents (72.50%) had medium level of marketing behavior followed by 16.66 per cent and 10.83 per cent had high and low level of marketing behavior, respectively.

Table 2 the nature of the relationship between the selected independent variables i.e., socio-economic profile and the dependent variable, i.e., marketing behaviour, is examined in this section. The data related to the above factors were subjected to correlation coefficient analysis in order to analysed the relationship. The statistical significance of the correlation coefficients (r) was then determined.

Table 2: Correlation coefficient analysis between socio-economic characteristics and Marketing behaviour of farmer

Independent variable	Correlation coefficient (r) value
Age	0.146^{NS}
Land holding size	0.217**
Number of crops grown by farmers	0.367**
Area under irrigation	0.217**
Area under drip/sprinkler	Constant
Area un-irrigated	Constant
Cost of irrigation	0.453**
Livestock possession	0.142^{NS}
Price related information through cosmopolite	0.599**
Price related information through mass media	0.338**
Agri related information through cosmopolite	0.534**
Agri related information through mass media	0.478**

**. Correlation is significant at rate of 0.01 level (2- tailed)

Correlation of coefficient (0.217**) between land holding size and marketing behaviour of farmer is smaller than 0.01 level of significance. Therefore, it can be said that there is positive and significant relationship between land holding size and marketing behaviour. It is reasonable to conclude that the larger the land holding, the better will be the decision of allocation and utilization of available resources and better will be the marketing behaviour, and vice versa. Contrast result found by Kad *et al.* (2013) in his study entitled "Marketing behaviour of pulse growers of Amravati district of Maharashtra" in which they observed that land holding was non-significant with marketing behaviour. Correlation of coefficient (0.367**) between number of crops grown by farmers and marketing behaviour is smaller than the 0.01 level of significance. Therefore, it can be concluded that there is positive and significant relationship between number of crops and marketing behaviour. It is reasonable to conclude that the more the crops farmer grows the more he/she has knowledge about crop diversification, the better risk management, better crop planning and the better knowledge to fetch more income. Correlation of coefficient (0.217**) between area under irrigation and marketing behaviour is smaller than the 0.01 level of significance. As a result, it can be determined that there is strong and meaningful relationship between area under irrigation and marketing behaviour. It can be concluded that the more the area under irrigation, better will be the yield and there will be more marketable surplus. Correlation of correlation (0.453**) between cost of irrigation and marketing behaviour is smaller than the 1 per cent level of significance. Therefore, it can be concluded that there is strong and meaningful relationship between cost of irrigation and marketing behaviour. As a result, it can be determined that the more he incurred cost in irrigation the more he/she is conscious about profit and cost benefit ratio. Contrast result found by Sapate, A.U. (2018) in his study entitled "Marketing behaviour of pomegranate growers" in which observed that irrigation status had strong and non-significant relationships with pomegranate growers' marketing behaviour. Correlation of coefficient (0.599**) between price related information got by cosmopolite and marketing behaviour of farmer is positive and significant. The might be that regular contact with the shopkeeper, friends, progressive farmers, relatives are the major channel to get the price related information. Farmers may be able to receive dependable market information if they maintain regular communication with various cosmopolites. Correlation of coefficient (0.388**) between price related information through mass media and marketing behaviour is positive and significant. The possible reason for this

significance might be that farmers may be able to receive valid and accurate market or price related information if they regularly updated with communication with various government portals and apps. Correlation of coefficient (0.534**) between agricultural/technical information through cosmopolite and marketing behaviour is positive and significant. The reason for this could be that regular contact with friends, relatives, shopkeepers, middlemen, and commission agents allows farmers to learn more about agricultural, technical, integrated nutrient management practices, integrated pest management practices, and other aspects of agriculture and allied sectors for fetching remunerative prices. Correlation of coefficient (0.478**) between agricultural/technical information through mass media and marketing behaviour is positive and significant. This could be the reason that if farmers are regularly updated with the best package of practices for various crops, site specific crop cultivation and nutrient management, site specific pest management, weather forecast, through different government channels, government website, Apps, it will ultimately lead to better decision-making ability of the farmers. These findings are consistent with those of Johnson and Manoharan in his study entitled "Marketing Behaviour of Cashew Farmers" in which they observed that mass media exposure has positive and significant association with marketing behaviour at one per cent level of probability.

Table 3 there is strong and meaningful relationship between Education and Marketing behaviour. This indicated that high or low formal education status does affect the marketing behaviour. The suitable explanation for this tendency is that education plays an essential role in improving thinking abilities and broadening the horizons of persons who have a higher capacity to comprehend things, evaluate them, and interpret them in a right possible way. The findings of the research are on par with findings of Vineetha *et al.* (2019), "Marketing behaviour of groundnut farmers in Anantapur Amu district of Andhra Pradesh" she found that farmer's education has significant relationship with their Marketing Behaviour. Chi- Square value (0.011*) between occupation and marketing behaviour of farmer is smaller than the 5 per cent level of significance. Therefore, it can be concluded that there is strong and meaningful relationship between occupation and marketing behaviour of farmer. It can be inferred that more the people engaged in agriculture related occupation the more he gets the knowledge about markets, the ongoing activities and trending demand and supply in market. Contrast result found by Maratha and Badodiya (2017) in his study entitled "Study on Marketing Behaviour and Other Attributes of Vegetable Growers at Kota Block of Kota District in Rajasthan" revealed that occupation has positive but non- significant relation with marketing behaviour. Chi-Square value (0.018*) between status of beneficiary of government schemes and marketing behaviour is less than 5 per cent level of significance. Therefore, it can be concluded that there is strong and positive relationship between status of beneficiary schemes and marketing behaviour. As a result, it can be determined that there are several government policies and programmers' that create opportunities for farmers by giving financial help that improves their risk-taking abilities, innovativeness, crop planning and orientation, and self-confidence, all of which contribute to improved marketing behaviour.

Table 3: Chi Square analysis for Socio economic characteristics and marketing Behaviour of Farmer

Independent Variable	Degree of freedom	Pearson coefficient
Gender	2	0.251^{NS}
Education	12	0.022*
Type of family	2	0.241^{NS}
Electrification	-	Constant
Occupational details	8	0.011*
Land ownership	4	0.350^{NS}
Irrigation facility	2	0.744^{NS}
Source of irrigation	4	0.932^{NS}
Type of irrigation	-	Constant
Status of Scheme beneficiary	6	0.018*
Extension connectivity	4	0.861^{NS}
Participation in Farmers' Organisation	-	Constant
Loan and borrowing	2	0.068^{NS}

*Significant at rate of 0.05 level (2-tailed)

CONCLUSION

This study sheds light on the marketing behavior of farmers in Arajiline and Cholapur Block, Varanasi. The findings reveal that a majority of 943.33 per cent farmers exhibit a medium level of marketing behavior, indicating a balanced approach towards selling their produce. Socio-economic variables such as land holding size, number of crops grown, area under irrigation, and access to market-related information through various channels significantly influence farmers' marketing behavior. Furthermore, education, occupation, and beneficiary status of government schemes emerge as key determinants of marketing behavior, emphasizing the

importance of socio-economic empowerment in enhancing farmers' market participation. Overall, this study underscores the importance of tailored interventions aimed at improving farmers' access to market information, enhancing their socio-economic status, and promoting diversified farming practices to foster sustainable agricultural development and improve farmers' livelihoods in the region.

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REFERENCES

Das, L.; M.S. Nain; R. Singh and R.R. Burman. 2014. Constraints in marketing of fruits as perceived by the fruit growers and NERAMAC in Assam. *Journal of Community Mobilization and Sustainable Development,* 9(2): 114-117.

Gulati, A.; P. Terway and S. Hussain. 2021. Performance of Agriculture in Uttar Pradesh. In: Gulati, A., Roy, R., Saini, S. (eds) *Revitalizing Indian Agriculture and Boosting Farmer Incomes* (pp. 175-210). India Studies in Business and Economics. Springer, Singapore. https://doi.org/10.1007/978-981-15-9335-2_7

Gupta, S.K.; M.S. Nain; R. Singh and J.R. Mishra. 2022. Development of scale to measure agripreneurs attitude towards entrepreneurial climate. *Indian Journal of Extension Education*, 58(2): 153-157. https://doi.org/10.48165/IJEE.2022.58237

Johnson, B. and M. Manoharan. 2016. Marketing behaviour of cashew farmers. *Indian Research Journal of Extension Education*, 9(1): 6-10.

Kad, R.G.; A.N. Deshmukh; S.U. Mokhale and A.G. Angaitkar. 2013. Marketing behaviour of pulse growers of Amravati district of Maharashtra. *International Research Journal of Agricultural Economics and Statistics*, 4(1): 115-116.

Kumari, A.; B. Jirli; P. Singh and P. Roy. 2024. Utility of Agri Clinic and Agricultural Business Center Training contents for Agripreneurs in Uttar Pradesh. *Indian Journal of Extension Education*, 60(1): 20-24. https://doi.org/10.48165/IJEE.2024.60104

Maratha, P. and S.K. Badodiya. 2017. Study on Marketing behaviour and other attributes of vegetable growers at Kota Block of Kota District in Rajasthan. *International journal of Pure and Applied Bio Science*, 5(1): 329-337.

Nain, M.S.; R. Singh; J.R. Mishra; J.P. Sharma; A.K. Singh; A. Kumar and R.S. Suman. 2019. Maximising farm profitability through entrepreneurship development and farmers' innovations: feasibility analysis and action interventions. *Indian Journal of Agricultural Sciences,* 89(6): 14–18.

Pradhan, P.P. 2022. *Study on the Marketing Behaviour of Farmers of Arajiline and Cholapur blocks, Varanasi district.* M.Sc. desertation, Department of Extension Education, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi.

Raina, V.; M.S. Nain; B.S. Hansra and D. Singh. 2011. Marketing behaviour and information sources utilization pattern of flower growers. *Journal of Community Mobilization and Sustainable Development*, 6(2): 180-184.

Roy, P. and S. Ghosh. 2022a. Perceived marketing system effectiveness by pineapple growers in Tripura. *Indian Journal of Extension Education*, 58(3): 24–28.

Roy, P. and S. Ghosh. 2022b. Constraints faced by pineapple growers in Tripura. *Indian Journal of Extension Education*, 58: 140-143.

Sapate, A.U. 2018. *Marketing behaviour of pomegranate growers*. M.Sc. (Ag.) Thesis. Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar.

Singh, A.; R. Singh; M.S. Nain; J.R. Mishra; P. Kumar; D.K. Sharma and R.K. Paul. 2023. Linkage network structures of farmers: analysing FPOs of MP and Bihar in India. *Indian Journal of Extension Education*, 59(3): 14-20. https://doi.org/10.48165/IJEE.2023.59303

Singh, K.M.; P. Singh and B. Rani. 2021. Food and Nutritional Security Initiatives in Bihar (India): An Overview. *International Journal of Current Microbiology and Applied Science*, 10(1): 3174-3186.

The Economic Times, 2023, Dec19. Share of agriculture in India's GDP declined to 15% in FY23: Govt. https://m.economictimes.com/news/economy/agriculture/share-of-agriculture-in-indias-gdp-declined-to-15-in-fy23-govt/articleshow/106124466.cms.

Varadarajan, R. 2010. Strategic marketing and marketing strategy: domain, definition, fundamental issues and foundational premises. *Journal of the academy of marketing science*, 38, 119-140.

Vineetha, A.; V. Sailaja and P.V.S. Gopal. 2019. Marketing behaviour of groundnut farmers in Anantapuram district of Andhra Pradesh. *Agriculture Update*, 14(1): 47-51.

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Research Article

Assessment of Awareness Among Women Engaged in Floriculture: A Case Study of Dinapur Village in Chiraigaon Block, Varanasi

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ABSTRACT

Woman plays a significant and crucial role in agricultural development, livestock production, horticulture, and floriculture post-harvest operation, agro-social forestry and fisheries etc. as a manager, decision maker and skilled farm worker from preparatory stage to harvesting, storage and marketing of the flowers. The study was conducted in 2020 in Dinapur village, Chiraigaon block, Varanasi, Uttar Pradesh, focusing on Self-Help Group women involved in floriculture activities. The aim was to assess the awareness of these women regarding floriculture-related activities across three dimensions: production, processing, and marketing of flowers. Data were collected from 150 women respondents using a random sampling method, facilitated by a pretested interview schedule and an ex-post-facto research design. Majority of the respondents (74.00%) had high level of awareness followed by medium (18.00%) and low (8.00%) level of awareness in Production, Processing and Marketing of flowers. It was also found that age and family size had negative and significant relationship with awareness of women in floricultural activities at 0.05 level of significance while education have negative and socio-political participation Information utilization pattern have positive and significant relationship awareness of women in floricultural activities at 0.01 level of significance. In case of regression model revealed that Socio political participation, Information utiization pattern, Age, Family Size contributed 22.22 per cent of total of variance in Production, Processing and Marketing of flowers. So, awareness among Women engaged in floriculture activities help in improvement of Production, Processing and Marketing of flowers.

Keywords: Awareness, Marketing, Production, Processing and Self-Help-Group

INTRODUCTION

Flowers have historically been an essential part of society, with their essence and smell being valued for their roles in a variety of social, cultural, and religious events in all societies (Chaubey, 2020). Entrepreneurial education and training are essential because they enable people to identify business opportunities, build their self-confidence, and obtain the knowledge and abilities needed to take advantage of those opportunities (Kumari *et al.,* 2024). A branch of horticulture called floriculture is dedicated to the lucrative production of ornamental and flowering plants for use in outdoor gardens and floristry (Basnayake, 2022; Thakur *et al.,* 2018). From the planning stages through the flower harvesting, storing, and marketing phases, women are indispensable in the floriculture industry as managers, decision-makers, and competent farm labourers (Mankar, 2013). In rural places, floriculture generates a lot of job opportunities, especially for women who

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work in both floriculture and garlanding (Chaubey, 2020; Bharane, 2007). Studies carried out in Nagaland demonstrate how the floriculture sector of horticulture is growing quickly, giving women and young unemployed women chances to find work (Pusa and Giribabu, 2016). Likewise, another study carried out in Himachal Pradesh, India, emphasises how floriculture growth provides women with a stable means of subsistence and revenue production (Singh, 2017). According to Olaniran and Perumal (2021) empowering women would entail giving them the tools they need to be self-sufficient, independent, and confident in order to handle any challenging circumstances. It would also entail allowing them to take part in developmental activities. Women in Varanasi, traditionally engaged in various agricultural practices, are now increasingly participating in floriculture due to its lucrative potential and lower investment costs. However, their awareness regarding modern practices, pest management, market trends, and government schemes aimed at supporting floriculture remains questionable. Understanding this awareness is critical, as it directly impacts the productivity and sustainability of floriculture practices. Previous studies indicate that women's awareness significantly influences their participation in agricultural decision-making and innovation adoption, which can enhance their productivity and overall quality of life. Moreover, socio-cultural factors play a significant role in shaping women's engagement and awareness in floriculture activities. Societal norms and restrictions can limit women's mobility and access to information sources, thereby affecting their ability to engage effectively in floriculture. Addressing these socio-cultural barriers is essential to promote women's active participation in the floriculture sector. The objective of this study is to assess the awareness levels among women engaged in floriculture activities in Varanasi, focusing on various aspects such as cultivation techniques, pest management, market dynamics, and governmental support. The findings aim to identify gaps in knowledge and awareness that can hinder the growth and sustainability of floriculture enterprises run by women. This research will contribute to the existing literature on gender roles in agriculture and provide insights for policymakers and practitioners aiming to enhance women's participation in floriculture.

MATERIALS AND METHODS

The research was conducted in Dinapur village (Chiraigaon block) Varanasi, U.P., The sample consist of 150 women respondents involved in floriculture activities. Random sampling method was used for the selection of respondents and data was collected using interview schedule. The methodology used is ex-post-facto research design and collected data subjected to statistical analysis by computing frequency, percentage and CSFR. Cumulative square root frequency (CSRF) Method allows greater efficiency for setting stratum boundaries. CSRF methodology breaks down the population into intervals, which can be of equal or unequal width. Awareness of respondents were measured on 2-point continuum i.e. 'yes' / 'No' on 25 statements under three dimensions Production, Processing and Marketing of flowers. Score 1 for response 'Yes' and score 0 for response 'No'. By summing up the scores recorded, total score was computed and low, medium and high categories were made on the basis of CSFR in both the categories. To know the relationship of socio-economic profile with awareness in floricultural activities statistical test correlation and regression was applied.

RESULTS AND DISCUSSION

The total score of were added and three strata were made based on Cumulative square root frequency method (CSRF). Table 1 clearly stated that majority of the respondents (74%) had high level of awareness in Production, Processing and Marketing of flowers. This high level of awareness of respondents in Floriculture can be justified as Flower cultivation is the main source of livelihood of the research area and since more than 30 years this area is in Floriculture related activities. So, they have high level of awareness in Floricultural activities being performed by them and their Family and society, followed by medium category of

Table 1: Distribution of respondents according to the overall Awareness in Production, Processing and Marketing of flowers (n=150)

Awareness level	Strata	Frequency	Percentage
Low	< 14.6	12	8.00
Medium	14.6-22.47	27	18.00
High	>22.47	111	74.00

Table 2: Relationship with selected independent variables with Awareness of women in Floricultural activities (dependent Variable)

Selected Independent Variable	Value of correlation coefficient (r)	Significant (p value)
Age	-.161*	0.049
Education	-.227**	.005
Family type	0.052	.525
Family size	-.163*	.046
Farm size	-0.48	.563
Socio-political participation	.344**	.000
Daily income	-.060	.468
Information utilization pattern	.262**	.001
Self confidence	.030	.717
Risk taking ability	0.96	.244

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

awareness (18.00%), and low level of awareness (8.00%) in Production, Processing and Marketing of flowers.

An attempt has been made to elucidate the prediction of selected socio-economic profile with awareness of women in Floricultural activities. The coefficient of correlation between the selected independent variables and Awareness of women in floricultural activities was worked out and tested for its significance. It was evident from the Table 2 that Socio-political participation and Information utilization pattern were found to have positive and significant relationship at 0.01 level of probability. Variables like, Family size, age and education were negatively significant with awareness. Age, Family size, was negatively significant at 0.05 level of probability whereas Education was negatively significant at 0.01 level of probability. Variables like Socio-political participation, Information utilization pattern, show positive significant relationships with awareness. This means that these variables exert their influence positively on awareness of women in Floricultural activities. With the increase in these variables the awareness of the women will increase. Variables like Age, Education, Family size show negative significant relationships with awareness. This means that these variables exert their influence negatively on awareness of women in Floricultural activities. With the increase in these variables the awareness of the women will decrease.

The data reported in Table 3 indicated that the value of coefficient of multiple determination R2 .Socio political participation alone contributed to 11.9 percent followed by if both Socio political participation, Information utiization pattern taken contributed to 16.4 percent, and if Socio political participation, Information utiization pattern, Age taken together contributed to 19.6 percent and if all the four variables Socio political participation, Information utiization pattern, Age, Family Size taken together contributed to 22.2 per cent. It means these variables are important to predict the awareness of the respondents in floricultural activities

Table 3: Regression Analysis of independent variables with awareness of women

Model Summary										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.344a	.119	.113	3.68478	.119	19.928	1	148	.000	
2	.405b	.164	.152	3.60129	.045	7.942	1	147	.005	
3	.442c	.196	.179	3.54397	.032	5.794	1	146	.017	
4	.471d	.222	.201	3.49774	.026	4.885	1	145	.029	1.529

a. Predictors: (Constant), Socio political participation
b. Predictors: (Constant), Socio political participation, Information utiization pattern
c. Predictors: (Constant), Socio political participation, Information utiization pattern, Age
d. Predictors: (Constant), Socio political participation, Information utiization pattern, Age, Family Size
e. Dependent Variable: Awareness

CONCLUSION

The study conducted in Dinapur village, Chiraigaon block, Varanasi, revealed that the majority of Self-Help Group (SHG) women involved in floriculture activities possess a high level of awareness (74%) regarding production, processing, and marketing of flowers. However, factors like age and family size were found to have a negative impact on awareness levels, while education, socio-political participation, and information utilization positively influenced awareness. The regression analysis showed that these factors collectively contributed to 22.22 per cent of the total variance in awareness. This highlights the importance of targeted interventions focusing on improving information dissemination and socio-political involvement to further enhance women's engagement in floriculture. Enhancing their awareness can lead to improved efficiency in floriculture activities, ultimately contributing to better economic outcomes for women in rural areas.

REFERENCES

Basnayake. 2022. Women Entrepreneurs and Poverty Alleviation in Floriculture of Colombo District in Sri Lanka. *Colombo Journal of Multi-Disciplinary Research,* 7(1&2): 84-110.

Bharane, S.B. 2007. Role Performance of Rural Women in Vermiculture enterprise: A case study. Thesis, M.Sc. Dr. Panjab Rao Deshmukh Krishi Vidyapeeth, Akola.

Chaubey, S. 2020. Women Empowerment through Floriculture in Dinapur Village, Varanasi, Uttar-Pradesh. Thesis, M.Sc., Department of Extension Education, Institute of Agricultural Sciences, BHU, Varanasi.

Kumari, A.; B. Jirli; P. Singh and P. Roy. 2024. Utility of Agri Clinic and Agricultural Business Center Training contents for Agripreneurs in Uttar Pradesh. *Indian Journal of Extension Education,* 60(1): 20-24.

Mankar, D.M.; Y.B. Shambharkar and K. Khade. 2013. Role performance of farm women engaged in floriculture. *Karnataka journal of Agriculture Science*, 26(1): 161-163.

Olaniran, S.O. and J. Perumal. 2021. Enacting community development principles in women empowerment projects: a case study in Ondo State, Nigeria. *Global Social Welfare,* 8(2): 151-158.

Pusa, K. and M. Giribabu. 2016. Floriculture and role of women in Nagaland: A case study. Arthshastra: *Indian Journal of Economics & Research,* 5(6): 42. Retrieved from https://doi.org/10.17010/aijer/2016/v5i6/107524.

Singh, P. 2017. A Global Conference on Diaspora and Politics. In Floriculture as An Emerging Tool for Women Empowerment: A Case Study of Himachal Pradesh. Hague. Retrieved from https:// www.researchgate.net/ publication/352180279.

Thakur, R.; A.I. Nahvi; V. Sharma and S. Khan. 2018. Multi-Dimensional Role of Rural Women in Agricultural: A Review. *International Journal of Pure and Applied Bioscience,* 6(5): 510-515. doi: http://dx.doi.org/ 10.18782/2320-7051.6558.

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Research Article

Breeding Vines: Unlocking the Grapevine Pollination Dynamics and Potential for Hybridization in Temperate Region of Kashmir Valley

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ABSTRACT

Grapevine reproductive biology plays a crucial role in viticulture success, yet research specific to the Kashmir region remains limited. This study investigated pollination and hybridization characteristics across three grape varieties (Sahebi, Thompson Seedless, and Fantasy Seedless) over two growing seasons viz., 2022 and 2023 in Kashmir, India. The research examined key reproductive parameters including pollen viability, stigma receptivity, pollen germination, and fruit set. Results demonstrated significant varietal differences across all parameters, with Sahebi consistently outperforming other varieties. Sahebi exhibited superior pollen viability (82.13%), stigma receptivity (84.73%), pollen germination (73.27%), and fruit set (61.72%). These findings provide valuable insights for grape breeding programs in Kashmir and contribute to the optimization of commercial grape production in the region. The study highlights Sahebi's potential as a superior variety for both breeding and commercial cultivation, offering practical implications for improving grape yield and quality in temperate climates.

Keywords: Grapevine, Breeding, Temperate zone, Cultivar, Pollination

INTRODUCTION

Viticulture, the cultivation of grapevines, stands as one of the most economically significant horticultural industries worldwide. Grapes (*Vitis vinifera* L.) are not only a valuable fruit crop but also the foundation of the global wine industry. In 2020, global grape production reached 78 million tonnes, with China, Italy, and the United States leading in production (FAO, 2021). India, ranking 11th globally, produced approximately 3 million tonnes of grapes in the same year, showcasing the crop's growing importance in the country's agricultural landscape (APEDA, 2021).

The success of grape cultivation and breeding programs hinges critically on understanding and optimizing pollination and hybridization processes. These processes are fundamental to both natural reproduction and controlled breeding efforts aimed at developing improved cultivars. Grapevines exhibit a range of reproductive systems, from perfect flowers capable of self-pollination to functionally female flowers requiring cross-pollination. Most cultivated varieties of *V. vinifera* are hermaphroditic, possessing both male and female reproductive organs within the same flower (Suleiman and Hernandez, 2022). However, the efficiency of self-pollination can vary significantly among cultivars and is influenced by environmental conditions. Pollination efficiency in grapes is influenced by various factors, including pollen viability, stigma receptivity, and environmental

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conditions (Sabir, 2011). Pollen viability and stigma receptivity are key determinants of successful pollination. Abreu *et al.* (2006) found that pollen viability in grape cultivars can range from 60 per cent to over 90 per cent, with significant variations among genotypes. Stigma receptivity typically peaks around bloom and can remain high for several days, depending on environmental conditions (Carreno *et al.*, 2006). Hybridization, the controlled crossing of different grape varieties or species, is a cornerstone of grape improvement programs, allowing breeders to combine desirable traits from different parents (Topfer *et al.*, 2011).

In India, grape cultivation spans diverse agro-climatic zones, from the tropical regions of Maharashtra and Karnataka to the temperate areas of Kashmir. This diversity presents both opportunities and challenges for grape breeding and cultivation. The Kashmir valley, with its temperate climate and distinctive soil conditions, presents unique opportunities and challenges for grape cultivation and breeding. Mir *et al.* (2015) conducted a survey of indigenous grape germplasm in Kashmir, identifying several local varieties with potential for use in breeding programs. These varieties, adapted to the region's cooler climate, could serve as valuable genetic resources for developing cold-hardy cultivars.

However, research on grape pollination and hybridization specific to Kashmir remains limited. Given the region's unique agro-climatic conditions, there is a pressing need for targeted studies to understand the reproductive biology of grapes in this environment and to develop varieties optimized for local cultivation (Riaz *et al.*, 2019). The aim of this study was to explore the current state of knowledge regarding pollination and hybridization of grape genotypes under Indian conditions, with a special focus on Kashmir. By examining the physiological, genetic, and environmental factors influencing these processes, we seek to provide insights that can inform and enhance grape breeding efforts in India and contribute to the global body of knowledge in viticulture.

MATERIALS AND METHODS

Parental selection: Seedless and seeded parents are to be selected in the Grape Experimental Farm at SKUAST-K Shalimar as per their quality attributes keeping in view the breeding programme under study.

Parameters to be recorded:

1) Percent pollen viability: Pollen viability will be determined by acetocarmine test. The per cent pollen viability shall be recorded by randomly selecting 50 flowers. The percent pollen viability shall be calculated by the formula as given below:

Pollen viability (%) = No. of viable pollens/ Total No. of pollens on a slide × 100

2) Percent pollen germination: Pollens will be dusted on agar medium containing 20 per cent sucrose and 0.01% boron and will be incubated at 25°C for 24 hours. The percent pollen germination shall be recorded by randomly selecting 50 flowers. The percent pollen germination shall be calculated by the formula as given below:

Pollen germination (%) = No. of pollens germinated / Total No. of pollens inoculated × 100

3) Percent stigma receptivity: Stigma receptivity will be determined by hydrogen peroxide test. Stigmas are to be observed under microscope and the release of air bubbles from its surface will be considered as receptive. The per cent stigma receptivity shall be recorded by randomly selecting 50 flowers. The per cent stigma receptivity shall be calculated by the formula as given below:

Stigma receptivity (%) = No. of stigmas with air bubbles/ Total No. of stigmas treated × 100

Hybridization: Here the seedless parent (Thompson Seedless) will serve as the female parent and seeded one (Sahebi) will be as male parent. The process will begin with the emasculation of the female parent before anthesis followed by pollination (using pollen of the male parent) then bagging and tagging. Percent fruit set will be determined by using the following formula:

Fruit set (%) = No. of berries formed / Total No. of flowers pollinated × 100

Statistical analysis: The observations recorded during the course of the investigation were subjected to statistical analysis according to the method of Analysis of Variance (Gomez and Gomez, 1984). The significance and non-significance of treatment effects were judged using R- software. A significant difference in the means was tested against the critical difference at a 5% significance level.

RESULTS AND DISCUSSION

Analysis of reproductive parameters across three grape varieties over two consecutive growing seasons (2022-2023) revealed significant variations in reproductive biology traits. All parameters demonstrated normal distribution as confirmed by Shapiro-Wilk tests ($p>0.05$), validating the statistical approach employed.

The observed differences in pollen viability across grape varieties demonstrate the inherent genetic diversity in their reproductive traits (Table 1 and Figure 1). Sahebi exhibited superior pollen viability (82.13%), significantly higher than Thompson Seedless (76.08%) and Fantasy Seedless (72.85%). While slight year-over-year variations were observed, they were not statistically significant between 2022 and 2023 for individual varieties. Sahebi, with a pollen viability of 82.13 per cent, stands out as an exceptional candidate for breeding programs, emphasizing its role as a reliable pollinator. High pollen viability is crucial for successful fertilization, as it directly affects pollen tube growth and ovule fertilization. The minimal variation between 2022 and 2023 aligns with prior research, suggesting that pollen viability remains relatively stable under uniform environmental conditions. This stability indicates that genetic factors are more influential than external conditions like temperature or humidity in determining this trait (Eibach and Topfer, 2003; Sabir, 2011; Topfer *et al.*, 2011; Celik and Marasali, 2017; Dantas *et al.*, 2021).

Stigma receptivity plays a vital role in the reproductive success of grapevines, influencing the pistil's capacity to support pollen germination and subsequent fertilization (Table 1 and Figure 1). The significant varietal differences observed here underline the specific reproductive capabilities of each variety. Sahebi maintained the highest receptivity (84.73%), followed by Thompson Seedless (82.05%) and Fantasy Seedless (79.25%). Temporal differences between years were minimal and non-significant, suggesting stable expression of this trait across growing seasons. Sahebi demonstrated the highest stigma receptivity at 84.73%, further enhancing its reproductive efficiency when coupled with its high pollen viability. The extremely low coefficient of variation (0.86%) reflects the reliability of the measurements. Moreover, the lack of significant differences between 2022 and 2023 indicates that stigma

Table 1: Effect of grape genotypes on pollen viability, stigma receptivity, pollen germination and fruit set in year 2022 and 2023

Genotype	Pollen Viability (%)		Stigma Receptivity (%)		Pollen Germination (%)		Fruit Set (%)	
	Year		Year		Year		Year	
	2022	2023	2022	2023	2022	2023	2022	2023
SA	81.57a	82.70a	84.30a	85.17a	72.33a	74.20a	60.63a	62.80a
TS	76.37b	75.80b	82.03b	82.07b	66.07b	67.17b	54.53b	54.73b
FS	72.73c	72.97c	79.13c	79.37c	63.17c	63.53c	50.43c	51.60c
Mean	76.89	77.16	81.82	82.20	67.19	68.30	55.20	56.38
CD ($p\leq0.05$)	1.89	1.92	1.32	1.35	1.78	1.81	1.85	1.88

CD= Critical difference; SA= Sahebi; TS= Thompson Seedless; FS= Fantasy Seedless

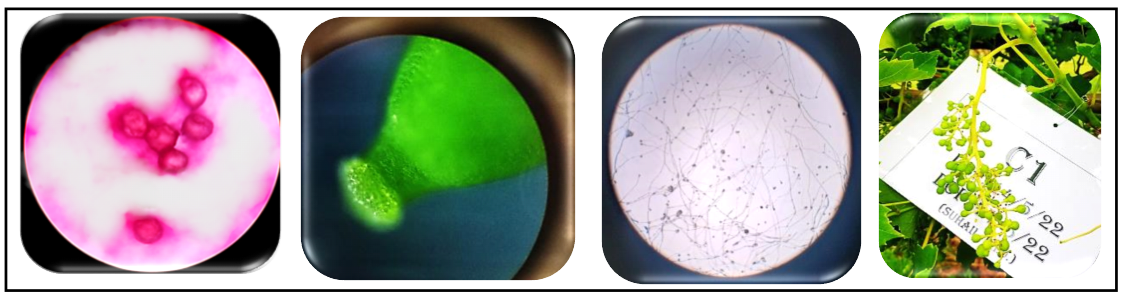

Figure 1: Photographs from left to right depict Pollen viability, Stigma Receptivity, Pollen Germination and Fruit Set (Thompson Seedless x Sahebi)

receptivity is largely unaffected by yearly climatic changes. This consistency supports its use as a stable selection criterion in grape breeding programs (Carreno *et al*., 2006; Pereira and Lima, 2019; Riaz *et al*., 2019; Ghaffari and Tavassolian, 2020).

Pollen germination rates provide a direct indicator of viable pollen functionality. Sahebi consistently demonstrated superior germination rates (73.27%), significantly exceeding both Thompson Seedless (66.62%) and Fantasy Seedless (63.35%). Notably, 2023 showed marginally improved germination rates across all varieties compared to 2022 (Table 1; Figure 1). The significant differences among varieties confirm the genetic basis of this trait, with Sahebi achieving the highest rate at 73.27 per cent. While genetic factors primarily control pollen germination, the significant temporal variation ($p<0.05$) suggests a secondary influence of environmental conditions, such as soil moisture and temperature. This finding is consistent with previous research, which observed enhanced germination rates in warmer seasons (Rao *et al*., 2015; Grigorova *et al*., 2018; Giacomelli *et al*., 2019; Suleiman and Hernandez, 2022). Furthermore, the slight improvement across all varieties in 2023 could indicate adaptive responses to changing environmental factors, providing a basis for optimizing cultivation techniques.

From the perusal of Table 1 (Figure 1) it is evident that fruit set, a critical indicator of successful fertilization and a key determinant of grape yield, exhibited the most pronounced varietal differences and temporal variation ($p<0.05$). Sahebi demonstrated significantly superior fruit set (61.72%), showing marked improvement from 2022 (60.63%) to 2023 (62.80%). Thompson Seedless maintained intermediate levels (54.63%) with minimal year-to-year variation, while Fantasy Seedless consistently showed the lowest fruit set (51.02%). Sahebi again outperformed the other varieties, with a fruit set of 61.72 per cent, improving from 2022 to 2023. This increase in fruit set highlights the combined advantages of Sahebi's high pollen viability, stigma receptivity, and pollen germination rates. The observed year-to-year variation ($p<0.05$) points to the influence of environmental factors such as temperature and humidity, which have been linked to fruit set variability in earlier studies (Sabir, 2011; Martin and Cavagnaro, 2019; Muthukumar *et al*., 2019; Keller, 2020). These findings emphasize the importance of selecting the right variety and optimizing environmental conditions to maximize fruit set in vineyards (Serrano and Barros, 2018; Zheng and Zhang, 2021).

CONCLUSION

This study provides strong evidence of significant varietal differences in the reproductive traits of grapevines, with Sahebi consistently emerging as the top performer. The stability of most parameters across seasons reinforces their potential as reliable selection criteria in grape breeding programs. Additionally, the observed improvements over the two years highlight the value of refining vineyard management practices. These insights contribute to a deeper understanding of grape reproductive biology, offering valuable guidance for enhancing both yield and quality in commercial grape production (Mullins *et al*., 1992; Rao *et al*., 2015; Wan *et al*., 2020; Jones and Davis, 2020).

REFERENCES

Abreu, C.; J.M. Da Silva and V. De Freitas. 2006. Study on pollen viability and stigma receptivity in grapes. *Journal of Horticultural Science and Biotechnology*, *81*(3): 470–474.

Agricultural and Processed Food Products Export Development Authority (APEDA). 2021. Annual Report 2020-2021. Retrieved from https://apeda.gov.in

Carreno, J.; M. Tellez and J. Velez. 2006. Research on stigma receptivity duration in grape cultivars. *European Journal of Agronomy*, *25*(4): 307–314.

Çelik, S. and B. Marasali. 2017. Pollen quality and fertilization potential in grapevine varieties. *Journal of Agricultural Science and Technology,* 19(2): 305–312.

Dantas, B.F.; M.A. Correia and M.P. Silva. 2021. Environmental stability of grapevine reproductive traits under different climate conditions. *Acta Horticulturae,* 1303: 231–238.

Eibach, R. and R. Topfer. 2003. Development of the 'Regent' grape variety. *Weinwirtschaft*, *34*(2): 38–45.

Food and Agriculture Organization. 2021. *Global grape production statistics*. FAO Yearbook of Agricultural Statistics.

Ghaffari, S. and I. Tavassolian. 2020. Stigma receptivity and fertilization dynamics in table grapes. *Plant Reproductive Biology,* 10: 45–53.

Giacomelli, L.; G. Marziano and A. Nardini. 2019. Impact of temperature on pollen germination in grapes. *Functional Plant Biology*, *46*(3): 289–298.

Gomez, K. A. and A. A. Gomez. 1984. *Statistical procedures for agricultural research*. John wiley & sons.

Grigorova, M.; I. Ivanova and T. Stoyanova. 2018. Pollen germination in Vitis vinifera under varied climatic conditions. *Bulgarian Journal of Agricultural Science,* 24: 1010–1018.

Jones, G.V. and R.E. Davis. 2020. Climate variability and wine grape production: a case study. *Australian Journal of Grape and Wine Research,* 26: 18–31.

Keller, M. 2020. The Science of Grapevines: Anatomy and Physiology. *Academic Press*.

Martin, M. and P. Cavagnaro. 2019. Fruit set dynamics in grape cultivars under varying environmental conditions. *European Journal of Agronomy,* 112: 125–133.

Mir, Z. A.; A. A. Shikh and Z. A. Bhat. 2015. Survey of indigenous grape germplasm in Kashmir. *Indian Journal of Agricultural Sciences*, *85*(6): 787–792.

Mullins, M.G.; A. Bouquet and L.E. Williams. 1992. Biology of the Grapevine. *Cambridge University Press*.

Muthukumar, D.; G. Narayanan and C. Diwakar. 2017. Impact of heat stress on grapevine reproduction in Tamil Nadu. *Indian Journal of Agricultural Research*, *51*(1): 34–39.

Pereira, G.E. and T.M. Lima. 2019. Impact of environmental factors on stigma receptivity and reproductive success in *Vitis vinifera*. *Journal of Berry Research,* 9: 199–210.

Rao, P. S.; R. K. Sharma and M. R. Reddy. 2015. Development of 'Arka Neelamani' and 'Manjri Naveen' grape varieties. *Journal of Horticultural Science*, *10*(2): 123–130.

Riaz, S.; K. Shimizu and T. Akagi. 2019. Advances in grape breeding and marker-assisted selection. *Molecular Breeding*, *39*(7): 78.

Sabir, F. 2011. Overview of factors influencing pollination in grapes. *Horticultural Reviews*, *37*: 222–250.

Serrano, G. and T. Barros 2018. Assessing varietal performance for grape reproductive traits. *Vitis,* 57: 23–30.

Suleiman, A. and O. Hernandez. 2022. Germination efficiency of grapevine pollen under controlled environmental conditions. *Scientia Horticulturae,* 296: 109-116.

Topfer, R.; R. Eibach and Y. Kebede. 2011. Hybridization as a cornerstone of grape improvement. *Plant Breeding Reviews*, *35*(1): 1–93.

Wan, Y.; Y. Li and C. Zhang. 2020. Development of Pierce's disease-resistant grape varieties through interspecific hybridization. *Plant Disease*, *104*(4): 1017–1025.

Zheng, X. and T. Zhang. 2021. Evaluation of genetic and environmental influences on grape reproductive traits. *Plant Physiology and Biochemistry,* 162: 198–206.

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Research Article

Gender Based Perception on Climate Change Awareness in Myanmar's Upland, Shan Region

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ABSTRACT

The study, conducted in 2024, aimed to assess gendered perspectives on climate change awareness among 200 respondents from Upland Shan State, Myanmar. A stratified random sampling method was used to select equal numbers of male and female participants from both Climate-Smart and Non-Climate-Smart Villages. Respondents were evaluated on their climate awareness, with particular attention to demographic factors such as age, education, occupation, farming practices, and local ecological knowledge. Women demonstrated higher awareness in areas such as water management and shared farming practices, while men with primary education and greater dependence on agriculture exhibited higher overall climate awareness. Statistical analysis revealed significant gender differences, with women placing more emphasis on water-related issues and community practices. The findings underscore the importance of gender-sensitive climate education programs that consider local ecological knowledge and the distinct roles of men and women, enhancing resilience in rural agricultural communities.

Keywords: Climate change awareness, Climate-Smart Villages (CSVs), Farming practices, Gender differences, Local ecological knowledge, Sustainable agriculture

INTRODUCTION

Climate change is recognized as one of the most significant global challenges, impacting ecosystems and human societies worldwide (Borras *et al.*, 2020). However, its effects are unevenly distributed, with rural and marginalized communities often bearing the brunt of climate-induced disruptions due to limited resources and greater exposure to environmental degradation (Nong *et al.*, 2020). In Myanmar, particularly in agricultural regions like Shan State, climate change threatens both the environment and the livelihoods of millions who rely on subsistence farming (Borras *et al.*, 2020). Women in these rural areas are especially vulnerable due to entrenched gender roles and inequalities, which restrict their access to critical resources and decision-making processes (Ylipaa *et al.*, 2019). This emphasizes the importance of understanding how climate change impacts and adaptation strategies differ between genders (Sujakhu *et al.*, 2022).

Myanmar's geographic location, coupled with its reliance on climate-sensitive sectors such as agriculture and fisheries, exacerbates the country's vulnerability to climate change (Oo *et al.*, 2020). Rural regions, especially Shan State, are increasingly exposed to climate-related

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disasters, including irregular rainfall, droughts, and soil erosion, which directly affect crop yields and water availability (Swe *et al.*, 2015). These environmental challenges impose additional burdens on rural communities, who already struggle with limited infrastructure and resources (Maung *et al.*, 2016). As a result, adaptation to climate change has become both urgent and challenging for these populations.

Gender plays a key role in how communities perceive and respond to climate change. In Myanmar, traditional gender roles place the responsibility of managing household resources, such as water, food, and energy, largely on women (Cai, 2022). As climate change affects the availability of these resources, women experience increased stress and workloads, as they search for alternatives to meet their families' needs (Rao *et al.*, 2019). Despite their critical role in maintaining household and community resilience, women are frequently excluded from formal decision-making processes related to climate adaptation and mitigation (Forsyth, 2018). This exclusion intensifies their vulnerability, as they lack access to essential information, resources, and technologies needed to adapt effectively to climate change (Faxon *et al.*, 2015).

Efforts to address gender inequality in climate adaptation have gained momentum in Myanmar and neighbouring countries. Gender-transformative resilience programs aim to empower women by addressing the root causes of gender inequality and ensuring their inclusion in climate adaptation strategies (Skakun *et al.*, 2021). These programs foster leadership roles for women in climate resilience, helping to build more equitable and resilient communities. For example, programs in Bangladesh have successfully involved women in climate adaptation, enabling them to contribute to both household and community resilience (Jordan, 2019).

This study aims to explore the gendered dimensions of climate change in Myanmar's Shan State, focusing on the exclusion of women from formal adaptation processes and its effects on the effectiveness of climate strategies. By assessing gender-based differences in climate awareness and evaluating climate-smart initiatives, this research hopes to contribute to the development of more inclusive and equitable adaptation strategies that enhance community resilience in the face of increasing climate challenges.

MATERIALS AND METHODS

A quantitative methodology was employed in this study to refine and validate statements that are foundational to climate change awareness, with the goal of constructing a precise and reliable awareness scale. Initially, 40 statements were developed through an extensive literature review and structured focus group discussions, ensuring alignment with the study's objectives and relevance to climate change awareness concepts. These statements were subsequently evaluated by a panel of 94 experts from Myanmar and India, selected for their specialized knowledge and experience in relevant fields. The expert panel, which included researchers, academics, and practitioners, assessed each statement's relevance using a five-point Likert scale ranging from "Highly Relevant" to "Highly Irrelevant."

To quantitatively assess each statement's relevance, the Relevancy Weightage (RW) was calculated by dividing each statement's cumulative score by the Maximum Possible Score (MPS), which was determined by multiplying the number of experts by the highest Likert score of 5. Statements with an RW exceeding 0.70 were retained, indicating sufficient relevance for further analysis. To ensure internal consistency and reliability across the scale, Cronbach's alpha was computed, with a threshold of 0.85 set to confirm item consistency. This rigorous validation process resulted in a final set of 20 statements that demonstrated high relevance and reliability, forming the basis of the awareness scale. Statistical validation further confirmed that the scale met international standards for consistency and reliability, verifying its suitability for assessing climate change awareness.

This validated quantitative approach was applied in the field from May to June 2024 to investigate gendered perspectives on climate change awareness within Myanmar's Climate-Smart and Non-Climate-Smart Villages in the Upland Shan region. Stratified random sampling was employed, with strata based on village type (Climate-Smart or Non-Climate-Smart) and gender. Fifty respondents were selected randomly from each gender group within each village type, resulting in a total of 200 respondents equally divided by gender. This sampling method facilitated a detailed analysis of climate change awareness across gender and village types, with descriptive statistics enabling

comparisons between groups. The analysis revealed significant gender-based differences in awareness levels across village types. This methodology affirmed the robustness of the awareness scale, establishing the reliability and validity of the data collection instrument.

For calculating the Climate Change Awareness Index, first, the numerical scores assigned to each respondent's answers were summed. Each respondent's score was then normalized by dividing it with the maximum possible score, resulting in an index from 0 to 1. To express the index as a percentage, the result was multiplied by 100, with 0% representing no awareness and 100% indicating full awareness. Adapted from (Kutir *et al.*, 2015), the formula provides a standardized approach for calculating awareness levels as a percentage, thereby enhancing comparability and reliability. The formula used is:

$$\text{Climate Change Awareness Index} = \frac{\text{Awareness Score}}{\text{Maximum Score}} \times 100$$

RESULTS AND DISCUSSION

Table 1 presents climate change awareness levels among male and female respondents in Upland Shan State, Myanmar. The mean scores reflect agreement with climate-related statements, while t-statistics and p-values highlight gender differences. For most statements, both genders showed similar awareness levels, with no significant differences. For instance, the statements "Weather affects farming" ($t = -1.51$, $p = 0.13$) and "Climate impacts fish" ($t = -0.75$, $p = 0.45$) had p-values greater than 0.05, indicating no significant difference between male and female responses. However, significant differences were found in a few areas. Females scored significantly higher on statements like "Shared practices beneficial" ($t = -2.06$, $p = 0.04$), "Clean water essential" ($t = -2.30$, $p = 0.02$), and "Weather information necessary" ($t = -2.41$, $p = 0.02$), suggesting that women place more emphasis on these issues compared to men. Overall, while both genders are aware of climate change issues, women tend to

Table 1: Climate Change Awareness Among Genders in Upland Shan State, Myanmar (N=200)

Statement	Male		Female		Standard Error	t-statistic	p-value
	Mean	SD	Mean	SD			
Weather affects farming	3.03	1.57	3.35	1.43	0.21	-1.51	0.13
Climate impacts fish	3.17	1.33	3.31	1.3	0.19	-0.75	0.45
Heavy rains damage	3.48	1.37	3.75	1.33	0.19	-1.41	0.16
Heat hinders cultivation	3.46	1.37	3.65	1.18	0.18	-1.05	0.29
Drought-resistant crops necessary	3.32	1.32	3.47	1.18	0.18	-0.85	0.40
Water storage crucial	3.48	1.31	3.74	1.28	0.18	-1.42	0.16
Rainwater improves productivity	3.34	1.3	3.61	1.14	0.17	-1.56	0.12
Solar powers irrigation	2.86	1.39	3.02	1.24	0.19	-0.86	0.39
Natural fertilizers improve	3.4	1.4	3.54	1.29	0.19	-0.74	0.46
Diverse crops resilient	3.31	1.26	3.48	1.21	0.17	-0.97	0.33
Timing helps adaptation	3.24	1.31	3.53	1.16	0.17	-1.66	0.10
Windbreaks protect crops	2.89	1.32	3.06	1.2	0.18	-0.95	0.34
Water storage groups	2.69	1.28	2.8	1.18	0.17	-0.63	0.53
New techniques vital	3.12	1.47	3.24	1.31	0.20	-0.61	0.54
Climate-compatible farming	3.09	1.46	3.3	1.31	0.20	-1.07	0.29
Shared practices beneficial	3.12	1.41	3.52	1.33	0.19	-2.06	0.04
Clean water essential	3.28	1.45	3.71	1.18	0.19	-2.30	0.02
Weather information necessary	3.46	1.48	3.92	1.2	0.19	-2.41	0.02
Teach environmental care	3.33	1.56	3.69	1.36	0.21	-1.74	0.08
Strong buildings needed	3.44	1.51	3.78	1.35	0.20	-1.68	0.09

show greater awareness in areas related to water management and community practices, possibly due to their roles in agriculture and communal activities. The table highlights key gender differences in the awareness of specific climate-related challenges.

Table 2 presents a gender-based comparison of climate change awareness levels in relation to various socio-economic factors, including age, education, occupation, economic dependency, farming practices, and local ecological knowledge. The data indicates that awareness tends to increase with age, particularly among males, with higher awareness levels in the 36-65 age range.

Education also plays a significant role, as individuals with higher education levels (middle school and above) show greater climate change awareness, especially among males. Occupation further Influences awareness, with those engaged in agriculture, labour, and salaried jobs displaying higher awareness compared to other categories. Economic dependency appears to impact awareness, with very highly dependent males demonstrating the highest levels of awareness, while

Table 2: Gender Comparison of Climate Change Awareness in Relation to Socio-Economic Factors

Variables	Category	Climate Change Awareness Levels					
		Male			Female		
		Low (%)	Medium (%)	High (%)	Low (%)	Medium (%)	High (%)
Age	Very low (0-20)	0	3	4	0	0	3
	Low (21-35)	4	19	13	0	13	16
	Medium (36-50)	8	9	26	3	12	20
	High (51-65)	0	4	10	1	6	20
	Very High (>65)	0	0	0	0	4	2
Education Level	Primary school	3	3	1	2	12	13
	Middle School	9	32	52	1	11	22
	High School	0	0	0	1	9	12
	Graduate and above	0	0	0	0	3	14
Occupation	Others	0	0	1	0	2	4
	Salary-Man	0	0	1	0	0	12
	Agriculture + Business	7	9	4	0	1	2
	Agriculture + Services	0	1	1	0	1	1
	Agriculture + labour	4	6	15	2	15	23
	Agriculture	1	19	31	2	16	19
Economic Dependency	Slightly dependent	0	4	7	0	4	9
	Moderately dependent	11	13	8	3	13	13
	Very Dependent	0	2	17	0	5	23
	Very Highly Dependent	1	16	21	1	13	16
Farming Practices	Conventional	12	32	35	4	31	37
	Organic	0	0	0	0	2	0
	Mixed	0	3	18	0	2	24
Local Ecological Knowledge	Unsure	2	0	1	0	0	1
	Not knowledge	0	2	1	0	1	3
	Slightly knowledge	10	31	9	4	31	16
	Moderate knowledge	0	2	30	0	3	29
	Very knowledgeable	0	0	12	0	0	12

females show a more even distribution across all dependency levels. Finally, local ecological knowledge strongly correlates with awareness levels, with "very knowledgeable" males and females showing the highest levels of climate change awareness. These findings highlight the importance of socio-economic factors in shaping climate change awareness across genders.

The Figure 1 presents a comparison of climate change awareness levels between male and female respondents in the upland Shan region of Myanmar. The data is divided into three categories: low, medium, and high awareness. Among male respondents, 42 per cent fall into the low-awareness category, while none of the females are represented in this group, indicating a gender gap at the lower end of awareness. The majority of respondents, both male (56%) and female (75%), demonstrate medium awareness. However, the most significant difference is seen in the high-awareness category, where only 2% of males show high awareness compared to 25 per cent of females. This suggests that women in the region tend to be more aware of

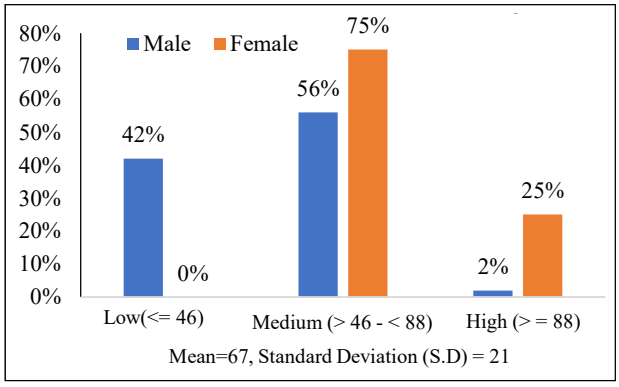

Figure 1: Distribution of Respondents by Awareness Levels of Climate Change Issues in Upland, Shan Region, Myanmar (Gender-Based Analysis) (N=200)

climate change issues, especially in areas related to water management and community practices, which are typically within their domain. These findings highlight the need to consider gender dynamics when developing climate change awareness programs, as women may be more attuned to certain climate-related challenges due to their roles in agriculture and communal responsibilities.

Table 3 presents the results of a gender-based comparison of socio-economic factors influencing climate change awareness, using Pearson's chi-square test and Cramer's V to measure the strength of association. For males, age ($\chi^2 = 13.388$, $p < 0.05$) and education level ($\chi^2 = 8.234$, $p < 0.05$) significantly influence climate change awareness, with Cramer's V values indicating moderate associations (0.259 and 0.287, respectively). Occupation ($\chi^2 = 22.012$, $p < 0.05$) and economic dependency ($\chi^2 = 33.599$, $p < 0.01$) also show significant associations for males, with strong relationships indicated by Cramer's V values (0.332 and 0.41).

In contrast, for females, only farming practices ($\chi^2 = 17.332$, $p < 0.01$) and local ecological knowledge ($\chi^2 = 39.511$, $p < 0.01$) significantly influence climate change awareness, with moderate to strong associations (Cramer's V = 0.294 and 0.444). Notably, variables such as age and occupation show non-significant associations for females, suggesting gender differences in how socio-economic factors influence climate awareness. These results emphasize the complexity of the gendered impacts of socio-economic factors on climate change awareness.

The study conducted in Upland Shan State, Myanmar, reveals both similarities and differences in

Table 3: Gender-Based Comparison of Socio-Economic Factors Influencing Climate Change Awareness

Variables	Pearson χ^2 value (Chi-square value)	
	Male	**Female**
Age	13.388* Cramer's V value= 0.259	10.693 ^{NS} Cramer's V value= 0.231
Education Level	8.234*Cramer's V value = 0.287	6.242 ^{NS} Cramer's V value= 0.177
Occupation	22.012*Cramer's V value= 0.332	10.788^{NS} Cramer's V value= 0.232
Economic Dependency	33.599** Cramer's V value= 0.41	12.134^{NS} Cramer's V value= 0.246
Farming Practices	11.816** Cramer's V value= 0.344	17.332** Cramer's V value= 0.294
Local Ecological Knowledge	66.881** Cramer's V value= 0.578	39.511** Cramer's V value= 0.444

$p < 0.05$ is marked as (*) and $p < 0.01$ as (**).

climate change awareness between male and female respondents. Both genders generally understand climate-related issues, such as recognizing that "weather affects farming" and "climate impacts fish," with no significant differences for most statements. These findings align with research in Myanmar's Central Dry Zone and the Indian Western Himalayas, where local communities share knowledge about climate variability and its impact on agriculture (Zin *et al.*, 2018; Khan *et al.*, 2022).

However, significant gender differences were observed in certain areas. Female respondents demonstrated higher awareness of topics such as "shared practices beneficial," "clean water essential," and "weather information necessary," which may be attributed to their roles in communal resource management. This mirrors findings from studies in India's Uttarakhand and Bihar, where women play critical roles in climate-sensitive activities such as water management and agriculture, and face greater barriers in climate adaptation due to socio-ecological contexts (Ravera *et al.*, 2016).

Socio-economic factors such as age and education were also significant. Males aged 36-65 displayed the highest awareness levels, with education particularly influential among males with middle school education and females with higher education. These findings are consistent with research in Northern Shan State and Nepal, as well as policy reviews in India, where age and education play key roles in shaping climate awareness (Kmoch *et al.*, 2018; Goodrich *et al.*, 2021; Singh *et al.*, 2021).

Economic dependency and occupation also shaped male awareness, with those engaged in agriculture showing the highest levels of climate change awareness. In contrast, female awareness was more balanced across different economic dependency levels. This reflects similar findings from the Nanda Devi Biosphere Reserve in India, where women's livelihoods were more affected by climate change due to their engagement in subsistence agriculture, but they showed greater adaptive capacity when involved in ecotourism and other livelihood diversifications (Ogra and Badola, 2015).

Furthermore, local ecological knowledge significantly influenced awareness in both genders, highlighting the role of traditional knowledge systems in climate adaptation strategies. This is similar to the findings from India's climate change adaptation policies, which emphasize the need to incorporate gender-sensitive strategies in policy frameworks (Sorensen *et al.*, 2018).

In conclusion, gender-specific trends indicate that women are more aware of issues related to community practices and water management, while men's awareness is more influenced by occupation and economic dependency. These findings highlight the importance of gender-sensitive approaches to climate change initiatives, emphasizing the need to consider socio-economic barriers, intersectional vulnerabilities, and knowledge systems in building resilience.

CONCLUSION

The study's findings reveal that gender significantly shapes climate change awareness in Upland Shan State, Myanmar, with distinct awareness levels and focal areas influenced by socio-economic factors. Both male and female respondents are generally aware of climate impacts on agriculture, though gender-specific roles lead to varied emphases. Policy recommendations include gender-sensitive adaptation strategies. Programs focused on water resources and community-led conservation are essential for women, while targeted education and agricultural training for men can improve resilience. These recommendations align with findings highlighting the need for tailored climate policies in rural and resource-dependent communities.

REFERENCES

Borras, S.M.; J.C. Franco and Z. Nam. 2020. Climate change and land: Insights from Myanmar. *World Development*, 129. https:// doi.org/ 10.1016/ J. WORLDDEV. 2019. 104864

Cai, Y. 2022. Climate resilience and resistance in Myanmar: transcripts from voiceless women. *Climate and Development*, 15(5): 456–465. https://doi.org/ 10.1080/ 1756 5529.2022.20 97162

Faxon, H.; R. Furlong and M. Sabe Phyu. 2015. Reinvigorating resilience: violence against women, land rights, and the women's peace movement in Myanmar. *Gender & Development*, 23(3): 463–479. https://doi.org/ 10.1080/13552074.2015.1095559

Forsyth, T. 2018. Is resilience to climate change socially inclusive? Investigating theories of change processes in Myanmar. *World Development*, 111: 13–26. https:// doi.org/ 10.1016/J.WORLDDEV.2018.06.023

Jordan, J.C. 2019. Deconstructing resilience: why gender and power matter in responding to climate stress in Bangladesh. *Climate and Development*, 11(2): 167–179. https:// doi.org/10.1080/17565529.2018.1442790

K, B.; R.R. Chapke and S. Kammar. 2022. Farmers' Perception about Climate Change and Response Strategies. *Indian Journal of Extension Education*, 58(1): 7–11. https:// doi. org/10.48165/ijee.2022.58102

Kutir, C.; B.N. Baatuuwie; S. Keita and M. Sowe. 2015. Farmers Awareness and Response to Climate Change: A Case Study of the North Bank Region, The Gambia. In *Journal of Economics and Sustainable Development www.iiste.org ISSN* (Vol. 6, Issue 24). Online. www.iiste.org

Maung, M.W.; J.M. Pulhin; M.V.O. Espaldon and N.M. Lalican. 2016. Climate change awareness and farm level adaptation of farmers (central dry zone) in monywa township, Sagaing Region, Myanmar. *Journal of Environmental Science and Management*, 19(1): 46–57. https://doi.org/10.47125/JESAM/2016_1/06

Nong, H.T.T.; C. Gan and B. Hu. 2020. Climate change vulnerability and adaptation in Vietnam from a gender perspective: a case study of Northern province of Vietnam. *International Journal of Social Economics*, 47(8): 953–972. https://doi.org/ 10.1108 /IJSE-09-2019-0534

Ogra, M.V. and R. Badola. 2015. Gender and climate change in the Indian Himalayas: global threats, local vulnerabilities, and livelihood diversification at the Nanda Devi Biosphere Reserve. *Earth System Dynamics Discussions*, 6(2): 505–523. https://doi. org/10.5194/ESD-6-505-2015

Oo, A.T.; G. Van Huylenbroeck and S. Speelman. 2020. Measuring the Economic Impact of Climate Change on Crop Production in the Dry Zone of Myanmar: A Ricardian Approach. *Climate*, 8(1). https://doi.org/10.3390/CLI8010009

Rai, R.; B. Satpathy and A.K. Singh. 2023a. Gender-based Variations in Perception of Flood Impacts-A Micro Study. *Indian Journal of Extension Education*, 59(2): 69–73. https:// doi.org/10.48165/IJEE.2023.59215

Rai, R.; B. Satpathy and A.K. Singh. 2023b. Gender-based Variations in Perception of Flood Impacts-A Micro Study. *Indian Journal of Extension Education*, 59(2): 69–73. https://doi.org/10.48165/IJEE.2023.59215

Rao, N.; E.T. Lawson; W.N. Raditloaneng; D. Solomon and M.N. Angula. 2019. Gendered vulnerabilities to climate change: insights from the semi-arid regions of Africa and Asia. *Climate and Development*, 11(1): 14–26. https:/ / doi.org/10.1080/ 17565529.2017.1372266

Ravera, F.; B. Martín-López; U. Pascual and A. Drucker. 2016. The diversity of gendered adaptation strategies to climate change of Indian farmers: A feminist intersectional approach. *Ambio*, 45: 335–351. https:// doi.org/10.1007/S13280-016-0833-2

Skakun, Z.; I. Smyth and V. Minne. 2021. *Gender-Transformative Resilience Programming Experiences from Bangladesh and Myanmar*. https://doi.org/ 10. 21201/ 2021.7635

Sorensen, C.; S. Saunik; M. Sehgal; A. Tewary; M. Govindan; J. Lemery and J. Balbus. 2018. Climate Change and Women's Health: Impacts and Opportunities in India. *GeoHealth*, 2(10): 283–297. https://doi.org/10.1029/2018GH000163

Sujakhu, N.M.; S. Ranjitkar; Y. Su; J. He and J. Xu. 2022. A gendered perspective on climate change adaptation strategies: a case study from Yunnan, China. *Local Environment: The International Journal of Justice and Sustainability*, 28(1): 117–133. https://doi.org/10.1080/13549839.2022.2130883

Swe, L.M.M.; R.P. Shrestha; T. Ebbers and D. Jourdain. 2015. Farmers' perception of and adaptation to climate-change impacts in the Dry Zone of Myanmar. *Climate and Development*, 7(5): 437–453. https://doi.org/10.1080/17565529.2014.989188

Ylipaa, J.; S. Gabrielsson and A. Jerneck. 2019. Climate Change Adaptation and Gender Inequality: Insights from Rural Vietnam. *Sustainability*, 11(10). https:// doi.org/10.33 90/SU11102805

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Research Article

Network Analysis and Trait Distribution of Traditional Rice Varieties in the Western Ghats: Implications for Climate-Resilient Agriculture

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ABSTRACT

Traditional rice varieties (TRVs) play a crucial role in bolstering agricultural resilience to climate change, thanks to their unique climate-adaptive traits. Typically, characters of these native varieties are studied from a life sciences perspective, focusing on their morphological and physiological features. Diverging from this approach, we investigated this critical topic through a social science lens. Our study analyzes the co-occurrence and distribution of climate-resilient traits in TRVs cultivated in Wayanad, a significant agro-biodiversity hotspot in the Western Ghats of India, utilizing secondary data. The patterns and distribution of these traits remain largely unexplored, limiting their potential to be harnessed for sustainable farming—an issue we sought to address in this research. Using Social Network Analysis (SNA), we identified notable interactions among traits, such as lodging resistance found across different TRVs. Additionally, cluster analysis revealed two distinct varietal groups, primarily differentiated by straw yield. The findings emphasize the importance of understanding trait distribution patterns to guide agricultural biodiversity conservation efforts and promote traditional rice varieties as sustainable options for climate-resilient farming.

Keywords: Traditional varieties, Western ghats, Climate resilience, Social network analysis, Rice

INTRODUCTION

India, recognized as a major center for rice cultivation, harbours an extensive diversity of over 200,000 rice landraces, reflecting its rich agro-biodiversity (Richharia and Govindasamy, 1990). Among these, scented rice varieties have held cultural significance, featuring prominently in religious rituals for approximately 3,000 years (Ahuja *et al.*, 2008) and being referenced in ancient Ayurvedic texts (Jose *et al.*, 2018; Sathiya, 2013). These traditional rice varieties (TRVs) have evolved across a diverse range of landscapes throughout the subcontinent, adapting to distinct soil types, rainfall patterns, and micro-climates (Agnihotri and Palni, 2007; Jayashankar *et al.*, 2001; Lakshmikutty, 2018). However, the Green Revolution of the 1960s marked a pivotal shift in rice cultivation, with the introduction of high-yielding varieties (HYVs) characterized by increased yields, shorter cropping periods, and higher cropping intensity. This shift significantly reduced the prevalence of TRVs, as HYVs, with their narrower and less stable genetic base, supplanted the more diverse traditional types (Ashraf and Lokanadan, 2017; Nelson, Ravichandran and Antony, 2019; Roy *et al.*, 2019), while necessitating intensive use of production inputs (Janaiah and Debdutt, 2017). The displacement of traditional varieties in favor of monohybrid crops has continued, despite the fact that these traditional varieties harbor a valuable genetic pool, crucial for adapting modern rice

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varieties to the growing challenges posed by climate change (Zhu *et al.*, 2003).

The TRVs of India exhibit a wide array of morphological and physiological traits, particularly in regions most affected by climate change (Muralikrishnan *et al.*, 2021). They contain critical genetic diversity, enduring drought, floods, salinity, pests, and diseases, while also lowering cultivation costs. These attributes contribute significantly to their climate resilience. Despite their declining cultivation, these varieties remain an essential component of indigenous farming systems, predominantly maintained by indigenous communities residing in marginal lands across diverse agro-climatic zones in India (Banerjee and Godda, 2013; Das and Das, 2014). The impact of climate change on agriculture is profound, affecting both individual farmers and broader populations (Grigorieva *et al.*, 2023). Local agricultural communities bear the brunt of these changes, which directly influence employment, income sources, and agricultural production. TRVs offer a promising opportunity for small and marginal farmers engaged in traditional, low-input, or organic farming systems to optimize production with reduced costs (Singh *et al.*, 2017). The conservation and utilization of these TRVs are paramount for sustaining agricultural biodiversity and enhancing resilience in the face of climatic uncertainties.

The Western Ghats, recognized as a biodiversity hotspot, is particularly significant for its rich rice diversity (Semwal *et al.*, 2019). Situated in the southwestern corner of the Indian peninsula, Kerala–part of the southern Western Ghats–hosts an estimated 2,000 TRVs, each adapted to a wide range of agro-ecological conditions (Blakeney, 2020). Wayanad district, located within the high-range zone of Kerala, boasts a rich agricultural heritage and a legacy of cultivating diverse TRVs. Historically, over 75 such varieties were grown in the region until the 1990s (MSSRF, 2011). However, the shift towards high productivity, driven by modern agricultural practices, has led to the replacement of these traditional varieties with modern high-yielding ones (Gopi and Manjula, 2018). Consequently, the area under traditional varieties has significantly declined. According to a study by the Kerala State Biodiversity Board, 55 local paddy varieties have vanished from the district. Another study highlights that only 11% of Wayanad's total rice area is now under traditional varieties (Government of Kerala, 2011). Currently, fewer than 20 varieties, specifically suited to the region's agro-climatic conditions, remain in cultivation (Department of Science and Technology, 2019). This underscores the urgent need to protect rice biodiversity in Wayanad. Integrating TRVs with modern farming practices could enhance food and nutritional security, improve climate resilience, and support the preservation of rice genetic diversity, both in India and in similar agricultural settings globally.

The aim of this study was to gain a deeper understanding of the characteristic traits of TRVs and their patterns of distribution. While previous research has documented the morphological features of these varieties, a comprehensive analysis of their prevalence and the extent to which these traits are shared among different varieties remains underexplored. Given the significance of these traits in enhancing resilience to climate change, this study sought to investigate them in greater detail. This study tried to address the following research questions:

1. What are the traits shared by the TRVs?
2. What is the pattern in which these traits are shared among different varieties? Is there any co-occurrence of traits across different rice varieties?
3. Can the TRVs be categorized into clusters based on their similarity of traits?

MATERIALS AND METHODS

This study intended to understand the pattern of shared traits by the TRVs and its dynamics. Towards this purpose, we mainly depended on two data sets. Primarily required data on key varietal characteristic such as duration, yield, straw yield, grain colour, lodging character, aromatic property, plant height and pest and disease resistant traits were obtained from the report published by Regional Agricultural Research Station, Ambalavayal, under the Kerala Agricultural University (https://kau.in/document/12012). Further, the flood tolerance and climate change resilience of the TRVs were reported by a study published by Kerala State Biodiversity Board, conducted by Community Agro Biodiversity Center, M.S. Swaminathan Research Foundation, Wayanad. (https://web.cdit.org/ksbb/wp-content/uploads/2023/02/Final_Report_MSSRF.pdf). Details of 61 TRVs found at Wayanad

were compiled from these reports and the scope of investigation of this study is limited to this data.

To understand the dynamics of traits and its sharing characteristics, we performed Social Network Analysis (SNA). Mapping of shared traits by the traditional varieties and that by the climate resilient varieties as reported by cultivators was performed by using SNA. Further, Hierarchical cluster analysis (HCA) was conducted using Ward's method with Euclidean distance. Since we were not sure about the number of clusters and because our data contained both quantitative and qualitative variables, we performed HCA for cluster analysis. Moreover, HCA is particularly effective for smaller datasets where visual inspection of the dendrogram is feasible and meaningful (Kaufman and Rousseeuw, 1990). Finally we also checked the determinant traits of the perceived climate resilient varieties using binary logistic regression. SNA was performed using the open source software Gephi© while HCA and regression analysis was performed using Python. Additionally correlation analysis was also performed by using the appropriate methods (Pearson Correlation for continuous quantitative variables and Spearman's Rank Correlation for qualitative variables).

RESULTS AND DISCUSSION

The study aimed to explore the patterns, distribution, and co-occurrence of traits in native paddy varieties to enhance understanding and profiling. Initially, Traditional Rice Varieties (TRVs) were categorized based on their duration into short (90-120 days), medium (120-140 days), and long (140-180 days) groups. Subsequent analysis was conducted using this classification as the foundation. It was done to generate meaningful inferences from the data analysis and to identify the pattern of shared traits in each group. The descriptive statistics of selected traits and results of SNA is given the below (Table 1).

SNA was performed to visualize the properties of TRVs segregated by their duration (Figure 1).

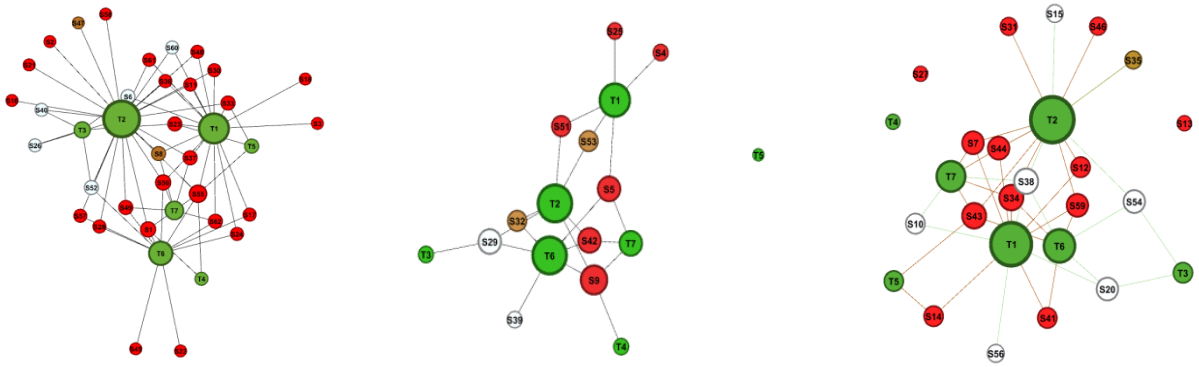
From the analysis, it is evident that graph density is higher for the network of medium followed by short and long duration varieties. It indicates the sharing of traits under consideration by the former to a greater extent than the latter two. Further, it is noted that lodging (T2) is the trait shared most commonly by these varieties followed by average yield (T1) for the TRVs irrespective of their duration. Only in the case of medium duration varieties, the trait pest and disease tolerance was also found to be shared high, only next to the lodging trait. As much as one third of the traditional varieties share the trait, P&D resistance irrespective of their duration.

Further, we also developed a network map of climate resilient varieties (as perceived and identified by the farmers) (Figure 2). It comprised 4 long duration, 6 short duration and one medium duration varieties. The mapping was conducted in a manner consistent with previous method.

In this map also prominently shared traits were average yield (T1) and pest and disease resistance (T6). Further, we performed hierarchical cluster analysis to check the groupings of the TRVs in terms of the traits (Figure 3). The results indicated existence of two prominent clusters. The branch at the bottom left of the dendrogram indeed contains the varieties V7, V28, V41, and V1. These varieties are grouped together in the orange branch, indicating they are more similar to each other compared to others in the dataset. These varieties are grouped together, indicating high similarity

Table 1: Descriptive Statistics and Social Network Analysis (SNA) of Traditional Rice Varieties in Wayanad, Kerala

Duration of Varieties	Long	Medium	Short
Total number	32	10	19
Mean Yield(kg/Acre)	1305 (±567.29)	1271 (±597.25)	1238 (±566.80)
Mean Straw yield	1742 (±1485.23)	1726 (±1636.80)	1626 (±1053.00)
Varieties with lodging trait	14	8	20
Varieties with scented trait	3	0	5
Graph Density	0.096	0.162	0.123
Prominently shared traits within the group	T2, T1	T2, T6	T1, T2



Long duration variety network Medium duration variety network Short duration variety network

In the figure (network graph), there are two types of nodes. The green coloured nodes (Traits) and rest of the nodes (varieties). Green nodes with Label T are the traits considered for the analysis (T1: Yield; T2: Lodging; T3: Aroma; T4: Flood Tolerance; T5: Drought Tolerance; T6: Pest and Disease Tolerance; T7: PPVFRA registration status). The size of the nodes is proportional to the total number of ties it has with the variety nodes. Other coloured nodes indicate the grain colour of the variety under consideration. The grain colours observed were white, red and brown as indicated by the respective nodes. The lines connected to the traits node indicate the presence of that trait for that particular variety and vice versa except in the case of yield. For mapping the trait of yield, the average yield within each category was used as the criterion to determine eligibility for a tie among particular varieties.

Figure 1: Network of traditional rice varieties segregated by duration

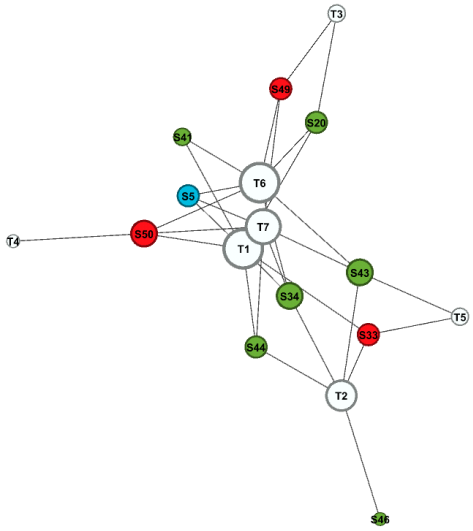


Figure 2: Network of climate resilient traditional rice varieties

In the figure (network graph), there are two types of nodes. The white coloured nodes (Traits) and rest of the nodes (varieties by duration). The duration of the varieties are signaled by their colour (Red: Long duration, Green: Short duration, Blue: medium duration)

among them. The low height at which they are merged supports this argument.

The right red coloured branch, which makes up the majority of the dendrogram, contains all the other rice varieties. These varieties are grouped at different levels within this larger cluster, showing varying degrees of similarity among them. This cluster contains a more diverse set of rice varieties, with varying levels of similarity. Additionally, at the top of the dendrogram, a significant vertical distance separates the orange branch from the red branch. This large distance suggests that Cluster 1 is significantly different from Cluster 2.

The clusters were compared with regard to important parameters such as duration, yield and straw yield per unit area (Table 2).

The cluster analysis revealed that Cluster 1 (V1, V7, V28, V41) differs significantly from Cluster 2 in terms of straw yield per acre, with Cluster 1 having a substantially higher straw yield. This finding suggests that the varieties in Cluster 1 might be particularly valuable for dual-purpose uses, such as both grain and biomass production, making them suitable for regions where fodder is also a critical requirement. No significant differences were observed between the clusters for duration or grain yield, indicating that these traits are more uniformly distributed across the traditional varieties under consideration. However, the distinct difference in straw yield highlights the potential for targeted conservation and breeding strategies to enhance biomass production in TRVs.

Table 2: Selected traits of traditional rice varieties in clusters

Clusters	Duration	Yield/acre	Straw yield/acre
Cluster 1	127.5 (42.91)	1306.46 (305.30)	7575.41(1732.7)**
Cluster 2	140.32(20.17)	1305.29 (582.84)	1340.43 (512.41)

** Significantly differ at 5 % level

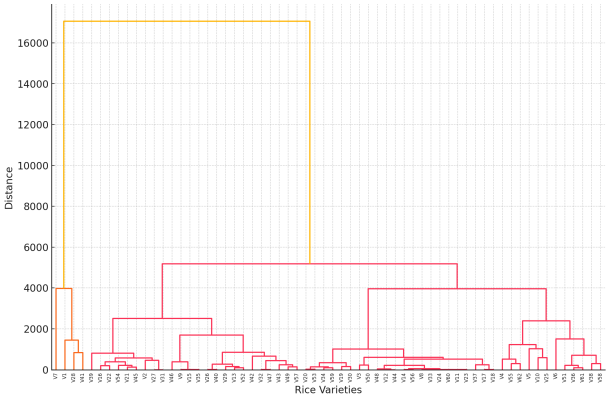


Figure 3: Hierarchical Clustering Dendrogram (Euclidean Distance)

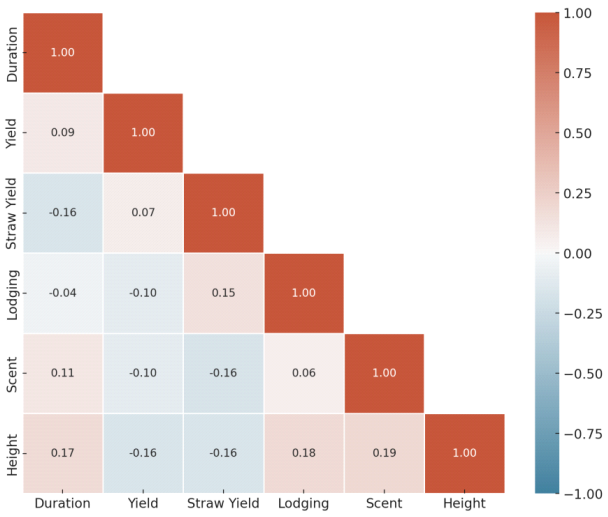


Figure 4: Half-Correlation Matrix of Traditional Rice Variety Traits

The plot visually represents the relationships between the variables, with the color intensity indicating the strength of the correlation. Positive correlations are shown in shades of red, while negative correlations are in shades of blue. The correlation analysis reveals generally weak relationships between the studied variables, suggesting that the traits of TRVs are relatively independent of one another. These findings underscore the complexity of trait distribution among TRVs. Traditional rice cultivars have evolved resistance to local pests and diseases, making them more sustainable in diverse agro-climatic conditions (Lunag, 2023). Several studies have already confirmed their adaptive resilience, which have evolved over generations to thrive in diverse agro-ecological conditions (Duncan *et al.*, 2017; Aich *et al.*, 2022). TRVs commonly share traits like aroma, varied seed color, moderate yield, straw yield, and pest resistance, which are crucial for climate change resilience (Ram *et al.*, 2023). These traits were observed commonly in the traditional varieties in this study region as well. Moreover, traits such as plant height, tiller number, and panicle length contribute to their adaptability and yield potential under stress conditions (Shyamalee and Ranawake, 2024; Mohanlal and Kandasamy, 2024). In this study, we were interested in understanding the traits which were commonly shared by the TRVs under consideration. The SNA revealed that lodging was the most shared trait in all the varieties irrespective of the duration, followed by yield. TRVs often exhibit lodging trait in contrast to semi-dwarf varieties, which are bred for shorter stature and stronger stems (Okuno *et al.*, 2014). However, yield potential of traditional varieties is less compared to the modern varieties of rice cultivated by farmers (Dwivedi *et al.*, 2016). Pest and disease resistance emerged as a prominent trait in medium-duration varieties, second only to lodging. This corroborates the findings of Saharia (2024). Medium-duration varieties are often subject to greater biotic stress for longer periods and therefore require stronger defenses. Hence this is of great importance for smallholder farmers in marginal areas who practice low-input agriculture (Muralikrishnan *et al.,* 2021). Further, this study revealed the presence of two prominent clusters among the TRVs of concern which differed significantly on straw yield. Higher straw yield in traditional varieties can improve soil health and provide fodder, enhancing their ecological benefits (Sabar *et al.*, 2024). Studies on traditional scented rice varieties in Kerala has already revealed high heritability for straw yield traits, suggesting that selective breeding

could enhance straw production further (Ram *et al.*, 2023). The correlation analysis revealed generally weak relationships between traits, suggesting that the co-occurrence of traits among TRVs is not straight. This is in contrast to the findings of Sabar *et al.* (2024) who reported correlations between traits like height, pest/disease resistance, scent, yield, and grain color. This complexity could be indicative of the highly diverse genetic backgrounds of these varieties, as suggested by Hour *et al.* (2020), who emphasized the ecological adaptability of traditional rice landraces. The independence of traits underscores the need for more detailed and nuanced studies on trait interactions to better understand how traditional varieties can be leveraged in breeding programs aimed at climate resilience. The study's identification of pattern of shared traits such as lodging resistance, pest tolerance, and straw yield highlights the critical role traditional varieties can play in developing climate-resilient farming systems. Integrating TRVs into modern agricultural practices and engaging in sustainable practices (Shahid *et al.*, 2021) can help mitigate the impacts of climate change, especially in regions like Wayanad that are highly vulnerable to environmental fluctuations. The adaptive resilience of indigenous, neglected, and endangered rice varieties could be a crucial asset in enhancing food production and tackling the impacts of climate change (Sambo, 2014). Findings in the study, could have implications for both agricultural biodiversity conservation and perceptions regarding sustainable farming of TRVs.

CONCLUSION

The study was set to understand the pattern of co-occurrence of traits by TRVs in Wayanad, a prominent Western Ghat region. It was found that traits such as lodging and mean yield were common across the traditional varieties. Cluster analysis revealed existence of two prominent clusters which differed mostly with respect to straw yield. The weak correlations overall suggest that while there are tendencies for certain traits to co-occur, no single trait is strongly predictive of another in this dataset. However, results of this study are not conclusive since meaningful inference making demands robust exploration of more traits of the traditional varieties. The aim of this study was only to indicate the possibility of investigating the traits in a different manner to generate newer insights, which was fulfilled. The study explored the traits of TRVs from a social science perspective by deviating from the conventional breeding/agronomic perspective. Future studies may be conducted by considering more traits which can be measured quantitatively to produce evidence based policy making in the areas like climate resilient agricultural development programmes.

REFERENCES

Agnihotri, R.K. and L.M.S. Palni. 2007. On-farm conservation of landraces of rice (*Oryza sativa* L.) through cultivation in the Kumaon region of Indian Central Himalaya. *Journal of Mountain Science,* 4(4): 354-360.

Ahuja, U.; S.C. Ahuja; R. Thakrar and N.S. Rani. 2008. Scented rices of India. *Asian Agri-history,* 12(4): 267-283.

Aich, A.; D. Dey and A. Roy. 2022. Climate change resilient agricultural practices: A learning experience from indigenous communities over India. *PLOS Sustain Transform,* 1(7): 1-14.

Ashraf, A.M. and S. Lokanadan. 2017. A review of rice landraces in India and its inherent medicinal values-the nutritive food values for future. *International Journal of Current Microbiology and Applied Science,* 6(12): 348-354.

Banerjee, S. and S. Godda. 2013. Study of Performance of Indigenous Paddy Varieties under SRI and Conventional Practices, National Consortium of SRI. Available at: www.indiawaterportal.org/articles/study-performance-indigenous-paddy-varieties-under-system-rice-intensification-sri-and (accessed on 25 September 2024)

Blakeney, M.; J. Krishnankutty; R.K. Raju and K.H.M. Siddique. 2020. Agricultural Innovation and the Protection of Traditional Rice Varieties: Kerala a Case Study. *Frontiers in Sustainable Food Systems,* 3: 116. doi: 10.3389/fsufs.2019.00116

Das, T. and A.K. Das. 2014. Inventory of the traditional rice varieties in farming system of southern Assam: A case study. *Indian Journal of Traditional Knowledge,* 13(1): 157–163.

Department of Science and Technology. 2019. Farmers turn saviours of traditional rice varieties. Available at:https://dst.gov.in/farmers-turn-saviours-traditional-rice-varieties (accessed on 25 September 2024)

Duncan, J.M.; E.L. Tompkins; J. Dash and B. Tripathy. 2017. Resilience to hazards: rice farmers in the Mahanadi Delta, India. *Ecology and Society,* 22(4). https://www.jstor.org/stable/26798986

Dwivedi, A.P.; P. Chand; A. Mishra; S.R.K. Singh and T. Athare. 2016. Identification of traditional rice varieties in Chhattisgarh: An institutional arrangement. *Ecology Environment and Conservation,* 23: 313-320.

Gopi, G. and M. Manjula. 2018. Speciality rice biodiversity of Kerala: need for incentivising conservation in the era of changing climate. *Current Science,* 114(5): 997-1006.

Government of Kerala (GoK). 2011. Panchayath Level Statistics, Various Districts in Kerala, Department of Economics and Statistics, Government of Kerala, Thiruvananthapuram. Available at https://www.ecostat.kerala.gov.in/publication-detail/panchayat-level-statistics-2011-thiruvananthapuram-district (accessed on 25 September 2024)

Grigorieva, E.; A. Livenets and E. Stelmakh. 2023. Adaptation of agriculture to climate change: A scoping review. *Climate,* 11: 1-37.

Hour, A.; W. Hsieh; S. Chang; Y. Wu; H. Chin and Y. Lin. 2020. Genetic diversity of landraces and improved varieties of rice (*Oryza sativa* L.) in Taiwan. *Rice,* 13: 82. https://doi.org/10.1186/s12284-020-00445-w

Jannaiah, A. and B. Debdutt. 2017. The rice seed system in India: Structure, performance and challenges. The Future Rice Strategy for India. Academic Press: pp. 359-382.

Jayashankar, N. *et al.* 2001. Indigenous rice varieties. Chennai, India: Chennai Centre for Indian Knowledge Systems.

Jose, M.; R.D. Raj; M.R. Vinitha; R. Madhu; G. Varghese; J. Bocianowski; R. Yadav; B.C. Patra; O.N. Singh; J.C. Rana; S.L. Kurmari and G. Thomas. 2018. The Prehistoric Indian Ayurvedic Rice Shashtika is an extant early domesti-cate with a distinct selection history. *Frontiers in Plant Science,* 9: 1203.

Kaufman, L. and P.J. Rousseeuw. 1990. Finding Groups in Data: An Introduction to Cluster Analysis. Wiley-Interscience.

Kerala Agricultural University. 2019. Wayanadan Nellinanagal. Regional Agricultural Research Station, Ambalavayal, Wayanad. Available at:www.kau.in/sites/default/files/announcements/wayanadan_nellinagal.pdf (accessed on 25 September 2024)

Kumari, L.S. 2012. Status paper on rice in Kerala. Available at: www.rkmp.co.in/ (accessed on 25 September 2024)

Lakshmikutty, D. 2018. Traditional Rice varieties of India. Available at https://www.esam-skriti.com/e/Culture/Indian-Culture/Traditional-Rice-Varieties-of-India-1.aspx.Accessed 25 Sep 2024.

Lunag, A.B. 2023. Molecular Diversity Analysis of Traditional Rice Varieties (TRVs) in Nueva Vizcaya, Philippines. International journal of membrane science and technology, 5. doi: 10.15379/ijmst.v10i2.3178

Mohanlal, V.A. and S. Kandasamy. 2024. Exploring genetic diversity in traditional rice genotypes (*Oryza sativa* L.) through cluster analysis of qualitative and quantitative traits. *Ecology, Environment & Conservation,* 3.

MSSRF. 2011. Twenty-Second Annual Report: 2011-2012 M. S. Swaminathan Research Foundation, Chennai. http://59.160.153.188/library/sites/default/files/AR2011-2012.pdf

Muralikrishnan, L.; R.N. Padaria; A. Dass; A.K. Choudhary; B. Kakade; S. Shokralla; T.K.Z. El-Abedin; K.F. Almutairi and H.O. Elansary. 2021. Elucidating Traditional Rice Varieties for Consilient Biotic and Abiotic Stress Management under Changing Climate with Landscape-Level Rice Biodiversity. *Land,* 10(10): 1058. https://doi.org/10.3390/land10101058

Nelson, A.R.L.E.; K. Ravichandran and U. Antony. 2019. The impact of the green revolution on indigenous crops of India. *Journal of Ethnic Foods,* 6(8): 1-10.

Okuno, A.; K. Hirano; K. Asano; W. Takase; R. Masuda; Y. Morinaka; M. Ueguchi-Tanaka; H. Kitano and M. Matsuoka. 2014. New Approach to Increasing Rice Lodging Resistance and Biomass Yield Through the Use of High Gibberellin Producing Varieties. *Plos One*, 9(2): 1-12. doi: 10.1371/JOURNAL.PONE.0086870

Ram, A. Adheena; C.R. Elsy and C. Beena. 2023. Deciphering Variability and Genetic Parameters in Traditional Scented Rice (*Oryza sativa* L.) Genotypes of Kerala, India. *International Journal of Plant & Soil Science,* 35(18): 2230-2236.

Richharia, R.H. and S. Govindasamy. 1990. Rices of India. Academy of Development Science. Karjat.

Roy, K.; A. Mukherjee; A. Maity; K. Shubha and A. Nag. 2018. Protecting non-Basmati Indigenous Aromatic Rice varieties of West Bengal, India under Geographical Indication: A critical consideration. In: The Role of Intellectual Property Rights in Agriculture and Allied Science. Oakville, Canada: Apple Academic Press, Taylor and Francis group, pp. 273-295.

Sabar, M.; S.E. Mustafa; M. Ijaz; R.A.R. Khan; F. Shahzadi; H. Saher; H.M. Javed; S.A. Zafar; M.U. Saleem; S. Siddique and A.M. Sabir. 2024. Rice Breeding for Yield Improvement through Traditional and Modern Genetic Tools. *European Journal of Ecology, Biology and Agriculture*, 1(1): 14-19.

Saharia, D.D.; P. Khoyumthem; A. Baruah; M.K. Sarma; M. Kalita; T.N. Singh and D. Biswas. 2024. Identification and characterization of drought-tolerant rice (*Oryza sativa* L.) genotypes using morpho-physiological and

biochemical traits. *Indian Journal of Genetics and Plant Breeding,* 84(2):174-185. doi: 10.31742/isgpb.84.2.4

Sambo, B.E. 2014. Endangered, neglected, indigenous resilient crops: a potential against climate change impact for sustainable crop productivity and food security. *IOSR Journal of Agriculture and Veterinary Science,* 7: 34–41.

Sathya, A. 2013. Are the Indian Rice landraces a heritage of biodiversity to reminisce their past or to reinvent for future? *Asian Agri-history,* 17(3): 221-232.

Semwal, D.P.; K. Pradheep; K.J. John; M. Latha and S.P. Ahlawat. 2019. Status of Rice (*Oryza sativa* L.) Genepool Collected from Western Ghats Region of India: gap analysis and diversity distribution mapping using GIS tools. *Indian Journal of Plant Genetic Resources*, 32(2): 166-173.

Shahid, M.; S. Munda; R. Khanam; D. Chatterjee; U. Kumar; B.S. Satapathy; S. Mohanty; D. Bhaduri; R. Tripathi; P.K. Nayak and A.K. Nayak. 2021. Climate resilient rice production systems: Natural resource management approach. *Oryza,* 58: 143-167.

Shyamalee, H and A. Ranawake. 2024. Path coefficient analysis using traditional and improved rice genotypes for trait effect on grain yield. *Journal of The National Science Foundation of Sri Lanka,* 1: 93-102.

Singh, D.K.; S. Gupta; G. Nanda; Y. Sharma; V.V. Singh and D. Bisarya. 2017. Evaluation of rice varieties for yield under organic farming in Tarai region of Uttarakhand, India. *International Journal of Current Microbiology and Applied Sciences,* 6(4): 734-738.

Zhu, Y.; Y. Wang; H. Chen and B. Lu. 2003. Conserving traditional rice varieties through Management for crop diversity. *Bioscience,* 53(2): 158–162.

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Research Article

Performance Analysis of Farmers Practicing Groundnut Based Cropping Systems

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ABSTRACT

Performance analysis of cropping systems involves evaluating their economic, agronomic, and environmental outcomes to identify the most efficient and sustainable practices. By comparing the performance of farmers practicing different cropping systems, researchers and policymakers can identify best practices, recommend strategies for improvement, and develop policies tailored to enhance agricultural productivity and sustainability. This ensures that farmers not only maximize their yields and incomes but also contribute to long-term environmental conservation and food security goals. The study reveled that majority groundnut farmers belongs to low to medium level of performance. Through the adoption of modern farming technologies, improvements in groundnut yield, and the promotion of groundnut-based oil products, India can enhance its self-sufficiency in edible oil production, reducing its dependence on imports and meeting domestic demand more effectively.

Keyword: Performance, Social, Economic, Production, Groundnut, Yield gap, Cropping system, CS-I (Groundnut alone), CS-II (Groundnut + Redgram)

INTRODUCTION

India is primarily an agrarian country, with over 58 per cent of its population dependent on agriculture for their livelihood. India ranks as the second-largest producer of oilseeds, which include peanuts, soybeans, sunflowers, sesame, niger, mustard, and safflower (Sardhara *et al.*, 2023). However, India is also the largest importer of edible oils. A significant 72 per cent of the oilseed area is cultivated by small farmers under rainfed conditions (https://www.ibef.org/exports/oilseeds-industry-india) which contributes to low yields due to constraints like soil degradation, climate change, nutrient imbalances, declining agricultural land holdings, and loss of soil fertility–exacerbated by the post-Green Revolution era–have further hindered productivity. Despite its importance, India faces a gap between oilseed production and consumption, leading to high reliance on imports for edible oils. Groundnut, being the second-largest oilseed produced in the country (Kaushikbhai, 2021), helps bridge this gap by increasing the availability of locally produced oil (Bhatt *et al.*, 2022). Moreover, it provides an economically viable option for smallholder farmers, who can increase their income by growing groundnut and selling the oil extracted from the crop. These issues can be addressed through the adoption of appropriate technologies and suitable cropping systems tailored to regional agro-climatic conditions. The study of cropping systems and their performance offers a pathway to balancing short-term gains with long-term sustainability, providing valuable data for empowering farmers and guiding agricultural development programs. Performance analysis is critical for understanding how cropping systems impact

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productivity, profitability, resource use efficiency, and resilience to external shocks such as climate change. It also provides insights into the socio-economic benefits to farmers, such as income stability and labor requirements, while considering environmental sustainability factors like soil health, biodiversity, and water use.

MATERIALS AND METHODS

An Ex-post facto research design was employed. The study was conducted in Tumkur district of Karnataka. Out of ten taluks, Sira and Pavagada were specifically selected for the study as these taluks have a larger area under groundnut cultivation compared to other taluks. From each taluk, three potential groundnut cultivating villages were selected. Further, from each village, 10 farmers practicing CS-I and CS-II groundnut cropping system were selected for the study, making the sample size 30 each under category from each taluk. Thus, the total sample size from these villages is 120. Data was collected using a pre-tested personnel interview questionnaire. Mann-Whitney U test was used to compare the performance among the farmers practicing different cropping system. The performance analysis of the groundnut growers include the measure of production, economic and social aspects of the farmers. Production performance is measured using the knowledge statements regarding the agronomical practices practiced in groundnut and extent of adoption of those practices and economic performance is measured by taking the average profitability (income generated) from groundnut cultivation as standard to classify as poor, average and better performer. Further, social performance is measured using the five continuum statements which indicate the farmers social participation, organization and their contribution in the society.

RESULTS AND DISCUSSION

The study revealed that overall performance of farmers practicing CS-I where, nearly half (46.67%) of them fell into the poor performance category, followed by 31.67 per cent in the average category and 21.66 per cent in the better performance category. In contrast, for farmers practicing CS-II, a majority (63.33%) were categorized under average performance, while 23.34 per cent belonged to the better performance category, and only 13.33 per cent were classified under poor performance. This indicates that farmers practicing CS-II demonstrated relatively better overall performance compared to those following CS-I (Table 1).

Production performance is measured by using two components i.e. extent of adoption and knowledge regarding groundnut agronomical practices. It is observed that, nearly half of (48.33%) farmers

Table 1: Performance of farmers practicing groundnut based cropping systems

Indicators	Category	Cropping System-I (n_1=60)		Cropping System-II (n_2=60)	
		Number	Percentage	Number	Percentage
Production performance	Poor (< 37.21)	29	48.33	09	15.00
Mean=39.15S	Average (37.21-41.08)	22	36.67	26	43.33
D=3.87	Better (> 41.08)	09	15.00	25	41.67
Economic performance	Poor (< 116.49)	25	41.67	10	16.66
Mean=123.23	Average (116.49-129.49)	29	48.33	28	46.67
SD=12.52	Better (>129.49)	06	10.00	22	36.67
Social performance	Poor (<2.42)	21	35.00	21	35.00
Mean= 3.07	Average (2.42-3.72)	21	35.00	15	25.00
SD=1.29	Better (>3.72)	18	30.00	24	40.00
Overall performance	Poor (<53.27)	28	46.67	08	13.33
Mean= 55.15	Average (53.27-57.82)	19	31.67	38	63.33
SD=4.55	Better (>57.82)	13	21.66	14	23.34

practicing CS-I, fall under poor category of production performance followed by average (36.67%) and better (15.00%) production performance category, respectively. With respect to farmers practicing CS-II, slightly more than two-fifth (43.33%) of them belonged to average category followed by better (41.67%) and only 15.00 per cent of them belongs to poor production performance category. It is interesting to note that more than two-fifth (41.67%) of them comes under better production performance category as against only 15.00 per cent of CS-I farmers belongs to better production performance category.

In bird eye view, farmers practicing CS-I predominantly fell into the poor to average production performance categories, primarily due to limited knowledge and awareness of recommended cultivation practices, a lack of motivation and confidence to adopt innovations, and inadequate access to timely inputs. Additional factors such as high input costs, improper input management, and poor soil fertility further contributed to their low production performance. Soil fertility issues were exacerbated by nutrient depletion, increased pest and disease incidence, soil erosion, reduced organic matter, imbalanced microbial communities, and diminished soil biodiversity–often the result of prolonged mono cropping practices. In contrast, CS-II farmers demonstrated average to better production performance by adopting timely and improved practices. These included the application of gypsum, earthing-up, micronutrient supplementation, and improved input management strategies. The inclusion of redgram as an intercrop also provided significant benefits, such as enhanced production and productivity, improved soil health, and increased nutrient availability. Redgram's symbiotic relationship with nitrogen-fixing bacteria in its root nodules boosted atmospheric nitrogen fixation, enriching the soil and promoting the growth and yield of neighboring crops.

In terms of economic performance, 48.33 per cent of CS-I respondents demonstrated average economic performance (Table 1), while 41.66 per cent fell into the poor category, and only 10.00 per cent achieved high economic performance. In comparison, 46.67 per cent of CS-II respondents attained average economic performance, 36.67 per cent were categorized as better performers, and only 16.66 per cent experienced poor economic outcomes. The improved economic performance of CS-II farmers can be attributed to their enhanced production practices and the supplementary income derived from redgram, cultivated as an intercrop. This intercropping system optimized resource and land-use efficiency, thereby improving economic returns. This trend reflects the limited resilience of CS-I farmers to crop failures, as groundnut serves as their sole source of income. Known as the "unpredictable legume," groundnut is highly vulnerable to climate variability and is frequently affected by pest and disease outbreaks, resulting in reduced yields and income. Where as, improved economic performance of CS-II farmers can be attributed by their enhanced production practices and the supplementary income derived from redgram, cultivated as an intercrop. This intercropping system optimized resource and land-use efficiency, thereby improving economic returns.

The analysis of social performance among groundnut farmers practicing CS-I revealed that 70.00 per cent exhibited poor to average levels of social engagement, with only 30.00 per cent achieving a higher level of social performance (Table 1). In contrast, farmers practicing CS-II demonstrated comparatively better social performance, with 40.00 per cent falling into the higher category, while 35.00% and 25.00% were classified under poor and average categories, respectively. The findings suggest that CS-II farmers were more socially engaged compared to those following CS-I.

The Mann-Whitney U test was used to compare the performance of two cropping systems: Groundnut alone (CS-I) and Groundnut + Redgram (CS-II). The test revealed a significant difference between the two systems, with a Z value of 5.7, indicating statistical significance at the 5% level. The mean rank for CS-II (78.60) was notably higher than that of CS-I (42.40). This suggests that farmers practicing the Groundnut + Redgram system performed better overall. The findings highlight the advantages of intercropping over monocropping. CS-II likely contributed to improved resource utilization and productivity. Additionally, it may have enhanced soil fertility and economic returns. The results support the adoption of diversified cropping systems for better performance. This disparity in the performance is attributed by the timely adoption of improved practices, greater extension contact, and

Table 2: Comparison between performance of farmers practicing groundnut based cropping systems (Mann-Whitney U test)

Cropping systems	Mean Rank	Mann-Whitney Z value
Groundnut alone (n_1-60)	42.40	5.7*
Groundnut + Redgram (n_2-60)	78.60	

*Significant at 5% level of significance

effective resource management among intercropping farmers. Redgram, as a leguminous intercrop, enhanced soil health through nitrogen fixation, improved nutrient cycling, and mitigated risks associated with monocropping, such as pest outbreaks and climate variability. Additionally, intercropping diversified income sources and improved economic stability, motivating farmers to invest in better practices. These findings highlight the advantages of intercropping, including risk reduction, improved yields, and long-term sustainability, reinforcing its potential as a strategy for enhancing agricultural performance and resilience.

The study revealed a notable yield gap in both cropping systems (Table 3). In the Groundnut alone system (CS-I), the potential yield was 800 kg per acre, while the actual yield was 620 kg, resulting in a yield gap of 22.50 per cent. In contrast, the Groundnut + Redgram intercropping system (CS-II) exhibited a lower yield gap. Groundnut yielded 470 kg per acre, with a 14.54 per cent yield gap, while Redgram produced 12 kg per acre, reflecting a 17.14 per cent gap. These findings suggest that intercropping reduces the yield gap, likely due to improved resource utilization and complementary crop interactions. The yield gap observed among different cropping system is mainly due to the non-adoption of recommended agricultural practices, such as improved varieties, balanced nutrient management, and pest control. Socioeconomic constraints and local climate conditions further limit technology adoption. Intercropping redgram with groundnut can help reduce the gap by improving soil health and nitrogen availability. Addressing the gap requires improved agronomic practices, better input access, and strong collaboration between farmers, researchers, and policymakers.

The correlation analysis was conducted to assess the relationship between the personal, socio-economic, and psychological characteristics of farmers and their performance. A correlation test was performed to evaluate the statistical significance of these relationships. For farmers practicing CS-I, variables such as economic motivation, landholding, and credit orientation exhibited a positive and highly significant relationship

Table 4: Relationship between personal, socio-economic and psychological characteristics of farmers practicing groundnut based cropping systems with their performance

Independent variables	CS-I (n_1=60)	CS-II (n_2=60)
Age	0.125 NS	0.030 NS
Education	0.454*	0.486*
Family size	0.134 NS	0.178 NS
Landholding	0.255*	0.391*
Annual income	0.456*	0.612**
Farming experience	0.296*	0.529*
Extension contact	0.423*	0.912**
Economic motivation	0.404**	0.318*
Management orientation	0.361*	0.389**
Mass media exposure	0.716**	0.480*
Credit orientation	0.621**	0.282*
Innovative proness	0.324*	0.458*
Risk bearing ability	0.485*	0.524*
Achievement motivation	0.436*	0.589*
Deferred gratification	0.302*	0.382*

*Significant at 5 per cent level of significance
**Significant at 1 per cent level of significance
NS-Non significant

Table 3: Yield gap analysis among farmers practicing different groundnut based cropping system

Cropping systems	Crop	Recommended yield (kg/ ac)	Actual yield (kg/ac)	Yield gap	
				kg/ac	Percentage
CS-I (n_1=60)	Groundnut	800	620	180	22.50
CS-II (n_2=60)	Groundnut	550	470	80	14.54
	Redgram	70	58	12	17.14

with their performance at the 1% level of significance. Additionally, characteristics including education, landholding, farming experience, extension contact, management orientation, deferred gratification, risk-bearing ability, and achievement motivation were positively and significantly correlated with their performance at the 5% level of significance. Conversely, variables such as age and family size demonstrated no significant relationship with their performance. In the case of farmers practicing CS-II, annual income, extension contact, and management orientation were positively and significantly associated with performance at the 1% level of significance. Similarly, factors including education, landholding, farming experience, economic motivation, mass media exposure, credit orientation, deferred gratification, innovativeness, risk-bearing ability, and achievement motivation were positively and significantly correlated with performance at the 5% level of significance. However, age and family size showed no significant relationship with performance.

CONCLUSION

Based on the findings of the investigation, several policies can be recommended to improve cropping systems and stabilize farmers' income. Firstly, the cropping system of Groundnut + Redgram (CS-II) has been identified as the most profitable under rainfed conditions compared to Groundnut alone (CS-I). It is crucial for agricultural organizations to promote this system, helping farmers utilize their resources more efficiently and enhance both productivity and profitability through effective extension strategies. Secondly, groundnut growers should be encouraged to adopt region-specific intercrops to mitigate the production and marketing risks caused by weather variations and market fluctuations. This diversification will offer more stability and reduce vulnerability. Lastly, many farmers tend to sell their produce immediately after harvest to village traders due to financial needs. Strengthening institutional support, particularly in terms of credit facilities, is essential to help farmers hold their produce and sell it at better prices through Agricultural Produce Market Committees (APMCs) or via farmer group formations. By implementing these strategies, the government can assist farmers in improving productivity, stabilizing their incomes, and building economic resilience.

REFERENCES

Bhatt, B.; S. Mehta and K. Sharma. 2022. Enhancing groundnut productivity through innovative farming practices in India. *Indian Journal of Agricultural Economics,* 77(3): 450-465. https://doi.org/10.1234/ijae.2022.003

Chodavadia, H.C.; H.C. Bariya and M.K. Deshmukh. 2013. A comparative study between demonstrator and non-demonstrator farmers of relay cropping system. *Global Advanced Research Journal of Agricultural Science,* 2: 160-163.

Choudhary, R.; D.S. Rathore and A. Sharma. 2017. An economics analysis of production and marketing of groundnut in porbandar district of Gujarat. *Economic Affairs*, 62(3): 547-553.

Gorfad, P.S.; J.V. Chovatia and B.N. Kalsariya. 2018. Adoption of improved groundnut production technology by groundnut growers. *Gujarat Journal of Extension Education,* 29(2): 201-202.

Hiren, P. 2023. Economic Analysis of Cost of Production and Return of Groundnut in Jamnagar District of Gujarat, India. *International Journal of Plant & Soil Science,* 35(18): 917-922.

International Business and Economic Forum (IBEF). (n.d.). Oilseeds industry in India. Retrieved from https://www.ibef.org/exports/oilseeds-industry-india

Jagadesh, R.; C. Velavan; N.V. Palanichamy and N.K. Sathyamoorthy. 2021. A study on technical efficiency of groundnut production in Tamil Nadu. *The Pharma Innovation Journal SP*, 10(10): 992-995.

Kaushikbhai, S. 2021. Groundnut farming and its contribution to India's edible oil production. *Journal of Agricultural Science and Technology*, 11(4): 230-240.

Kumari, S. and J. Singh. 2022. Impact of frontline demonstrations on oilseed production in Kapurthala district of Punjab. *Journal of Agricultural Development and Policy*, 32(2): 246-251.

Prajapati, M.R. and R.K. Ramoliya. 2022. A study on level of input and economics of production of groundnut in Gujarat. *Current Journal of Applied Science and Technology*, 41(37): 30-41.

Rai, A.K.; S. Khajuria and K. Lata. 2020. Impact of front line demonstrations in transfer of groundnut production technology in semi arid region. *Gujarat Journal of Extension Education*, 31(1): 6-10.

Ramachandran, R.; L.H.N. De Silva and N.W.B.A.L. Udayanga. 2021. Level of Technology Adoption in Groundnut (*Arachis hypogeae* L.) Production: A Case Study in Batticaloa District. *Applied Economics & Business,* 5(2).

Sardhara, G.; V. Kumar and R. Patel. 2023. Oilseed production and policy interventions in India: An overview. *Economic and Policy Studies*, 12(1): 95-108.

Shasani, S.; P.K. Banerjee; H.K. De; B.P. Mohapatra and M.K. Das. 2020. Correlates of adoption of groundnut cultivation technology: a micro level study from Odisha. *Indian Journal of Extension Education,* 56(4): 9-13.

Singh, I.; K.K. Singh and U.S. Gautam. 2012. Constraints in adoption of soybean production technology. *Indian Research Journal of Extension Education,* 2: 169-171.

Swami, S. and R.K. Verma. 2022. Knowledge level of farmers regarding demonstrated groundnut production technologies. *Indian Research Journal of Extension Education*, 22(5): 166-172.

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Research Article

Utilisation of Social Media in Agriculture: A Case of Fatehgarh Sahib district of Indian Punjab

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ABSTRACT

The purpose of the study is to examine how social media platforms are used for obtaining agriculture related information in Fatehgarh Sahib district of Indian Punjab. When taking into account the fact that over 70 per cent of Punjabis as a whole and 42.5 per cent in rural areas have mobile phone internet access, this study becomes more relevant. Nearly half of the Punjab's population has joined social media as a result of higher penetration of internet. It is interesting to determine how it is utilised in obtaining information about agriculture in the current scenario. The present study is based on primary data collected from 120 farmers from two blocks of Fatehgarh Sahib district. Based on the data, it can be inferred that the respondents were familiar with social media platforms such as WhatsApp, Facebook and You Tube. WhatsApp has emerged as the most popular platform for seeking information on agriculture among various social media platforms, with farmers regularly using it, with You Tube following closely behind. The main reason why most respondents used social media was to receive regular updates on upcoming training programmes, weather updates and getting connected with farmers from other states. Although social media platforms are popular among the respondents and can be used to gather agricultural information, farmers encounter different limitations when using them. Farmers are frequently discouraged from using social media platforms due to the risk of being exposed to deceptive information, lack of reliable information and one-way communication. Agriculture related applications have the potential to provide technical knowledge, but they are not widely used by the farmers.

Keywords: Social media, Utilization, Constraints, Agriculture

INTRODUCTION

Newspaper, television and magazines have been the primary source of information in the agriculture sector for a long time. Extension activities such as field days, demonstrations, *kisanmelas,* camps, group meetings, exhibitions and trainings are organised to share the technological advancements with farmers and for one-to-one interactions or two-way communication. The sharing of farmers' problems and experiences with the experts is crucial. The ways in which farmers can be reached individually and simultaneously are evolving with the changing face of agriculture. Information and Communication Technologies (ICTs) are therefore assuming greater roles. Recent years have seen an increase in the use of social media in agriculture sector and extension activities. Agriculture related information can now be disseminated to farmers through social media, which is the interaction between people where they create, share, consume and exchange information and ideas in virtual communities and networks. Social media is a web based tools of electronic communication that allow users to interact, create, share, retrieve and exchange information and ideas in any form (text, pictures, videos etc.) that can be discussed upon, achieved and used by anyone in virtual communities and networks (Suchiradipta and Saravanan, 2016).

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Social media tools are capable of being used to share content with other people through social networks, video sharing websites, photo sharing websites, blogs, microblogs, discussion groups, mobile text messaging and professional messaging. These are just a few of the social media tools available, but they are not the sole ones. Facebook, You Tube, Instagram, X (Twitter), Google Groups, WhatsApp and Linked in are among the most well-known social media tools. To reach the target groups, these social media tools employ a variety of modes on Facebook and You Tube platforms, users can upload and watch videos of their own choice at any place and at any time. These allow them to share these videos with others and leave comments. Blogs contain detailed information on specific topics and provide in-depth discussions on an issue through comments from the readers. Creating public opinions and organizing people into groups has been made possible by X which was previously known as Twitter. Instagram is becoming an essential tool for reaching a global audience in an interesting manner. WhatsApp is a messenger App for smartphones that supports text, audio, video, pdf and various other forms of files. Real time video-chatting, group video and audio calls are very popular among the WhatsApp users. Various groups can also be formed where information can be send to the members of that group or various groups quickly.

Furthermore, there are numerous Apps that have been discussed specifically for farmers. Some of the examples of such apps are *Kisan Suvidha*, *Pusa Krishi*, *Pashu Poshan*, My Agri Guru, RML Farmer, PAU *Kisan* App, IFFCO *Kisan* Agriculture, Agrimarket, E-NAM mobile App, Digital *Mandi* India and many others. Text, videos, pictures and other forms of information are provided to farmers in regional languages through these Apps.

It is important to acknowledge the evolution of social media and its rapid penetration into agriculture. Farmers are able to receive timely, relevant and actionable information from these tools at a lower cost than traditional extension services, which is why they are widely adopted in agriculture (Aker, 2011). Indicating the importance of social media in farming (Ankita *et al*., 2023) reported that the society-the rural people, the farmers do not read journals they read blogs, watch YouTube and use Facebook and twitter and these are the medium that reach them.

Over a period of time, several studies have been conducted to determine the extent and type of use of ICT by scholars involved in extension activities. According to Meena *et al.* (2013) agricultural researchers and extension professionals have used the internet, e-mail and social media particularly Facebook, as their primary media of disseminating and gathering information. The popular social media used was Facebook. Similarly, Typhina *et al.* (2015) highlighted the significance of images and short videos to disseminate information about extension activities. Likewise, Sulibhavimath and Sharma 2018 concluded that the use of Google search engine was most used for this purpose.

Thapar *et al.* (2019) highlighted that the majority of respondents were equipped with mobile phones that had internet access. The use of these smartphones was to receive weather updates, as well as to make calls to extension experts and establish connection with market. According to Tamizhkumaran and Saravanan (2021), YouTube has great potential in extension activities and advisory services. The study emphasized that videos are valuable sources of information and pictures draw the client's attention. The review of literature has also highlighted the use of SMS to disseminate information in agriculture. Based on the literature review, it is apparent that there are few studies that utilise empirical data to analyse how farmers use social media platforms to access agriculture related information. The present study fills the void left.

According to Telecom regulatory authority of India (TRAI) 2023, more than 70 per cent of *Punjabis* have access to the internet on their phones. The number of internet subscribers in Punjab is second only to Delhi. In rural Punjab 42.5 per cent of *Punjabis* had access to smartphones, which is quiet higher than the neighbouring states of Haryana (34.4%) and Jammu and Kashmir (18.6%). The report further states that high penetration of internet has also brought nearly 55 to 50 per cent of Punjab's population on social media. Considering this background, it is crucial to examine how social media is used to obtain agricultural information in the agriculturally state of Punjab, in general and Fatehgarh Sahib in particular. The present study is designed to:

- Gain insight into how farmers use social media platforms to gather agriculture related information;
- Determine the obstacles faced by farmers when accessing agriculture related information on multiple social media platforms; and
- Offer suggestions for enhancing the role of social media in obtaining and disseminating agriculture related information.

MATERIALS AND METHODS

Primary data collected from farmers in Fatehgarh Sahib district, India forms the basis of the study. The selection was made based on the fact that the authors regularly conduct and participate in extension activities relate to agriculture in the district. Subsequent to that, Sirhind and Kheda, two of the five administrative blocks in the district, were selected at random. Thereafter, six villages from each of two selected blocks were randomly visited to interview the farmers. The interview was conducted with ten randomly selected farmers from each of these villages. The study's sample consisted of 120 farmers from 12 villages in two administrative blocks. The study tool used for collecting detailed information was a pre-tested and pre-designed interview schedule. Farmer's awareness about various social media platforms was assessed using a three-point scale. It contained pre-coded and open-ended questionnaire, which were categorised into two parts. The first segment consisted of the responses to obtain socio-economic and demographic information of selected farmers. The second part dealt with questions about farmer's participation in extension activities and the availability of internet access. The responses were categorised as "Fully known," "Partially known" and "Not known". The responses were given scores of 3,2, and 1 respectively. The higher the score, the better awareness level of farmers on various social media platforms.

Social media platforms were analysed, with responses recorded as "Regularly", "occasionally" and "Never". Same scores were given here as well. Here also, the higher the score the more is use of social media by farmers. Tables have been generated to present the collected data in terms of frequency distribution, percentages, weighted mean score and ranking. The data collection was done during the year 2023.

RESULTS AND DISCUSSION

Table 1 exhibits the socio-economic profile of farmers who were sampled, including their age, educational attainments, landholding, type of family they belong to and their annual income.

The farmer's age ranged from 25 to 50 years, with median age being 38 years. The findings of this study are in accordance with the expectation that the majority of landholdings are held by general caste farmers compared to the backward and scheduled caste farmers. Evidently, general caste farmers made up eight out of every ten farmers, while backward or SC caste category made up only two. Barring 2 out of 120 farmers, all other had attained an education level of matric or above. Therefore, indicating that they were well-equipped to access agricultural related information on social media platforms. Out of all farmers, three-fifths

Table 1: Socio-economic distribution of the farmers (n=120)

Category	Frequency	Percentage
Age		
< 30 years	13	10.8
31 to 40 years	73	60.8
>40 years	34	28.3
Education		
Illiterate	2	1.7
Matric	53	44.2
Secondary education	37	30.8
Graduate	23	19.1
Post graduate and above	5	4.1
Type of family		
Joint	63	52.5
Nuclear	57	47.5
Land holding (acre)		
Marginal (< 2 acre)	18	15.0
Small (2-5 acre)	72	60.0
Large (>5 acre)	30	25.0
Annual Income (Rs.)		
<100000	3	2.5
100000 to 300000	84	70.0
300000 to 500000	27	22.5
>500000	6	5.0

Source: Field Survey, 2023

were small landowners, owning landholding between 2 to 5 acres, and one-fourth were marginal farmers. Approximately 90 per cent of the farmers earned annual income between Rs. 100000 to Rs. 500000/-

The collection of information from farmers was conducted to gauge their participation in various activities organised by different agencies. The significance of this data lies in its ability to provide insight into the connection between farmers and accessing and interacting with agriculture based technology.

The involvement of farmers in various extension activities is depicted in Table 2. According to the data, farmers frequently participated in *Kisan mela* followed by participation in field days. The farmers reported that the extension activity that involved meeting in groups was the least popular. It is worth noting that 13.3 per cent of the farmers interviewed in the study have not participated in any of the extension activities mentioned earlier. The reach of these extension activities is limited. The expansion of these activities is made possible by social media's role.

Table 2: Participation of farmers in different extension activities

Extension activities	Frequency	Percentage
Kisanmela	75	62.5
Field days	45	37.5
Awareness camps	30	25.0
Training	18	15.0
No participation	16	13.3
Group meeting	6	5.0
Multiple response		

Source: Field Survey, 2023

Table 3: Availability of regular internet connection on phone (n=120)

Availability of internet connection on phone	Frequency	Percentage
Own personal phone	92	76.7
Available in phone of some of the family member	28	23.3

Source: Field Survey, 2023

Access to agricultural based information is dependent on availability of internet connection on phone. Table 3 depicts a positive situation among sampled farmers in Fatehgarh Sahib district. The internet was accessible to all 120 farmers on their phones, 76.7 per cent using their personal phones and the remaining 23.3 per cent using family member's phone.

Since farmers don't struggle with internet accessibility, it is interesting to study their information communication behaviour and how well they know about different social media platforms. As is evident from Table 4, WhatsApp, with a weighted score of 2.6 was the most popular social media platform, while X (Twitter) was the least popular with a weighted score of 1.5. Contrary to the expectations, the utilisation of agriculture related mobile applications with weighted score of 1.9 was not found quiet encouraging.

Table 5 illustrates how farmers in the district use social media. This data was collected on the use of most popular social media platform by them. The findings revealed that WhatsApp, which has a weighted score of 2.4, is the most popular social media platform, with You Tube ranking second with a weighted mean score of 2.1 and Facebook being third with a weighted

Table 4: Distribution of farmers on the basis of knowledge about various social media platforms (n=120)

Type of social media	Fully known		Partially known		Not Known		Weighted mean score	Rank
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage		
WhatsApp	32	26.6	98	81.6	22	18.3	2.6	I
Facebook	84	70	6	5	30	25	2.4	II
YouTube	66	55	26	21.6	28	23.3	2.3	III
Instagram	52	43.3	30	25	38	31.7	2.1	IV
Agriculture related mobile apps	28	23.3	59	49.1	33	27.5	1.9	V
X (Twitter)	8	6.7	45	37.5	67	55.8	1.5	VI

Source: Field Survey, 2023

Table 5: Distribution of farmers on the basis of utilisation of social media (n=120)

Type of social media	Regular		Occasionally		Never		Weighted mean score	Rank
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage		
WhatsApp	76	63.3	14	11.7	30	25.0	2.4	I
YouTube	59	49.2	16	13.3	45	37.5	2.1	II
Facebook	38	31.7	52	43.3	30	25.0	2.0	III
Instagram	15	12.5	56	46.7	49	40.8	1.7	IV
X (Twitter)	12	10.0	46	38.3	62	51.7	1.6	V

Source: Field Survey, 2023

score of 2.0. While X (Twitter) with a weighted score 1.6 was the least popular social media platform. The findings of the current study are almost in line with those of Joshi and Dhaliwal 2019 which found that Facebook and WhatsApp were the most frequently used social media tools by farmers. The present study has some variance. In the present study WhatsApp and You Tube are the top ranked social media platforms. Singh et.al 2020 also concluded that the overall effectiveness of WhatsApp in dissemination of agricultural technology to farmers was high. Facebook came in the third place in terms of usage compared to the second ranked in the study mentioned above.

Given the popularity of Facebook and WhatsApp it is worth examining how farmers have used them specifically for agriculture (Table 6). The findings indicate that WhatsApp, with weighted score of 2.6 remained the most utilised social media platform for agricultural information, followed by You Tube with a weighted score of 2.5. Facebook was used by the respondents for agriculture related information and was ranked at Third position with a weighted mean score of 2.3. However, the use of X (Twitter) and agriculture related mobile applications were the least popular for agriculture related information. The findings of the present study are partially in line with the study conducted by Joshi and Dhaliwal 2019 in which WhatsApp and Facebook remained popular with the top two positions among use for agriculture. According to their study, the PAU *Kisan* App was ranked third when it came to agriculture related application. In addition, in this study, the utilisation of agriculture related app was ranked second last.

Lack of awareness among farmers and difficulty in their application may be the reasons why agriculture mobile apps are less popular. Similar to the findings of the present study, Thapar *et al.* (2019) reported that only 36.7 per cent of the total farmers use mobile based applications to obtain agriculture related information. Until recently, there has been no change in the preference and popularity of certain social media platforms such as WhatsApp, Facebook and You Tubesince (2019). According to Temizhkumara and Saravanan (2020), WhatsApp and You Tube's popularity is due to their use friendly, two-way communication, and ease to use.

Table 6: Utilisation of social media for agriculture related information by farmers (n=120)

Type of social media	Regular		Occasionally		Never		Weighted mean score	Rank
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage		
WhatsApp	93	77.5	10	8.3	17	14.2	2.6	I
YouTube	79	65.8	21	17.5	20	16.7	2.5	II
Facebook	49	40.8	58	48.3	13	10.8	2.3	III
Instagram	50	41.7	31	25.9	39	32.5	2.1	IV
Agriculture related mobile app	37	30.8	45	37.5	38	31.7	1.9	V
X (Twitter)	12	10.0	36	30.0	72	60.0	1.5	VI

Source: Field Survey, 2023

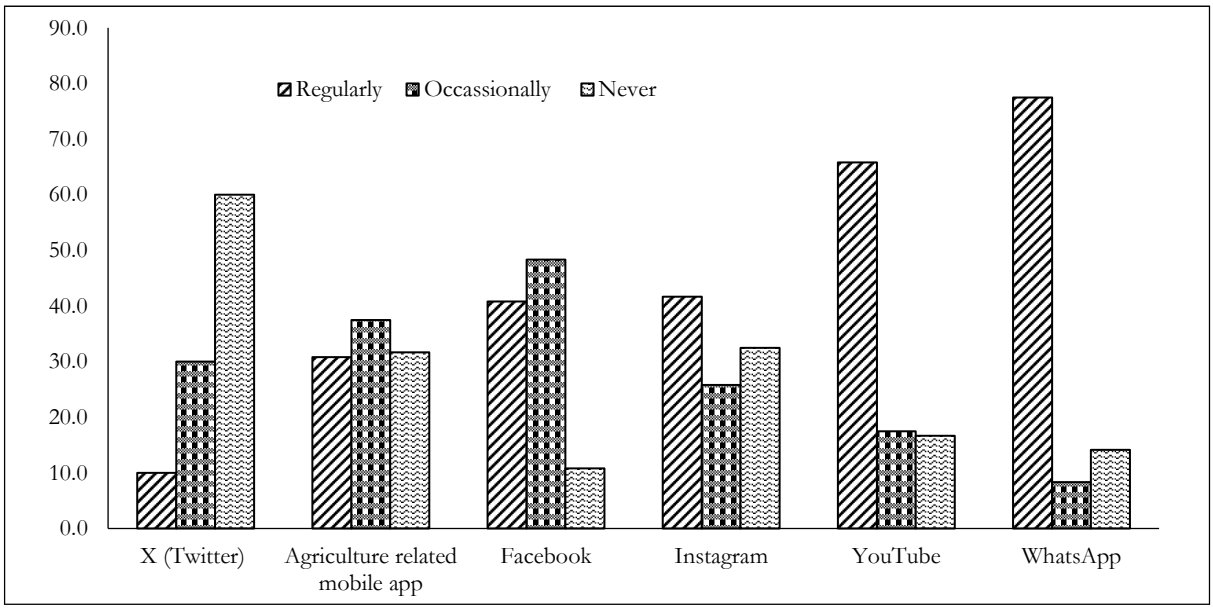

Figure 1: Utilisation of Social Media Platforms for Accessing Agriculture Related Information (%)

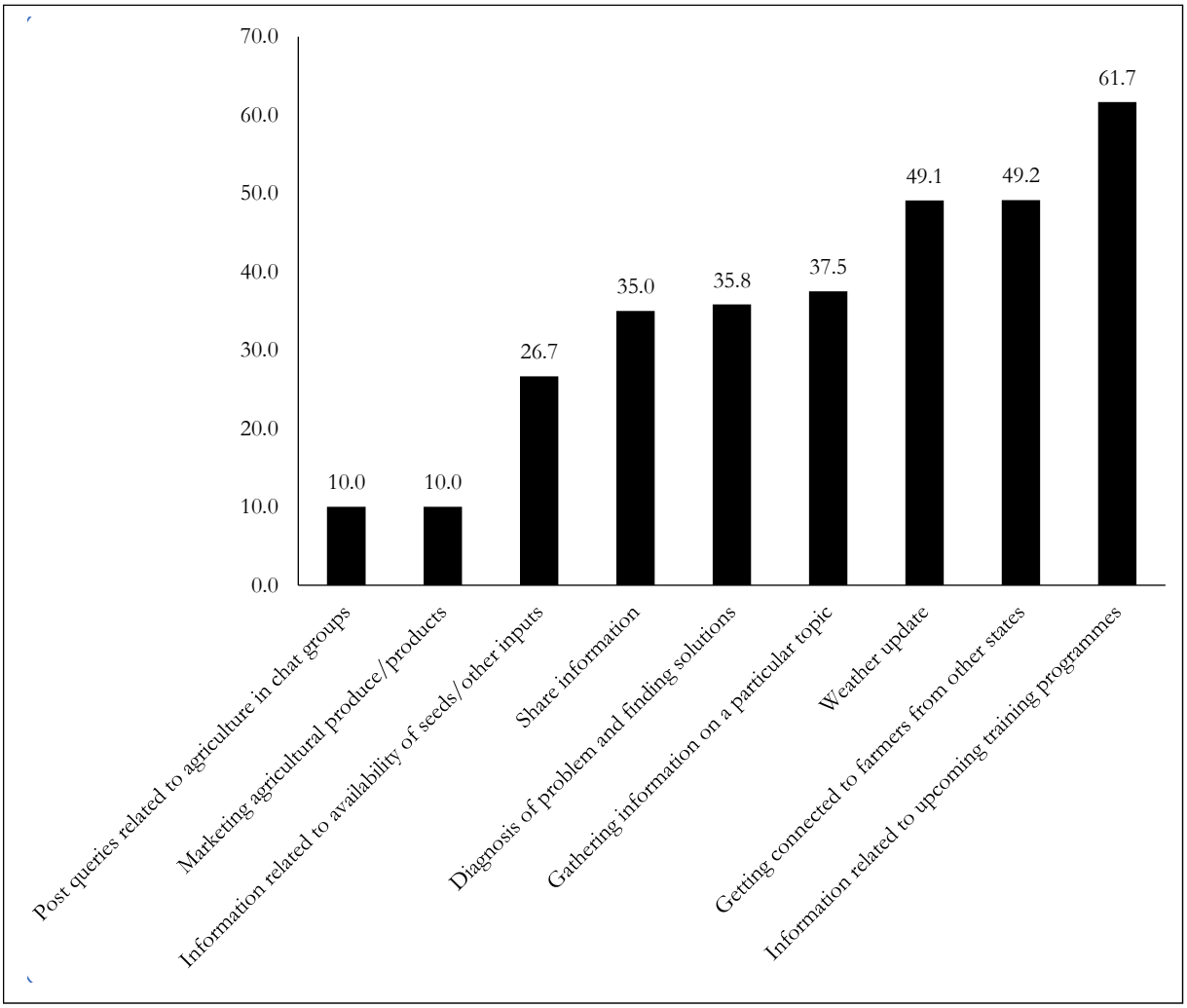

Figure 2: Types of Agriculture Related Activities Accessed through Social Media (%)

To comprehend the purpose of using social media for agriculture, it is necessary to conduct further research on the use of different social media platforms. The social media are commonly utilized to gather information about upcoming training programmes. WhatsApp is used frequently by 61.7 of farmers to receive updates on upcoming training programmes.

Social media platforms were used frequently by the farmers to get weather updates (49.1%) and connect with farmers from other states. More than 35.0 per cent of the respondents used social media platforms to gather information on a particular topic (37.5%) and diagnosis of crop related problem and find solutions (35.8%). It is pertinent to note here that only 10.0 per cent of the farmers use social media platforms to market their produce or their products. The use of social media platforms for marketing is a popular practice nowadays, and farmers should explore this potential too. The findings of the present study are contrary to those of the study conducted by Thapar *et al.* (2019) which indicated that more than half of the farmers used social media platforms to gather information regarding new technology, input prices and their availability. Another study by Sahar and Singh 2020 also indicated that YouTube was used by 76.16 per cent of famers in Punjab for getting farm information and other purpose of its use was entertainment (70.84%), news (35%) and shopping (12.5%).

The popularity of social media does not mean farmers can use them without encountering various constraints. For the present study constraints are divided into three groups, namely personal, accessibility and utilisation (Table 7). The data indicates that among the personal constraints, the proportion is highest in case of resistance due to exposure to deceptive information on social media as reported by 71.7 per cent of the respondents. Another personal constraint faced by the respondents was their lack of knowledge about its usage and dependency on the others for using social media. The farmers tend to rely on the younger generation for using social media platforms. The

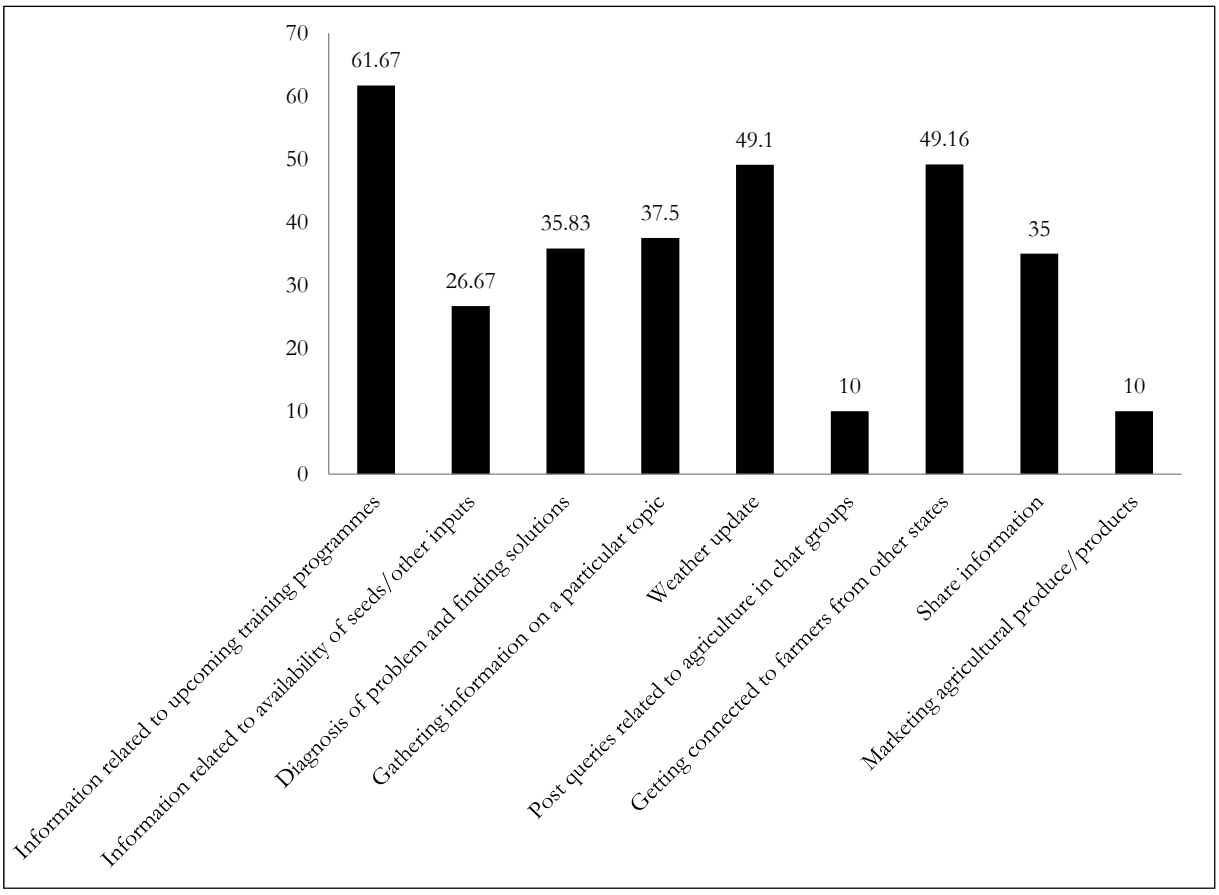

Figure 3: Purpose of using social media for agriculture related information (%)

Table 7: Constraints faced by the farmers in adoption of social media for agriculture

Constraints	Frequency	Percentage
Personal constraints		
Resistance due to exposure to deceptive information	86	71.7
Lack of knowledge about use/Dependency on others for use of social media	75	62.5
Cost	75	62.5
Lack of awareness about reliable sources	62	51.6
Lack of understanding due to low education	36	30.0
No interest	35	29.2
Lack of time	23	19.1
Accessibility constraints		
Reliable information not accessible	79	65.8
Language barrier	72	60.0
Lack of electricity	64	53.3
Lack of stable internet connection	24	20.0
Utilisation constraints		
One way communication	93	77.5
Reliability of source of information	76	63.3
Information too old	36	30.0
Use of technical/difficult words	26	21.7

Multiple response
Source: Field Survey, 2023

findings are in line with the study conducted by Das *et.al.*, 2020 which 38.96 per cent of the farmers perceived mobile phones easy to use, while 31 per cent found it difficult to use. More than quarter of the respondents found them moderately difficult to use. Under the accessibility constraints lack of reliable information was felt by 65.8 per cent of the respondents. Language barrier was reported as another constraint. There is a lack of information in the local language. Finally one way communication. in most of social media platforms except in case of WhatsApp is another constraint. Although the respondents expressed that they raise queries on YouTube and Facebook, they do not receive timely responses. The respondents also viewed that more information from individual farmers and private companies is available but the information from these sources is not always authentic (63.3%). Similarly, constraints such as difficulty in comprehending information due to the use of English language and difficult technical words were also reported by Thapar *et al.* (2019).

CONCLUSION

This study was intended to examine the manner in which social media platforms are used to obtain agricultural related information in the Fatehgarh Sahib district of Indian Punjab. It demonstrated that the farmers are proficient with social media platforms such as WhatsApp, Facebook and YouTube. However, the farmers view social media mainly as a source of entertainment rather than as a major source of information for obtaining information on agricultural-related activities. It is no surprise that farmers frequently use WhatsApp, which has become the most popular platform for seeking information on agriculture related matters, while YouTube being close behind. Nonetheless, the social media, to a great extent, is used to stay informed about upcoming training programmes and weather updates. The potential of various agriculture related applications is quite vast so it is important to promote them among farmers. The use of social media platforms to get information on processing and marketing of the agricultural produce are the crucial areas that require further exploration and promotion. Both extension agencies and farmers should delve into this aspect. According to the study, farmers are confronted with various limitations when using social media because they are prone to exposure to deceptive information and lack of reliable information. Therefore, extension agencies should strive to create digital content related to agriculture in easy to understand local languages so that accurate and trustworthy information is provided through social media channels, websites and mobile applications. For the benefit of farmers, it is necessary to organise training programmes by extension centres and related agencies on how to optimally utilise social-media platforms. Different social media platforms must be effectively integrated into agricultural extension service delivery by service providers, taking into account the literacy level of farmers and the level of institutional support they have. On the whole, the study suggests that farmers use social media, but it has not reached its full potential in terms of agricultural related activities. The proper use of social media, as stated above, can

highlight the challenges faced by farmers and provide cost-effective real-time solutions to their problems.

REFERENCES

Aker, J.C. 2011. Dial "A" for Agriculture: A review of information and communication Technologies for agricultural extension in developing countries. *Agricultural Economics*, 42: 631-47.

Ankita, S.; V. Verma. and E. Rani. 2023. Role of social media in extension - A Review. *International Journal of Humanities Social Science and Management*, 3(3): 7-17.

Das, U; P. Goswamy and V.L.V. Kameswari. 2020. Farmers' perception on use of mobile phones for agricultural information. *Journal of Community Mobilization and Sustainable Development,* 15(1): 155-159.

Internet users in India: Statistics and Data, Available from: https://datareportal.com.

Joshi, D. and D.K. Dhaliwal. 2019. Utilisation of social media by farming community: A Case from Punjab State. *Indian Journal of Extension Education*, 55(1): 47-52.

Kumari, A.R. 2018. Role of farm women in agriculture and their involvement in decision making- A study in Deoria district of Uttar Pradesh. *Journal of Pharmacogn Phytochem* 7: 1249-1253.

Meena, K.C.; S. Chand; N.R. Meena. 2013. Impact of social media in sharing information on issues related to agriculture among researchers and extension professionals. *Advanced in Applied Research*, 5(2): 166-169.

Sahar, M.F. and D. Singh. 2020. Access and use of information and communication technologies by the farmers: A case study of Punjab. *Journal of Community Mobilization and Sustainable Development,* 15(1): 247-253.

Singh, D. and V.K. Bhoopendra. 2023. The utilisation of social media for accessing farming information by progressive farmer. *Bhartiya Krishi Anusandhan Patrika*, 38(3): 290-295.

Singh, S.R.K.; A. Mishra; V. Jallaraph; A.A. Raur; R.K. Singh and S. Kumar. 2020. Measuring effectiveness of WhatsApp Messenger in dissemination of technological information among e-farmers in Madhya Pradesh. *Journal of Community Mobilization and Sustainable Development,* 15(1): 99-102.

Suchiradipta, B. and R. Saravanan. 2016. Social media: Shaping the future of agricultural extension and advisory Services GFRAS Interest Group on ICT4RAS Discussion Paper, GFRAS: Lindau, Switzerland, 9.

Sulibhavimath, A. and P. Sharma. 2018. The extent of use of information communication technology by extension agents of KVKs *Journal of Pharmacognosy and Phytochemistry*, 7(3): 3628-3631.

Tamizhkumaran, J. and R. Saravannan. 2021. YouTube-An effective tool for extension and advisory services, agricultural extension and advisory services. *Agricultural Extension in South Asia*, 23(4): 70-75.

Thapar, S., N. Singh; and R. Kaur. 2019. Utilisation of new media among farmers of Punjab: A study of Moga district, India. *Indian Journal of Current Microbiology and Applied Science*, 8(10): 2344-2357.

Typhina, E., R.E. Bardon and L.W. Gharis. 2015. Collaborating with your clients using social media and mobile communications. *Journal of Extension*, 53(1): 40-43.

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Research Article

Why are Farmers in Punjab Getting Trapped in a Vicious Cycle of Debt?

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ABSTRACT

The present study was conducted to identify the reasons why farmers are getting trapped in vicious cycle debt in Punjab State (India). The results are based on the data collected from 200 farm families representing five agro climatic zones of Punjab namely zone I (sub - mountain undulating zone), zone II (undulating plain zone), Zone III (central plain zone), Zone IV (western plain zone) and zone V (western zone) through structured interview schedule. The study revealed that majority (67.0%) of farm families had annual income less than four lakhs. Majority of farm families had availed loan from different sources. Institutional sources primarily through commercial banks became the major source (99.9%) for rural credit in Punjab. Large majority (81.6%) of families were in debt of less than 5 lakhs. It was found that the highest percentage (40.8%) of families used agricultural loan for construction of house followed by 15.2 per cent using it for marriage of a family member. Very low percentage (5.6%) used it to purchase farm input and machinery and to pay for lease to the landlord (8.8%), whereas a negligible percentage (1.6%) used it to purchase land. Its use for purchase of livestock was made by few families (2.4%) or to start some enterprise. There is a need to create a positive financial environment with ease to borrow from the institutional sources.

Keywords: Commercial banks, Debt, Farm families and Farming, Income, Loan

INTRODUCTION

Agriculture plays a significant role in the Indian economy. Over 70.0 per cent of the rural families bank on agriculture. It plays a significant role in Indian economy as it contributes about 17.0 per cent to the total GDP (Shagun, 2021) and provides livelihood to over 60.0 per cent of the population (Kant, 2019). It can rightly be termed as the backbone of Indian economy.

Farming is risky and cost intensive occupation and agricultural loans plays a pivotal role in supporting farming business. Agricultural loans are availed by a farmer to fund seasonal agricultural operations and allied activities. This type of loan also helps in buying inputs such as fertilizers, seeds, insecticides etc. Farm mechanisation loans are offered to farmers to purchase/repair/upgrade farm machinery. Some banks provide general farm mechanisation loans, while others offer sub-category loans like drip irrigation loans, tractor loans, combine harvester loans, etc. Loan can be very helpful to the farmers to recuperate after natural disasters. Farmers generally faces drought, floods, fire, insect or disease infestations and other threats that can put a serious interruption in their ability to generate fixed income from farming. When these interruptions happens, farmers can take out an agriculture loan to help cover the costs of repairs, operating costs etc. An agriculture loan also helps in protecting farmers during the ups and downs of their business. Sigh *et al.* (2014) indicated that low price for the produce and low profit margin were the main reason for the farmer's

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indebtedness. Use it to cover operational costs and the costs of getting back on their feet and agriculture loans are also there to help farmers during a lean season. Many farmers who have already outstanding agriculture loans may want to refinance it, means taking out a new, lower-interest loan and using the proceeds to pay off the old, higher-interest one.

There is no doubt that the average farm size and income of Punjab's farmers is higher than their counterparts in other states because of wheat and paddy being major commercial crops fetching better prices, due to its easy procurement by government on minimum support price assured by government. But, it is not sufficient as to meet the agriculture and non-agriculture needs of farmers of the state. The reasons may be that the farmers of the state are investing more money on inputs like fertilisers and pesticides and may be using heavy machineries and equipments for farming along with hired labour and due to these reasons farmers are forced to take debts. Many Government institutions as well as private institutions are providing easy loans to the farmers on the basis of their operational landholdings at lower interact rates. Crop loan waiver schemes are being running by the state government for waiving debts of the farmers. But, due to low and fluctuating income from farming many farm families also prefer to take loans from other sources like cooperative banks, traders and their relatives to support their family expenditure and they may be giving higher interest rates. Farmers are trapped in vicious cycle of debt and many of them are forced to commit suicides due to their inability to repay higher interest rates along with principal amount of loan. Singh *et al.* (2014) concluded that level of education, non-farm income, farm size and non institutional credit affected the level of farmers indebtedness. Singh and Dhaliwal (2011) The institutional sources alone could not meet the credit requirements of the farmers and they had to go for non-institutional credit, especially from commission agents.

Indian Council of Social Science Research (2015) revealed that due to inability to meet their expenditure with their poor income, farmers have been spending around 30.0 per cent share of their total debt on meeting their domestic needs, maintaining their families, repairing houses, on health, education, and socio-religious purposes. Majority (68.0%) per cent farmers have incurred major debt for purchase of farm inputs in the state. But, domestic needs were the second major purpose of debt for marginal farmers. The share of domestic needs, major repairs of households and socio-religious ceremonies is around 30.0 per cent of total debt in the state.

On the basis of above background, it becomes imperative to understand the income earned by farm families and their loan profile. Hence, a pan Punjab data from different agro climatic zones represented by 200 farm families was taken. Keeping this in view, the study was conducted to analyse the annual income earned and debt taken by the farm families.

MATERIALS AND METHODS

The study was conducted in Punjab state represented by all the five agro climatic zones of Punjab. Punjab has 23 districts. Out of these, two districts were selected randomly from each zone, thus total ten districts were selected for the study. From each selected districts, one block in which main city or some other main city is situated and second block away from the district headquarters was selected. Hence, twenty blocks were selected for the study. Ten farm families actively engaged in farming as their major family occupation were selected from each block through proportionate random sampling on the basis of operational landholding in Punjab. Data was collected from 200 farmers. Data was analyzed using frequency, mean and percentages. One way ANOVA was used to statistically test the variation of income and loan differences between zones.

Selected Zones	Selected Districts
Sub-mountain undulating zone	Gurdaspur, Hoshiarpur
Undulating plain zone	Rupnagar, SBS Nagar
Central plain zone	Tarn Taran, Ludhiana
Western plain zone	Faridkot, Ferozpur
Western zone	Bhatinda, Sri Muktsar Sahib

RESULTS AND DISCUSSION

Income of farm families ranged from 20,000 to 16,00,000 rupees annually and it was divide into four categories namely low (less than 4 lakhs), medium (4-8 lakhs), high (>8-12 lakhs) and very high (>12-16 lakhs).

Data given in Table 1 showed that majority of sample families (67.0%) had annual income of less than four lakhs followed by nearly one fifth (18.5%) families having income up to eight lakhs and 9.0 percent families having annual income upto twelve lakhs, while only 6.5 per cent reported earnings of twelve-sixteen lakhs rupees annually. Shukla (2018) also reported that majority of the family in Punjab had annual earning of up to 3 lakhs, while Kaur *et al.* (2019) found majority (74.0%) of farmers in rural Punjab earning up to 5 lakhs. National Survey Organisation (2019) in its report of trends in all India income indicated that annual income of Punjab farmers was less than 3.5 lakhs. Singh and Singh (2019) stated that the average income of farm household of Hoshiarpur district of Punjab earned 48950 rupees annually.

Zone wise data also revealed that majority (62-87.0%) of families from each zones were having low annual earning except zone IV (50.0%) and zone III (57.5%). However, one fourth of sample families in zone III and IV had medium annual earning. In the higher income bracket, 15.0 percentage in zone IV followed by 12.5 per cent in zone III and least percentage (2.5%) in zone V earned twelve lakhs annually. Similar percentage (2.5%) of families in zone I and zone V and 10.0 percent in zone IV had income ranging from twelve lakhs to sixteen lakhs.

Total annual income was found to be Rs. 4,49468. Maximum earning was reported from zone IV (Rs. 6,53750) followed by zone III (Rs. 4,86425) and zone II (Rs. 4,72800), whereas zone I had minimum mean annual income (Rs. 3,05368). However, this difference among agro climatic zones was found to be non-significant. An Indian fortnightly business magazine Business Today (2020) also reported Rs 216708 as annual income of an average farm household in Punjab.

Families were profiled for the loan taken by them which included outstanding amount of loan, information on source and nature of the loan.

Data given in Table 2 revealed that majority (62.5%) of farm families had availed loan from different sources. The trend was observed in all agro climatic zones with comparatively lesser percentage in zone IV (52.5%) and zone V (55.0%). Singh (2021) also found large majority (89.0%) of farmers in Punjab in debt. NSSO (2014) in report on "key Indicators of Situation of Agricultural Household in India", indicated that more than half of the total agricultural household in the India were in debt.

It is interesting to note that the evolution of the institutional structure through various Government policy interventions changed the scenario of traditional loan system, whereby institutional sources primarily through commercial banks became the major source for rural credit. This trend has been supported by data given in Table 3 as it was found that very large majority (99.9%) of families who had taken loan had sourced it from commercial banks. Findings are in accordance with the findings of Kingra *et al.* (2018) and Singh *et al.* (2014) they found that more than 60.0% of the farmers in Punjab availed loan from institutional sources.

Kumar *et al.* (2019) in Ahmedabad also reported that commercial banks deployed larger funds for

Table 1: Distribution of farm families according to their annual income

Income	Agro climatic zones					Total
	Zone I (n_1=40)	Zone II (n_2=40)	Zone III (n_3=40)	Zone IV (n_4=40)	Zone V (n_5=40)	(n=200)
	f (%)	f (%)	f (%)	f (%)	f (%)	f (%)
Income from major source (Rupees)						
Low (< 4 lakhs)	31(77.5)	25(62.5)	23(57.5)	20(50.0)	35(87.5)	134(67.0)
Medium (4-8 lakhs)	5(12.5)	9(22.5)	10(25.0)	10(25.0)	3(7.5)	37(18.5)
High (>8-12 lakhs)	3(7.5)	3(7.5)	5(12.5)	6(15.0)	1(2.5)	18(9.0)
Very high (>12-16 lakhs)	1(2.5)	3(7.5)	2(5.0)	4(10.0)	1(2.5)	11(6.5)
Mean income (Rupees)	3,05368	4,72800	4,86425	6,53750	3,28725	4,49468
			p=0.72			

Table 2: Distribution of farm families according to their loan profile (n=200)

Loan profile	Agro climatic zones					Total
	Zone I (n_1=40) f (%)	Zone II (n_2=40) f (%)	Zone III (n_3=40) f (%)	Zone IV (n_4=40) f (%)	Zone V (n_5=40) f (%)	f (%)
Families taken loan	29(72.5)	26(65.0)	27(67.5)	21(52.50)	22(55.0)	125(62.50)
Sources of loan						
Commercial bank (Agricultural loan - limit)	29(100.0)	25(96.10)	27(100.0)	21(100.0)	22(100.0)	124(99.9)
Relatives	0	1(3.84)	0	0	0	1(0.05)
Purpose of taking loan						
Purchase of farm input and machinery	1(3.44)	3(11.5)	1(3.70)	1(4.76)	1(4.54)	7(5.60)
Rent /lease of land	1(3.44)	1(3.84)	4(14.8)	0	5(22.7)	11(8.80)
Purchase of land	1(3.44)	0	0	0	1(4.54)	2(1.60)
Purchase of livestock	1(3.44)	0	1(3.70)	1(4.76)	0	3(2.40)
Starting some business	0	3(11.5)	0	0	0	3(2.40)
House construction	15(51.7)	10(38.4)	11(40.7)	8(38.09)	7(31.8)	51(40.8)
Education of children outside country	2(6.89)	3(11.53)	3(11.1)	3(14.2)	2(9.09)	13(10.40)
Sending family member abroad	4(13.7)	3(11.5)	3(11.1)	4(19.0)	2(9.09)	16(12.8)
Marriage of the family member	4(13.7)	3(11.5)	4(14.8)	4(19.0)	4(18.1)	19(15.2)
Amount of loan taken (Rupees)						
< 500000	27(93.10)	19(73.0)	25(92.5)	15(71.40)	16(72.7)	102(81.60)
500000-1000000	2(6.89)	2(7.69)	0	5(23.80)	4(18.10)	13(10.40)
>1000000-1500000	0	2(7.69)	0	1(4.76)	0	3(2.40)
>1500000-2000000	0	2(7.69)	0	0	1(4.54)	3(2.40)
>2000000-2500000	0	1(3.84)	0	0	0	1(0.8)
>2500000 -3000000	0	0	2(7.40)	0	1(4.54)	3(2.40)
Mean loan amount	185000	385897	350000	282500	482750	337229.4
			p = 0.05*			

*Significant at 10% level of significance

agriculture sector. Reserve bank of India (2015) reported that the share of institutional credit was approximately 72.0 per cent among farmers. Reserve bank of India (2017) also reported institutional sources as preferred by agricultural households to avail credit as approximately 61.0 per cent of them avail credit from them. Beside banks Singh *et al.* (2014) in Punjab found that 35.25 per cent of the total credit is advanced by the commission agents (*Arhtiyas*), 2.35 per cent by the big landlords and about 1.0 per cent of the total credit is borrowed from shopkeepers, relatives, friends and others which includes service men, neighbours etc. Kaur *et al.* (2019) also found that majority (73.0%) of farmers in Punjab borrowed loan from institutional sources. Natioanl Sample Survey 70th round (2013) also revealed that about 60.0 per cent of the outstanding loans were taken from institutional sources which included Co-operative society (14.8%) and banks (45.0%) and among the non-institutional sources and professional money lenders (25.8%) were the major source for providing loan to the farmers.

Data in Table 2 showed that the loan availed from commercial banks was mainly agricultural loan limit against the land and meant for use for agricultural purposes. However, it was found that the highest percentage (40.8%) of families used agricultural loan for construction of house followed by 15.2 per cent using it for marriage of a family member. Singh *et al.* (2008) recommended that was need to o launch a mass campaign against extravagant expenditure on social

festivities. Nearly 13.0 per cent used it to pay expenses for sending a family member abroad and 10.4 per cent invested this money in educating their children abroad and these purpose were mainly non productive with high investment of money which was particularly meant for supporting farmers in farming and allied activities. Regarding productive purposes a very grim picture was found that very low percentage (5.6%) used it to purchase farm input and machinery and to pay for lease to the landlord (8.8%), whereas a negligible percentage (1.6%) used it to purchase land. Its use for purchase of livestock was made by few families (2.4%) or to start some enterprise and these were the reasons due to which farmers in Punjab are getting trapped in vicious cycle of debt and many of them were forced to do suicides.

The recent trend of making large sized houses in the villages and moving away from living simpler life may be one of the reason for farming families availing credit. The data also points towards interest in settling abroad. Families are spending large amount of money to ensure that the family can settle abroad.

Zone wise data also revealed similar trend. Most of the families across zones used it for making a house, with maximum percentage in zone I (51.7%) and least in zone V (31.8%). Sending family member abroad and sending children abroad for study purposes was also the reason for availing loan across all zones. Singh and Gupta (2014) concluded that 57.0 per cent of the credit was taken for productive purposes like purchase of farm inputs, farm machinery and agricultural land in Punjab. The remaining was used for non-productive purposes like housing loan, consumption loan, health care and social ceremonies the results are in agreement with the findings of Kingra *et al.* (2018) revealed that the per hectare debt among marginal and small farmers of Punjab was found to be Rs 263011 and Rs. 166790 respectively. Despite the vast network of banks in the country, more than 50.0 per cent of the total marginal and small farmers were borrowing from non-institutional sources of loan, out of which a major proportion of loan was being used for non-productive purposes.

Amount of loan ranged from less than five lakhs to thirty lakhs. However, a large majority (81.6%) of families were in debt of less than 5 lakhs, Similarly Kingra *et al.* (2018) also revealed that the average amount of debt per household was Rs. 215669 on marginal farmers and Rs. 278539 per household on small farmers of the state. 10.0 per cent had 5 lakhs to 10 lakhs. Lesser families had taken loan more than 10-30 lakhs (2.4%). Negligible percentage (0.8%) reported to have secured an amount of 20 lakhs to 25 lakhs as loan. National Sample Survey 70th round (2013) given data that the average amount of outstanding loan per agricultural household was Rs. 47000.

Zone wise data indicated that very large majority (93.0%) of families in zone I and III had availed loan upto 5 lakh rupees, whereas in zone II (73.0%), zone V (72.7%) and zone IV (71.4%) lesser percentage fell in this category. However, nearly one fourth (23.8%) farm families in zone IV,18.1 per cent in zone V and only 6.89 per cent families in zone I had debt of 5 lakhs to 10 lakhs. None of the families in all zones had taken loan upto 20-25 lakhs, except 3.84 per cent families in zone II, whereas very high amount of loan (Rs. 2500000- Rs. 3000000) were taken by 7.40 percent families in zone III and 4.54 per cent families in zone V. While none of the family in zone I, zone II and zone IV availed such high amount of loan.

Total mean amount of loan was found to be Rs. 337229.4. Mean amount of loan for each zone was also calculated and was found that zone V had taken maximum (Rs. 482750) amount as loan followed by zone II (Rs. 385897), zone III (Rs. 350000) and minimum (Rs. 185000) amount of loan was taken by families in zone I and this difference was found to be statistically significant across five zones. Singh *et al.* (2014) also found that the debt per farm household in Punjab was Rs. 218092. Data clearly shows that farm families were under debt.

CONCLUSION

Very large percentage of farm families had low income and to overcome this barrier in farming, Government is providing agricultural loan to farmers to be spend on inputs of farming, but it was found that non productive use of agricultural loan was more prevalent among farm families which was the major reason for the farmers in Punjab to get trapped in vicious cycle of debt. Agricultural loan should be used for agricultural purposes only to fetch better income from farming

and allied activities which would lead to overcome vicious cycle of debt. Effective measures should be taken to increase the income of the farm and agricultural household.

REFERENCES

Agricultural Census. 2015. Debts of farmers. Retrieved from https://indianexpress.com/article/india/punjab-farmers-loans-debt-income-suicide.

Kaur, L.; P. Sharma and L. Garg. 2019. Perceived causes of farmers suicides in rural Punjab. *Indian Journal of Extension Education,* 3: 168-172.

Kingra, H.S.; S. Singh and M. Kaur. 2018. Indebtedness among Marginal and Small Farmers of Punjab. *Journal of Agricultural Development and Policy*, 28(1): 92-100.

National Sample Survey 70th Round. 2013. Key Indicators of Situation of Agricultural Households in India. Retrieved from http://mospi.nic.in/sites/default/files/publication_reports/KI_70_33_19dec14.pdf on 23 February 2018.

National Sample Survey Organisation. 2014. Key Indicators of Situation of Agricultural Household in India. pp. 23-25.

National Survey Organisation. 2019. Annual Report. Department of Agriculture, Cooperation and farmers welfare. Retrieved from https://agricoop.nic.in/sites/default/files/ACFW%20English%20%20Annual%20Report%202019-20.pdf.

Reserve Bank of India. 2015. Reports of RBI. Retrieved from https://www.rbi.org.in/Scripts/Publication ReportDetails on 27 Dec 2020.

Reserve Bank of India. 2017. Reports of RBI. Retrieved from https://www.rbi.org.in/Scripts/Publication ReportDetails on 28 Dec 2019.

Shukla, N. 2018. Performance of elected members of Panchayati Raj Institutions (PRI) in implementation and monitoring of development schemes. Ph.D. dissertation, Punjab Agricultural University, Ludhiana, India.

Singh, R. and K. Gupta. 2014. Attitude of male adolescents towards family occupation of farming: management perspective for Indian policy makers. Retrieved from file:///C:/Users/user/Downloads/2511-6960-1-PB%20(4).pdf.

Singh, S. and G. Singh. 2019. Distribution pattern of income among farm and non farm households in Hoshiarpur district of rural Punjab. *Journal of National Development,* 32: 45-59.

Singh, S. and K.D. Tejinder. 2011. The Status of Commission Agent System in Punjab Agriculture. *Indian Journal of Agriculture Economics*, 6(4): 663-678.

Singh, S.; K.N. Manjeet and H.S. Kingra. 2008. indebtedness among Farmers in Punjab. *Economics and Political Weekly,* 43(26): 130-136.

Singh, S.; S. Bhogal and R. Singh, 2014. Magnitude and determinants of indebtedness among farmers in Punjab. *Indian Journal of Agricultural Economics,* 69(2): 220-226.

Vinaya Kumar, H.M.; N. Chauhan and D.D. Patel. 2019. Predictive factors to avoid farming as a livelihood. *Journal of Economics Structure*, 8: 10-15.

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Research Article

Traditional Practices of Reproductive Health Care Management followed by Pregnant and Lactating Women's of Sawai Madhopur District of Rajasthan

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ABSTRACT

Pregnancy is the time during which one or more offspring develops (gestates) inside a woman's uterus (womb). A multiple pregnancy involves more than one offspring, such as with twins. An understanding of the traditional practices associated with pregnancy and delivery in immigrant women's countries of origin is essential for Indian health care professionals who attend these women. This study, intended for Indian families, nurses and other health workers, reviews pregnancy, childbirth, and newborn care practices in India. Present study was conducted in Sawai Madhopur district of Rajasthan to quantify the Traditional practices followed by pregnant women in rural areas of Sawai Madhopur district. The result suggests that pregnancy traditional practices has proved a Feasibility, Accessibility and Replicability to conditions of pregnant, lactating women of sawai madhopur district. In 2020-2023, 120 pregnant and lactating women's sample was conducted in sawai madhopur pachayat samiti. The Major findings of the study revealed that 95 per cent of women follows the Traditional practices during and after pregnancy of the rural women of Sawai Madhopur Panchayat Samiti. Findings further indicates that 45 per cent of the respondents had 1-2 alive children's followed by 3-4 alive children (31.67%), 17.50 per cent of the respondents did not have children as their first pregnancy. Only 5.83 per cent of the respondents had five and above children. The Major findings were respondents 83.33 per cent of the respondents had normal deliveries. Only 16.67 per cent respondents had cesarean deliveries. Majority of the respondents (55%) were pregnant and had normal deliveries. Respondents were married between 19 to 22 years of age and fifteen percent had miscarriages. There were some traditional practices also done by rural women in prenatal and postnatal period.

Keywords: Health care, Lactating women, Practices, Pregnant, Reproductive, Traditional

INTRODUCTION

Welfare of a country depends mainly on welfare of its women as they quietly play a significant role in Development of their equal status in the society. Even girl child is discriminated against male child since birth and new with technology advances even prior to birth. Existing poor health status, lack of preventive measures and obstetric care and unequal access to resources, malnutrition, lack of sex education, cultural taboos, unsafe abortion, infections, HIV etc. Result in high, maternal mortality and morbidity. The state of health in India, prior to independence, was miserably poor. With successive five year plans and sustained developmental efforts, the country has achieved significant improvement in the health status of its people. This study, intended for Indian families, nurses and other health workers, reviews pregnancy, childbirth, and newborn care practices in India. Although most Indian women believe they have little or no control

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over pregnancy and its outcomes, certain beliefs, customs, and taboos surround pregnancy and the perinatal period. Among the practices discussed in this article are consumption of "hot" versus "cold" foods during pregnancy, reduced food consumption during pregnancy, son preference, uses of herbal medicines, home delivery by a traditional birth attendant, exclusion of men from most aspects of childbirth, the role of extended family, confinement after delivery, delayed onset of breast feeding, and rituals aimed at warding off the "evil eye." Childbirth practices in India are shaped by the prevalence of religious customs and joint-family living, India's young average population, the lower national average age at marriage, and disparities in social status and literacy between men and women. Inadequate maternal health care services in India are a result of poor organization, the huge rural-urban divide, and large interstate disparities coupled with stringent social-economic and cultural constraints. In preparing for birth, Indian women who live with their husbands generally seek counsel from their mothers-in-law. The advice of maternal figures is highly valued, and expectant mothers will follow the childbearing rituals passed down to them by their mother-in-law. Sleep positions, eating habits, and level of activity are all influenced by the views of older women of the family. Aside from what is told to them, women receive very little knowledge regarding birth itself. Often, women are very fearful for their birth, as they have only been told of the pain from others. The maternal figures of the family, especially the mothers-in-law, pass on customs regarding nutrition, hygiene, and daily activities during pregnancy. Frequently, "cold" foods such as fruit are avoided during pregnancy for fear of causing sickness or stillbirth. In some traditions, women may only drink hot tea and rice milk. The older women of the family determine each expectant mother's activity level and sleep habits, following family tradition. Some women are told to increase their activity levels in order to prepare the body for the hard work of labor, while other rest throughout pregnancy to save energy. Sleeping may also be regulated, and some women never sleep on their back or turn over during pregnancy. Although most Indian women believe they have little or no control over pregnancy and its outcomes, certain beliefs, customs, and taboos surround pregnancy and the perinatal period. Among the practices discussed in this article are consumption of "hot" versus "cold" foods during pregnancy, reduced food consumption during pregnancy, son preference, uses of herbal medicines, home delivery by a traditional birth attendant, exclusion of men from most aspects of childbirth, the role of extended family, confinement after delivery, delayed onset of breast feeding, and rituals aimed at warding off the "evil eye."

MATERIALS AND METHODS

The study was conducted in Sawai Madhopur district of Rajasthan. In Sawai Madhopur, there were total 5 blocks namely Sawai Madhopur, Chouth ka Barwara, Khandaar, Bonli, Malarna. For the study sawai madhopur block was selected as Village " Padli" and Karmoda. There were total 120 pregnant and lactating women were selected randomly. Different capacity building activities including training, exposure visit and farmer's scientist's interaction on various aspects including were planned and undertaken. Pre-survey was conducted to obtain information regarding profile and respondent's dietary food habits and nutritional deficiency diseases were also pre-surveyed. After one year of establishment of nutritional garden, a post-survey was done to analyses the impact of traditional practices on pregnant and lactating practices. Data were collected by interview schedule. Map of Sawai Madhopur shows production and productivity of major recipes.

RESULTS AND DISCUSSION

Reproductive Profile of the Respondents: The data pertaining to the selected reproductive profile of the respondents have been presented in this section like reproductive stage, Respondent's age of marriages, Husband's age of marriage, Age of 1st delivery, Type of delivery.

Reproductive Stage: Perusal of result of Table 1 show that 55 per cent of respondents were pregnant and 45 per cent respondents were lactating mother.

Table 1: Distribution of the Respondents according to Reproductive stage (N = 120)

Reproductive Stage	Frequency	Percentage
Pregnant	66	55
Lactating	54	45

Age of 1st Delivery: Table 2 shows that more than half of the respondents (66.67%) from the total sample delivered then baby between the age of 22-30 years. 17.50 per cent of the respondents had first delivery between 18-22 years years of age while only 15.83 per cent respondents delivered this first baby between the age of 30 above years of age.

Table 2: Distribution of the Respondents according to Age of 1st Delivery (N = 120)

Age of 1st Delivery	Frequency	Percentage
18-22 years	21	17.50
22-30 years	80	66.67
30 above years	19	15.83

Type of delivery: Table 3 reveals that 83.33 per cent of the respondents had normal deliveries. Only 16.67 per cent respondents had cesarean deliveries.

Table 3: Distribution of the Respondents according to Type of delivery (N = 120)

Type of Delivery	Frequency	Percentage
Cesarean	20	16.67
Normal	100	83.33

Distribution of Respondents according to Infant mortality and miscarriage: These tables enfolds the information related to distribution according to the infant mortality and miscarriages as follows:

Number of alive children: Table 4 results that 45 per cent of the respondents had 1-2 alive children's followed by 3-4 alive children (31.67%), 17.50 per cent of the respondents did not have children as their first pregnancy. Only 5.83 per cent of the respondents had five and above children.

Traditional Practices of Reproductive Health Care Management followed by respondents of Sawai Madhopur District of Rajasthan: Traditional beliefs and practices adopted by rural women before and during pregnancy. Scrutiny of Table reveals the beliefs and practices adopted by rural women before and during pregnancy which are as follows:

Table 4: Distribution of the Respondents according to Number of Alive children (N = 120)

Number of alive children	Frequency	Percentage
None/First Pregnancy	21	17.50
1-2 Children	54	45.00
3-4 Children	38	31.67
5 and above	7	5.83

Preparation for pregnancy

Particular period to conceive: It was observed that during preparation period of pregnancy, respondents 66.67 per cent believed in conceiving during moon light which leads to birth to male child.

Ceremonies to be performed during pregnancy: During pregnancy, 95.83 percent respondents did prayers, visit to family *devta* and visit to family *guru* during pregnancy.

Prenatal phase

Practices adopted for common problems of pregnancy: Most of 58.33 percent the respondents were like to adopt home remedies for the treatment of common problems constipation. For the problem of constipation, took hot milk with *gur*, mixture of *elaichi*, *harar* and black salt with lukewarm water.

Morning Sickness: It was observed for treating the problems of morning sickness mixture of *saunf* plus *mishri* plus *elaichi* and biscuit in early morning was practiced. For Cramps, milk ghee which provide strength to the muscles, and consume mixture of *til* and ghee as treatment of cramps during pregnancy.

Compulsory items to be taken during pregnancy: In this it was observed that 58.33 per cent respondents preferred not only one item compulsory but preferred several items according to their beliefs. As shown in table respondents prefer to eat fresh coconut and sona bhasm, milk ghee as well as coconut seeds, *methi* and cucumber during pregnancy as their preferable.

Food items restricted during pregnancy: Table further depicts restricted items during pregnancy *Gur* and *Til* restricted as this is hot in nature and leads to abortion where as respondents avoid papaya as it leads to abortion and lady finger leads to birth of girl child. *Channa* was avoided as it causes indigestion, 90.83 percent brinjal avoided because as it leads to dark complexion of a baby and new child born will be violent in nature.

Activity to be avoided during pregnancy: Beliefs related to activities to be avoided during pregnancy were also practiced by rural respondents. It was found that

Table 5: Traditional beliefs and practices adopted by rural women before and during pregnancy periods documented from respondents (N = 120)

Practices	Frequency	Percentage
Before conception		
Preparation of pregnancy		
Moon light (Birth of male child)	80	66.67
Did not know	40	33.33
Ceremony before pregnancy		
Prayers	110	91.67
Visit to family *Devta* (temple)	115	95.83
Visit to family *Gur*u (Ashram)	50	41.67
Treatments During Pregnancy constipation		
Constipation		
Mixture *of Elaichi, Harar, Kala Namak* with luke warm water	50	41.67
Hot milk with *gur*	70	58.33
Morning sickness		
Mixture of *saunf* + *mishri* + *elaichi*	70	58.33
Biscuits in early morning	50	41.67
Cramps		
Milk with Ghee	116	96.67
Til+*ghee*	100	83.33
Compulsory foods taken during pregnancy		
Coconut seed	55	45.83
Sora bhasm	45	37.5
Methi seeds	62	51.67
Milk	39	32.5
Cucumber	80	66.67
Restricted foods during pregnancy		
Til	90	75
Bajra	80	66.67
Gur	95	79.16
Channa	110	91.67
Papaya	100	83.33
Ladyfinger	103	85.83
Brinjal	109	90.83
Non –vegetarian	115	95.83
Activities to be avoided during pregnancy		
Healthy work	96	80
Traveling	99	82.5
Looking at Solar / Lunar Eclipse	110	91.67
Going for Mourning	90	75
Special prayers to be performed during pregnancy		
Daily prayers	96	80
Pray to God and not goodness	99	82.5
Ceremony in 8th month (*Godh Bharai*)	118	98.33

respondents avoid most of respondents travelling as it creates uneasiness and avoid to do heavy work with belief that it will lead to abortion. Respondent believed as going to mourning is a family taboos and 91.67 per cent believed looking at solar/lunar eclipse may develop defects in child to be born.

Special prayers to be performed during pregnancy: During prenatal phase pregnant women did daily players with belief that it will leads to good nature / sanskar in child whereas pray to God and not goddess with the desire of male child.

Ceremony in 8th month (Godh Bharai): Godh Bharai (98.33% women;)ceremony in the 8th month of pregnancy was performed by respondents to welcome the baby and bless expectant mother.

Traditional beliefs and practices adopted by rural women during pregnancy: Traditional beliefs and practiced adopted by rural women during delivery have been presented in Table as follows:

Place of delivery: 75 per cent pregnant womenhad the practices of having their delivery at parent's house simply for more freedom, whereas pregnant women (respondent) who believed in having delivery at in-laws house, being their responsibility.

Food grain during labour pain: For the safe and easy delivery, various food items were given to respondents. Pregnant women practiced and having *Kadha* of long plus 66.67 percent Jaiphal for easy and safe delivery and having *Kadha* plus *Methi ajwain* and *kapas ke dode*. Roots of *Bajra* and *Kesar* with milk taken for easy and safe delivery.

Methods to be adopted in case of difficult delivery: Some methods were adopted as initiatives or rituals which were performed during difficult delivers. 75 per cent Pregnant women believed to keep grains near cot of mother and later given to Brahmin or harijan with practice that it will ward of evil spirit who is creating difficulty, removal of nose pin as family taboo whereas practices giving cow dung with water to the mother to drink and giving ash with water to the mother to drink which leads to vomiting which puts preserves on uterus. Keeping clothes as ease in the name of god and goddess practices so that God and Goddess will be happy and will make the delivery easy and putting

expectant mothers hairs in her month so that she can bear pains.

Food avoided during delivery: During delivery period, 93.33 per cent avoid of drinking water was avoided which leads to accumulate in uterus and it enlarges, avoided full meal during pregnancy which causes swelling in uterus.

Food items to be given just after delivery: Several practices regarding of food items to be given to the new mother just after delivery were practiced. Pregnant women practiced *gur* plus roasted wheat flour plus *jeera* for milk secretion and ghee with milk for cleaning of uterus and makes uterus strong and practiced *ajwain* ka *Kadha* for cleaning of all left over in uterus and 75 per cent *Gola kutti* to avoid pain in uterus. *Gur* and *Kamarkas* practiced during delivery period which gives strength and makes the bones stronger.

First food items given to infant after delivery: After delivery, most of women practices traditionally like coloustrum and honey given because it increase immunity of infant, *ghutti* (readymade)was given to infant for clear the stomach of infant. After delivery soft *gur* to the infant to clean the stomach.

Giving bath to mother: 91.67 per cent Practice of giving bath to mother from sixth day of delivery because it was their family customs and it protect the genital organs of the mother.

Time for clothing of infant after birth: 91.67 per cent the first clothes on the infant on sixth day of birth with the belief that baby will acclimatize with environment, during this period. Clothing to infant just after birth as a family custom and clothing infants at the time of Hawan as family tradition.

Type of clothes used for the 1st time for baby: Cent percent women's performing traditional practice like Old clothes of elderly person were used for clothing the new born child for the first time with belief that the new born child will have a long life.

Miscellaneous: Most of respondents performing practices like Other beliefs shows that practiced of Lighting lamp for whole night to ward evil spirit and respondent who practiced by keeping items under cot of mother and baby like iron items and water as protected from spirit. Mother will not have her back towards baby to

Table 6: Traditional beliefs and practices adopted by rural women during delivery period documented from respondents (N = 120)

Practices	Frequency	Percentage
Place of delivery		
In-laws	30	25
Parents	90	75
Food given during labour pains (for safe and easy delivery)		
Kadha of long + jaiphal	*80*	*66.67*
Kada of *methi* + ajwain	20	16.67
Kapas ke dode	*10*	8.33
Roots of bajra	10	8.33
Kesar with milk	50	41.67
Initiatives taken in difficult delivery		
Grains kept near the cot of mother which are later given to Brahmin or Harijans	90	75
Take out / keep aside cloths or cash in the name of God and Goddesses	10	8.33
Putting expectant mothers hair in her mouth	10	8.33
Giving ash with water to the mother to drink	10	8.33
Giving cow dung with water to the	10	8.33
Mother to drink	10	8.33
Nose pin of mother is removed	10	8.33
Food avoided during delivery period		
Water	112	93.33
Full meal	55	45.83
Food given just after delivery		
Gur + roasted wheat flour + *jeera*	*80*	*66.67*
Gola Kutti	90	75
Ajwain ka *kadha*	80	*66.67*
Gur and Kamar Kas	*80*	*66.67*
Ghee with milk	70	58.33
First food items to be given to infant just after delivery		
Soft *gur*	10	8.33
Honey	70	58.33
Ghutti (readymade)	116	96.67
Colostrum	110	91.67
Giving Bath to mother from 6th Day of Delivery		
After 6th day	110	91.67
To protect genital organ from water	25	20.83

Table 6 contd...

Practices	Frequency	Percentage
Time for clothing of infant after birth		
Just after birth	105	87.5
On 6th day of birth	110	91.67
At the time of Hawan	0	0
Time for clothing of infant for 1st time		
Old clothes of elderly person	120	100
Others (Miscellaneous)		
Lighting lamp for whole night	90	75
Mother will not have her back towards baby while sleeping	110	91.67
Keeping some items	115	95.83
Mother and child will not left alone	115	95.83

develop more affection with baby and protect the baby. Mother and child will not be left alone and visitors have to sit for sometime in other room then they come to room of mother and baby toward from evil spirit and protection of mother and child.

Traditional beliefs and practices adopted by rural women during postnatal period

Bedding material used by mother: The use of old clothes as bedding material by 66.67 per cent it soaks well and can be easily disposed off and sand as bedding because so it can soak well and can be easily disposed off. Straw as it burns easily and ash preferred as soak well and can be burned.

Activities avoided by mother: The 83.33 respondents, who had a delivery, avoid needle work, reading and watching T.V, as eye sight will be affected. During this period, respondents avoided long sitting because it will cause backache and avoid work requiring concentration because it create headache and affect eye sight.

Food items restricted during postnatal period: Some of the items were restricted for the mother during postnatal period. Among various restricted foods items, avoided spicy food and citrus fruits (75%) which leads to acidity, loose motions, indigestions to mother and baby, also cause swelling and pain in uterus. Avoid water, which leads to swelling of stomach and avoid curd and *lassi* leads to cold to both mother and baby. Mother were avoiding radish which leads to indigestion to mother as well as baby. Avoid potato and whole grains because it may cause gastric.

Table 7: Traditional beliefs and practices adopted by rural women during postnatal period documented from respondents (N =120)

Practices	Frequency	Percentage
Bedding material use for mother		
Straw	20	16.67
Ash	10	8.33
Sand	10	8.33
Old clothes	80	66.67
Activities avoided by mother		
Watching T.V.	100	83.33
Reading	5	4.16
Needle work	5	4.16
Long sitting	5	4.16
Work requiring concentration	5	4.16
Restricted food items		
Spicy food	20	16.67
Radish	35	29.16
Curd, *lassi*	70	58.33
Whole grams	20	16.67
Citrus fruits	90	75
Potato	10	8.33
Water	0	0

Table 8: Practices adopted by rural women for lactation and weaning period documented from respondents (N = 120)

Practices	Frequency	Percentage
Period for breast feeding		
1-2 years	114	95
More than 2 years	2	1.67
Till secretion	3	2.5
Till next conception	1	0.83
Age to start weaning		
Between 4-5 months	55	45.83
Between 6-7 months	60	50
Between 8-10 months	2	1.67
After 10 months	3	2.5
Materials to be adopted for weaning		
Liquids	55	45.83
Semi solids	55	45.83
Solids	10	8.33

Practices adopted by rural women for lactation and weaning

Period for breast feeding: During this period, mother feeds her baby as 95 per cent 1-2 years, more than 2 years, till secretion or till next conception.

Age to start weaning: During lactation period, mother starts weaning between 45.83 per cent 4-5 years, between 50 per cent 6-7 months, between 8-10 month or after 10 months.

Material used for weaning: During lactation period, 45.83 per cent liquid semi solid and solid food items were given to the baby as weaning food or material.

CONCLUSION

From the above finding it can be concluded that majority of the respondents were pregnant, marriage age was 12-18 years, husband's age of marriage below 21 years, age of *gaunna* was 18 and above, normal delivery. During pregnancy different practices adopted by rural women like particular period of conceive was during moon light, ceremonies to be performed prayers, visits to family *devta* and visit to family *guru* during pregnancy. In prenatal phase practices adopted by pregnancy women were common problems like constipation, morning sickness, cramps. Some compulsory items to be taken during pregnancy like coconut seeds, *sona bhasm*, *methi* seeds, milk, cucumber, fresh coconut. Food items restricted during pregnancy like heavy work, Travelling, looking at solar / lunar eclipse and going to mourning. Special prayers, pray to god not to goddess, special customs and rituals to be fulfilled during pregnancy 8th month. In delivery period practices were followed as preparation to be given during labour pain, *kada* of *laung* plus jaiphal, *kadha* of *methi* plus *ajwain*, kapas ke dode, root of bajra, kesar with milk, method to be adopted in case of difficult delivery were grain kept near the cot of mother which was later given to brahmin, putting expectant mothers hair in her mouth, giving ash with water to the mother to drink, giving cow dung with water to drink, Food items avoided during delivery period were water, full meal, food items to be given just after delivery, *gur* plus roasted wheat flour plus *jeera*, *gola kutti*, *ajwain ka kadha*, *gur* and *kamarkas*, ghee with milk. First food items given to infant just after delivery were soft *gur*, honey, *ghutti*, colostrums. Bath given to mother after 6th month and protect genital organs from delivery. Time for clothing of birth just after delivery, 6th day of birth and at time of *hawan*. In Postnatal period practices were followed as type of bedding material used for mother like straw, ash sand, old clothes. Activities to be avoided by mother watching T.V., reading, needle work, long sitting, work required concentration. Food items restricted during postnatal period like spicy food, radish, curd and *lassi*, whole grain, citrus fruits, potato and colostrums.

REFERENCES

Bhatia, J. and J. Cleland. 2004. Health care of female out patient in south-central India: comparing public and private sector provision. *CPS-DFID RepWth.Prog.7 dec.htm*.

Dudi, A. and A.R. Singh. 2007. Traditional wisdom practices among rural women regarding health care of infant. *Indian Research Journal of Extension Education*, 7(1).

Kaewsarn, P.; M. Wendy and C. Debra. 2003. Traditional postpartum practices among Thai women. *Article first published online:* 10 FEB 2003. DOI: 10.1046/j.1365-2648.2003.02534.x.

Kavitah and Audhinaryana. 1997. Reducing maternal mortality in St. Petersburg. *Health forum,* 2: 189-193.

Kestler, E. 1996. Wanted: Better care for pregnant women. *World Health Forum*, 14: 356-359.

Khan, M.E.; A.S.K. Richard; D. Ghosh and B. Sashi. 1997. Inequalities between men and women in nutrition and family welfare services : An in-depth enquiry in an Indian village. *Social Action*, 38(October- December).

Konteh, R. 1998. Saving mother's lines things can go wrong. *World Health Forum*, 19: 136-139.

Laddha S. 2006. Reproductive health care management pattern of rural women. Sunita Laddha 2002 HS 119 D. I.C. College of Home Science, Department of family resources Management CCS Haryana Agricultural University, Hissar-125004.

Laddha, S. and S. Singal. 2010. Action imperatives for improving reproductive health of women of semi arid Rajasthan and Haryana. http://knol. google.com/k/john-britto /action-imperatives-for- improving/3aeb2yvvu.

Lal, S.; P. Khanna; B.M. Singh; M.S. Punia; S.S. Kumar. 1994. Participation of pregnant and lactating mothers in ICDS programme in Rural area. *Indian Journal of Public Health*, 38(3): 65.

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Research Article

Marketing Behaviour of Jute Growers in North 24 Parganas District of West Bengal

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ABSTRACT

Jute mills procure raw jute for making various types of eco-friendly products ranging from hessian clothes to geotextiles. Better marketing facilities is essential to ensure remunerative price to the jute growers, like other agricultural produce. The present study was conducted during 2023-24 in the district of North 24 Parganas to know the marketing behaviour of jute growers. Majority of the respondents were showing medium level of marketing behaviour. Which had significant relationship with their educational status, information utilization sources and innovativeness. The major constraints faced by the respondents were increased cost of cultivation followed by fluctuation in market price and lack of storage facility. Aa a corrective measure, some of the suggestions were assured procurement of the jute fibre at the minimum support price followed by policy measures reducing the middleman intervention, enhancing the purchasing capacity of Departmental Purchase Centres of the Jute Corporation of India and creation of common storage structure at the village level.

Keywords: Marketing behaviour, Jute growers, Correlation, Garrett table

INTRODUCTION

Jute (*Corchorus* spp.) is one of the most important cash crops of South-Asia and it is largely produced in India and Bangladesh. It plays a crucial role in the agriculture, industrial growth of the nation and makes significant contributions towards rural economic transformation (Kalita and Bhuyan, 2018). In India, it is grown on 0.686 mha area with a production of 9.6 million bales (1 bale= 180 kg). West Bengal is the leading state of jute production in the country, followed by Bihar and Assam and contribute about three-fourth of the country's production (Mondal *et al.*, 2014). Majority of the jute growers are small and marginal farmers and they face various kind of risk *i.e.* production, marketing, financial, human and environmental during production affecting their decision making process. Besides this rising cost of production coupled with extreme climatic condition are making life difficult of the jute growers. At the final stage of crop production normally the jute growers are subjected to issues in marketing of the harvested produce. Marketable risk can be handled through market tools like crop insurance, future markets. Production levels and market supply-demand dynamics usually cause unforeseen price swings. Various types of intermediaries ranging from village traders, *Forias*, commission agent, miller's agent operate between the jute growers and the consumer of the raw jute *i.e.* jute mills. As the number of intermediaries increases the marketing cost also increases (Shamna *et al.*, 2017). Majority of the jute growers prefer to dispose it quickly because of storage issues *i.e.* bulkiness, inflammable nature, other social and family obligations leading to distress sale which favours the buyers market *i.e.* jute mill. Continuous change/improvement are required in the present marketing system, in favour of the jute growers for which complete knowledge about buyers choice/ preferences is very much needed. All these present a

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scenario of conflicting interests. Like other agricultural commodities, the jute growers also face the problem of lack of market infrastructure and price. Although, Minimum Support Price (MSP) serve as a safeguard to the jute growers and ensure minimum profit from the jute cultivation, but the percentage increase in MSP during 2011-12 to 2014-15 showed a declining trend. It was identified as one of the possible reason for decline in acreage of jute cultivation in West Bengal (Sarkar *et al.,* 2018).

Recent study by Barman and Anoop (2023) in North Bengal has highlighted the problems faced by the jute growers viz. problem of middlemen, lack of organized marketing system, high marketing cost, non-availability of markets in the nearby areas, transportation of the harvested product. The jute marketing problems in rural areas of North 24 Parganas have not been studied in a systematic way. Such observation needs validation from other jute growing areas also. Hence, the present study was undertaken with the objectives to understand the marketing behaviour of jute growers, ascertain the constraints and suggestions perceived by them.

MATERIALS AND METHODS

The study was conducted purposively in North 24 Parganas district, where major crops grown are paddy, vegetables, jute and onion etc. The net sown area of the district is 2,25,000 ha out of which, jute occupy around 27% area *i.e.* 61,274 ha (Anon, 2015) and one fourth of the total jute mills are also located in this district. Five major jute growing blocks of this district namely, Baduria, Deganga, Swarupnagar, Gaighata and Bagdah were selected for the study. From each block one village having maximum acreage under jute cultivation were taken up. From each selected village (namely Panji, Mangalnagar, Goaldah, Vennapara and Bagdah), 20 jute growers, as respondents, were selected by using simple random sampling (SRS) method. Thus, a total of 100 jute growers were selected as the sample for the study. All the respondents had marginal land holding and were growing the jute crop since last 10 years. The primary data were collected during November-December, 2023 through personal interview schedule with the help of pre-tested interview schedule. Garrett Ranking technique was used to analyze the constraints and suggestions of the jute growers with regard to strengthening the marketing situation of the jute fibre. The sampled jute growers were asked to rank the constraints faced by them in marketing of jute fibre. The rank assigned by them was converted into percent position, from which Garrett values were obtained using Garrett's table (Garrett and Woodworth, 1969). Then Garrett value were multiplied to rank given by the individual responses and added together. The obtained sum value was divided by total number of respondents'. Thus mean score obtained from each constraint was ranked by arranging in the descending order. The formula used to calculate this is as follows:

$$\text{Percentage Position} = \frac{100\ (R_{ij} - 0.5)}{N_j}$$

Where, R_{ij}= Rank for i^{th} item by j^{th} individual

N_j = Number of items ranked by j^{th} individual.

The statistical tests and procedures were used for analyzing the data with the help of statistical tools like mean, S.D., percentage, Karl Pearson's coefficient of correlation and multiple regression.

Parameters assessed with respect to marketing behaviour of jute growers: Since, jute is a commercial fibre crop, entire effort of a jute grower revolves around production as well as marketing of his produce. At the production level, the fibre is generally available during September-October for sale after the completion of retting process. Marketing behavior of a jute grower is helpful in the assessment of probable sale and formulating the desired marketing strategy of jute fibre. The marketing risk *i.e.* price risk is a major factor in conditioning of the behaviour of jute growers in terms of increase/decrease of area. Marketing behaviour of a jute grower refers to the responses with respect to marketing aspects of jute with the identified nine (09) components namely, i) time of sale, ii) place of sale, iii) mode of sale, iv) distance to the market, v) credit availed, vi) mode of transport, vii) collection of money, viii) grading and sorting, ix) style of product clearance. Responses of the jute growers were recorded and analyzed for interpretation.

RESULTS AND DISCUSSION

Profile of the respondents: The sample data of jute growers obtained from the study area showed that all

of them belonged to marginal farmers category and were engaged in jute cultivation for more than 10 years. Majority of them (76%) were having more than 35 years of age with family size of more than 6 members (66 %) and annual income of > Rs. 1 lakh (87%). With regard to schooling, most of them had education of primary school (40%) followed by high school (25%), functional literacy (15%), graduate (16%) and higher secondary (4%). About three fourth of the respondents, were in medium range of sources of information utilization (73%) and innovativeness (75%).

Marketing behaviour of the respondents: Generally, effort of a jute grower revolves around production as well as marketing of the produce. The data presented in the Table 1 shows the different components of marketing behaviour of the jute grower.

Time of sale: It was found that majority of the jute growers (39%) preferred to sell their produce (fibre) at the earliest after harvesting (September-October) to meet domestic and farm needs. This timing of sale of raw jute fibre generally coincides with the festival season of both Hindus (*Durga puja*) and Muslims (*Id-u'l-Zuha*). As per the respondents, storage risk is avoided due to its bulkiness and inflammable nature. While 32 per cent respondents sold their produce in the month of December-January (after 2-3 months) whereas, it took around more than six months for 29 per cent of the respondents to sell the fibre at an attractive price.

Place of sale: With regard to place of sale, more than half of the respondents (55%) preferred to sell their fibre produce (11.96 q ± 5.93 q) at the village level itself. As per them, it saved their time as well as transportation cost involved in marketing of their produce. Next preferred place was nearby mandis (25%). One fifth of the respondents (20%) approached to the Departmental Purchase Centres (DPCs) of The Jute Corporation of India (JCI). However, these places were far away from their residence.

Mode of sale: In a village generally 5-7 persons were active in purchasing, storage and onward transmission activities of jute fibre. These persons (*forias*) were generally happened to be their kin/friends. More than half of the respondents (55%) preferred to sell their fibre to them (*forias*). Those having more quantity of jute fibre (≥18 q) opted to visit either nearby mandis (25%) or the DPCs of JCI (20%) depending upon the situation. It required extra effort as well as network relationship. At DPCs of JCI, there was a ceiling of 45q/individual jute grower in a crop season. It had fixed working hours 9.30 A.M.-6.15 P.M. Unnecessary deduction were not made at this place.

Distance to the market: Hired vehicle *Jugad (Van engine)* and *tricycle rickshaw* was the major mode of

Table 1: Marketing behaviour of jute growers (n=100)

Category	Frequency	Percentage
Time of sale		
Somehow harvest is over	32	32
When price is attractive	29	29
Immediately as per the need of cash	39	39
Place of sale		
In the village	55	55
Nearby mandi	25	25
DPCs of JCI	20	20
Mode of sale		
Local *vyaparies (forias)*	55	55
To the wholesaler /businessmen	25	25
DPCs of JCI	20	20
Distance to the market		
Up to 5 km	62	62
5- 10 km	38	38
Mode of transport		
No use of vehicle	55	55
Hired vehicle	42	42
Own vehicle	3	3
Collection of money		
1-2 day after sale	26	26
Within 3-4 days	20	20
One week after sale	54	54
Credit availed		
Financial institution	67	67
Non-financial institution	11	11
Self-managed	22	22
Grading and sorting		
Yes	73	73
No	27	27
Style of produce clearance		
Whole	53	53
Partwise	47	47

transport to carry the jute fibre from the doorstep of jute growers to the purchaser. The village *vyaparies (forias)* bore the transportation cost. At the village level 62 per cent respondents availed the service of *vyaparies (forias)* living within a periphery of 5 km. While remaining 38 per cent respondents travelled to distance of 5-10 km to reach at mandi/DPCs.

Mode of transport: Majority of the respondents (55%) who opted to sale jute fibre at village, did not require any arrangement of the transportation. It was arranged by the local *foria*. More than two fifth of the respondents (42%) were going either to mandis or to DPCs and used hired vehicles to carry their jute fibre. The transportation charge was (Rs. 60-80/q for 10 km). Only 3% respondents had their own vehicle to carry their jute fibre.

Collection of money: Around one fourth (26%) of the respondents received quick payment (1-2 days) of the jute fibre sold by them (< 6q). Around one fifth of the respondents selling their fibre to DPCs of JCI were used to get online payment through their bank account within 3-4 working days.

However, in the case of sale of bigger amount (≥6 q) at village and madis, more than half of the respondents (54%) reported that they received the receipt of sale amount after one week. It seemed there was more involvement of cash transaction. The traders might be taking more time to rotate their capital invested in onward transmission of the fibre.

Credit availed: Most of the respondents (67%) availed the facility of Kisan Credit Card (KCC) to meet out expenditure (Rs. 25,000-30,000/ crop season) during crop production. While one fifth of the respondents (22%) managed the expenditure from own saving. Around one tenth of the respondents (11%) availed credit from non-institutional sources to meet out the plant protection expenditure, carriage charges of green harvested jute plants from field to nearby retting ponds etc.

Grading and sorting: More than two third of the respondents (73%) were aware of grading (TD1 to TD 5) and sorting of jute fibre and used to grade their produce based on root content, impurity, colour, strength and fineness. They followed better retting method of jute like application of CRIJAF Sona microbial power. They knew the consequences of using banana stem/mud for retting of *jak* (bundle of jute) in water. Hence, they avoided such practices in order to upgrade the fibre quality and get additional remuneration (Rs. 300/q more).

Style of product clearance: Majority of the respondents (53%) sold their whole produce at one stretch. They had lesser acreage of jute as well as quantity of sale. While 47 per cent respondents sold their fibre judiciously in part-wise to earn more profit. They bore the risk of fluctuation of market price of fibre.

The overall marketing behaviour of the respondents has been presented in Figure 1. Mean marketing behavioural score of the respondents was 15.80 (±S.D. 2.39). It was found that majority of the respondents (*i.e.* 65%) had medium level of marketing behaviour (score 13.42 -18.18) followed by low level of marketing behaviour (score <13.41). More than one sixth of respondents (16%) had high level of marketing behaviour (score >18.19). This finding was in conformity with the findings of Maratha and Badodiya (2017), Rahinipriya and Rani (2018), Marbaniang *et al.* (2020) and Sravani *et al.* (2022) who studied marketing behaviour of vegetable growers, organic farmers, tomato growers and turmeric growers respectively.

Relationship between attributes of jute growers and their marketing behaviour: To study the

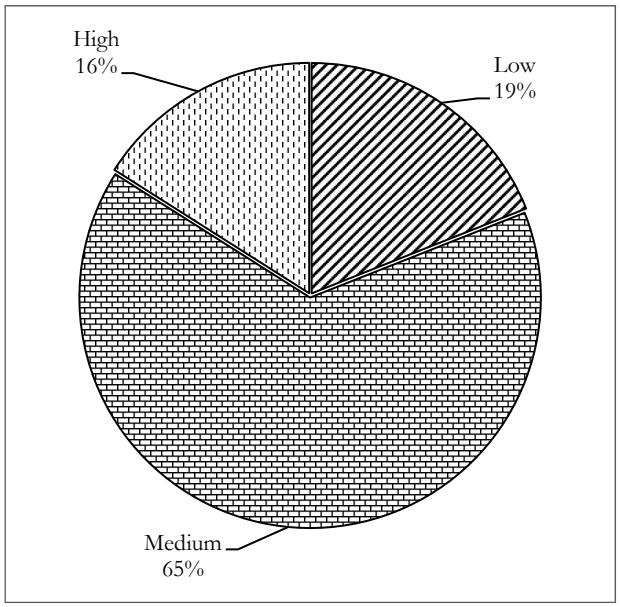

Figure 1: Distribution of respondents according to their marketing behaviour (n=100)

association of different attributes of jute growers with their marketing behaviour, the values of zero order correlation coefficient were calculated. The Table 2 depicted the relationship of the independent variables viz. education, annual income, sources of information utilization and innovativeness on the marketing behaviour (dependent variable) of the respondents. The respondents with higher level of education utilized newer technologies and adhered to production standards. Respondents with higher annual income enabled them to afford necessary farm inputs and produced the required quality for the market. More sources of information utilization helped the respondents validating the latest market related information like- announcement of minimum support price, forecast of jute acreage and production. It enabled the jute growers to update information on prices and other market factors to negotiate with traders. Innovativeness of the respondents showed their quickness of accepting the innovations, new ideas/ practices in relation to others. It might have helped them accepting improved method of retting of jute through CRIJAF SONA to comply the latest grading (five instead of earlier eight) criteria adopted by Bureau of Indian Standard (BIS). Similar type of findings has been reported by Katole *et al.* (2018), Anusha and Padma (2022) and Nagar *et al.* (2022) among the turmeric growers, vegetable growers and pea growers, respectively.

Table 2: Correlation coefficient of marketing behaviour of jute growers with their selected traits (n=100)

Traits	Correlation coefficient 'r' value
Age	-0.145
Education	0.542*
Farming experience	-0.133
Acreage of jute	0.152
Family size	-0.128
Annual Income	0.335*
Sources of information utilization	0.649*
Innovativeness	0.682*

**Significant at p=0.05

Multiple regression analysis of predictor variables with marketing behaviour of jute growers: The multiple regression analysis was undertaken to determine the extent of contribution of selected jute growers attributes on their marketing behaviour. In multiple regression study, the values of partial regression coefficients were calculated by taking marketing behaviour as dependent variable and age, education, farming experience, land holding, annual income, sources of information utilization and innovativeness about jute production as independent variables.

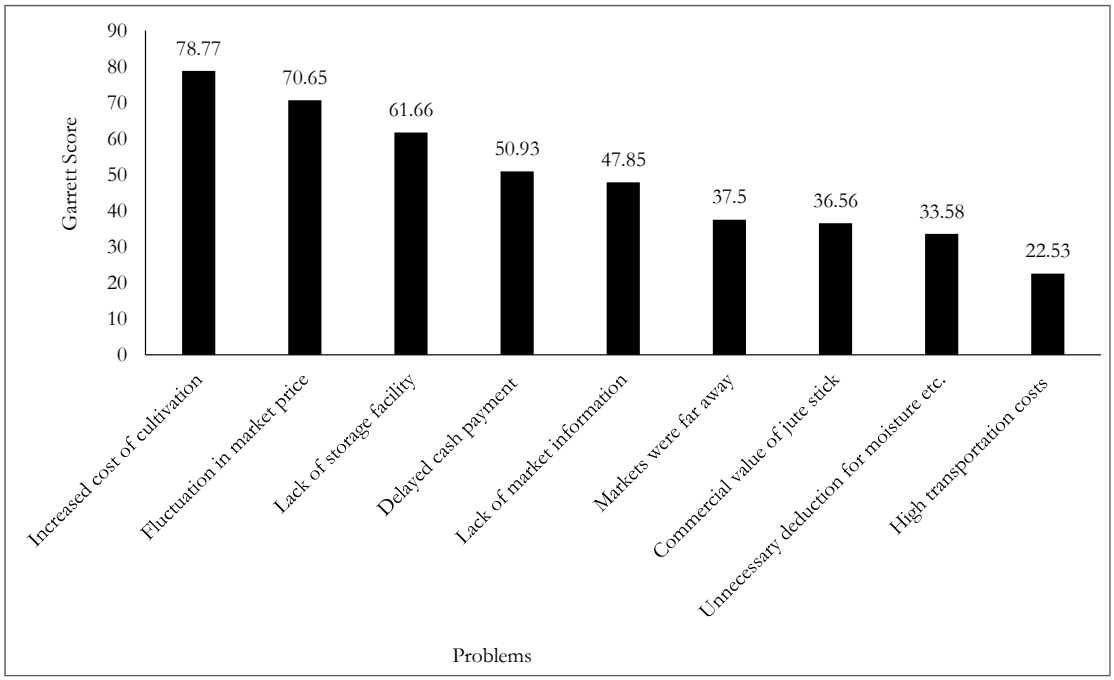

Figure 2: Constraints faced by the jute growers (n=100)

Regression analysis pertaining to marketing behaviour of the jute growers with their selected traits (Table 3) revealed that 70 per cent of variation in marketing behaviour of the jute growers was explained by all the three traits of the respondents included in the study.

Multiple R^2 value of 0.700 with highly significant 'F' value (26.601) revealed the significance of regression equation in the prediction of marketing behaviour of the jute growers. Out of seven traits, three traits viz., education, sources of information utilization and innovativeness had positive and significant relationship with marketing behaviour of the jute growers. This finding is in corroboration with the findings of Haque *et al.* (2022), where farmers of Alipurdwar district of West Bengal with higher education level were reported to have greater access to sources of information.

Table 3: Multiple regression analysis of predictor variables with their marketing behaviour (n=100)

Traits	b value	t value
Age	0.061	1.023 NS
Education	0.504	3.675**
Farming experience	-0.085	-1.446 NS
Acreage of jute	-0.884	-1.211 NS
Agricultural income	1.506	1.910 NS
Family size	-0.067	-0.751 NS
Sources of information utilization	0.717	4.799**
Innovativeness	0.738	6.504**

Multiple R^2 (Coefficient of determination) = 0.700**
**Significant a p=0.1,*Significant at p=0.05. NS= Non significant

Constraints in marketing of jute perceived by the jute growers: A constraint limits the activity of marketing due to time or cost factor. The contents presented in Figure 2 revealed (based on Garrett Score) that major constraint of the respondents were increased cost of cultivation (Rank I). It was followed by fluctuation in market price (Rank II), lack of storage facility (Rank III), delayed cash payment (Rank IV), lack of market information (Rank V), markets were far away (Rank VI), commercial value of jute stick (Rank VII), unnecessary deduction for moisture etc.(Rank VIII) and high transportation cost (Rank IX). The facts are in line with the observations made by Sarkar *et al.* (2018) and Nayak *et al.* (2021) amongst the jute growers of West Bengal and Bihar, respectively. Similar results has been reported by Roy *et al.* (2022) and Khalko *et al.* (2023) among mango grower and maize growers of West Bengal, respectively.

Market-related suggestive measures as perceived by jute growers have been presented in Figure 3 (based upon the Garrett Score). Assured procurement of the jute fibre at the minimum support price was ranked first followed by policy measures to reduce the middlemen intervention in the market (Rank II). Enhancing the purchasing capacity of DPCs of JCI

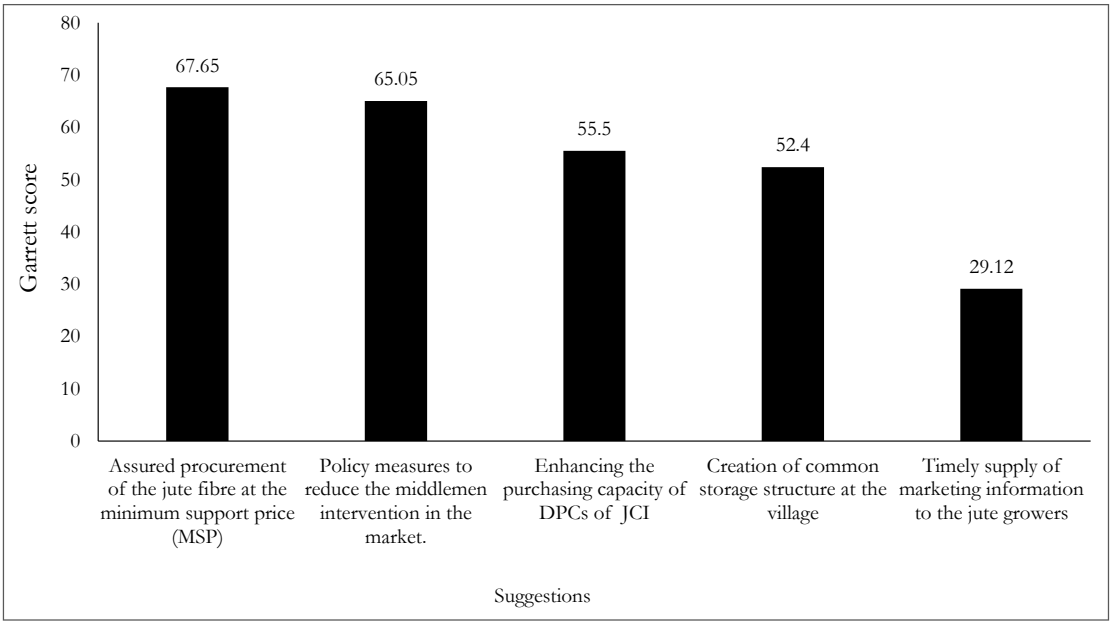

Figure 3: Suggestions offered by the jute growers (n=100)

and creation of common storage structure at the village were ranked third and fourth, respectively. Fifth ranked was given to timely supply of marketing information to the jute growers.

CONCLUSION

The study revealed that marketing behaviour of the jute growers were mostly influenced by their education, sources of information utilization and innovativeness about jute production. Their suggestions to deal with constraints were assured procurement of the jute fibre, reduction in the intervention of middleman in the market, enhancing the purchasing capacity of DPCs of JCI. It needed two different approaches, first *i.e.* adoption of agro-technologies for reducing the cost of cultivation at the jute grower level and the second one infrastructural support by the institutional as well as non-institutional agencies involved in marketing of jute fibre at local level to improve the situation in favour of the jute growing communities.

REFERENCES

Anonymous. 2015. Directorate of Agriculture, Govt. of West Bengal, Kolkata, West Bengal

Anusha, V.V.S.S. and S.R. Padma. 2022. Relationship Analysis Between Marketing Behaviour and Profile of Vegetable Growers of Ranga Reddy District. *Journal of Research ANGRAU*, 50(4): 124-134.

Barman, D. and M. Anoop. 2023. Assessment of Efficiency of Marketing Channels and Constraints in Marketing of Jute in Cooch Behar District, West Bengal. *Economic Affairs*, 68(1): 417-421.

Garrett, H.E. and R.S Woodworth. 1969. Statistics in Psychology and Education. Vakils, Feffer and Simons Pvt. Ltd., Bombay.

Haque, M.; S.K. Acharya and B. Sarkar. 2022. Farmers' Perception towards Transformation of Rice-based Cropping System into Tea Garden. *Indian Journal of Extension Education*, 58(1): 12-16.

Kalita, B.J. and A. Bhuyan. 2018. An Analysis of the Marketing Practices of Jute Farmers in Assam. *International Journal of Management Studies,* 2(7): 53-61.

Katole, R.T.; G.B. More; P. Todasam and A.S. Darange. 2018. Marketing Behaviour of Turmeric Growers in Akola District of Maharashtra State. *International Journal of Chemical Studies,* 6(5): 9-12.

Marbaniang, E.K.; D. Pasweth and J.K. Chauhan. 2020. Marketing Behaviour of Tomato Growers in West Khasi Hills District of Meghalaya. *Indian Research Journal of Extension Education,* 20(2&3): 22-26.

Maratha, P. and S.K. Badodiya. 2017. Study on Marketing Behaviour and Other Attributes of Vegetable Growers at Kota Block of Kota District in Rajasthan. *ndian Journal of Pure & Applied Biosciences,* 5(1): 329-337.

Mondal, D. and A.K. Bandyopadhay. 2014. Adoption of Jute Production Technology in West Bengal. *Economic Affairs,* 59(special): 701-709.

Nagar, A.K.; S. Namdeo; M.K. Dubey and S. Naberia. 2022. Factors Affecting Marketing Behaviour of Pea Farmers in Jabalpur District of Madhya Pradesh. *Asian Journal of Agricultural Extension, Economics &Sociology*, 40(9): 196-201.

Nayak, S.; M.K. Wadhwani; S. Kumari and S. Susovita. 2021. Marketing Behaviour of Jute Farmers in Katihar District of Bihar. *Biological Forum - An International Journal*, 13(3a): 270-274.

Khalkho, R.; S. Mondal; M. Haque and S.K. Acharya. 2023. Factors Driving Jute to Maize Shift in Uttar Dinajpur, West Bengal. *Indian Journal of Extension Education*, 59(4): 125-129.

Rahinipriya, R. and R.J. Rani. 2018. Marketing Behavior of Organic Farmers in Karur District of Tamil Nadu. *Journal of Extension Education,* 30(4): 6186-6189.

Roy, R.; S. Das; V. Sarkar; B. Das; A. Mondal; B.C. Rudra; P. Bhowmik and D. Majumder. 2022. Marketing of Mango: Perceived Constraints During Normality and due to Lockdown in West Bengal. *Indian Journal of Extension Education*, 58(1): 176-179.

Sarkar, S.; A. Maity; T. Mondal; S. Jose; R.C. Sangma; A.M. Khan; S. Kumar and S.K. Jha. 2018. Participatory Agro-ecological and Socio-economic Analysis of Jute Cultivation in West Bengal. *Journal of Community Mobilization and Sustainable Development*, 11(1): 43-51.

Shamna, A., S.K. Jha; A.K. Chakraborty and S. Kumar. 2017. Jute Production: The Need for Linkage among Research, Farmers and Industries in West Bengal, India. *Current Journal of Applied Science and Technology,* 25(3): 1-6.

Sravani, S.; S.V. Prasad; P.L.R.J. Praveena and G. Karuna Sagar. 2022. Marketing Behaviour of Turmeric Farmers in Kadapa District of Andhra Pradesh. *Indian Research Journal of Extension Education,* 22(3): 198-202.

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Research Article

Food Safety Practices: A Survey of Rural and Urban Households of Punjab

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ABSTRACT

Food safety and hygiene have a substantial impact on illnesses caused by food contamination. In the food cycle, food contamination can happen at any stage. Lack of knowledge regarding safe food purchasing, preparing and storing practices can lead to various food borne diseases. Keeping this in mind, the current study was designed to evaluate practices towards food safety among rural and urban households of Ludhiana district of Punjab state. Data were collected with self-structured interview schedule from hundred rural and hundred urban households. Results revealed that urban households scored better in all the four major food safety practices as compared to rural households. Further, it was found that majority of the overall households were not checking nutritional value, standard marks and storage instructions on labels of packed food items. It can be concluded that here is need to educate and create awareness among people regarding various food safety practices. Therefore, improving food safety measures will aid in reducing the burden of food related illnesses, eradicating poverty and advancing the Sustainable Development Goals.

Keywords: Food safety, Food hygiene, Food borne diseases, Practices and Households

INTRODUCTION

India has a rich and immense variety of food, which has a significant connection to religion, social identity and other cultural aspects (Vij and Mann, 2022). Having access to adequate, nutritious and secure food is essential for sustaining life and supporting good health in India. Unsafe food can cause more than 200 distinct illnesses varying from diarrhea to cancer (Raphael *et al.,* 2018). The symptoms of a food borne illness can range from mild gastrointestinal issues like nausea, vomiting, diarrhea and abdominal cramps to more serious illnesses including paralysis and meningitis. According to Food and Agriculture Organization, having access to healthy and safe food is one among the basic rights of an individual. However, this right to get healthy food is frequently violated (Chellaiyan *et al.,* 2018). Food safety involves the actions that are needed to guarantee that food is safe to eat and devoid of hazardous pollutants such as bacteria, viruses and chemicals. According to a WHO report, there are more than 150 million people in South East Asia become ill from food-borne diseases. Children under the age of five make up almost one-third of these figures (WHO, 2022).

Currently it is an important issue in both rural and urban households. In rural households, food safety can be a challenge due to the lack of access to clean water, proper sanitation facilities and inadequate refrigeration. In many cases, food is prepared and consumed in the same location, making it difficult to maintain a hygienic environment. Additionally, food may be sourced from local markets or even from home-grown crops that may be subject to contamination from pesticides, animal waste or other environmental factors. In urban households, the challenges to food safety are different but no less significant. With more people living in close

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proximity, there is a higher risk of contamination from food handlers or improper storage and handling practices. Urban households may also rely more heavily on processed or packaged foods, which can be more susceptible to contamination during production, transportation and storage. Less knowledge regarding various food quality related standardization marks on food items are also have impact on health of consumers because non-standardized and fake products are sold at low price (Karki *et al.,* 2009).

So, Food safety is important for several reasons. Firstly, it protects public health by preventing the spread of foodborne illnesses. Secondly, it assures that consumers have access to healthy food, which is necessary for preserving good health. Thirdly, it helps to build consumer trust in the food supply chain, which is important for the food industry to maintain its reputation and profitability. Since December 2019, COVID-19 significantly altered the daily lifestyle habits as global threat through many stages (Singh and Wadhawan, 2023). Though Covid-19 situation has led to a rise in awareness of food safety among households still poor personal cleanliness, improper storage methods, and ignorance of food safety procedures are causes of concern food handlers in rural communities. So, Food safety is the growing health concern of 21st Century (Narendran, 2019). Hence, the present study is being conducted to assess the practices towards food safety among rural and urban households of Ludhiana district of Punjab state.

MATERIALS AND METHODS

A cross sectional study was carried out in the Ludhiana district of Punjab. Descriptive research design was used in this. The study was carried out from October 2022 to February 2023. Simple random sampling method was followed for the selection of samples. Data were collected with self-structured interview schedule from hundred rural and hundred urban households. Total of 200 respondents were selected in the present study. The interview schedule was pre tested for clarity and validity on 20 randomly selected samples. The respondents were interviewed by using interview schedule in local language regarding their food purchasing practices, food preparation practices, food storage practices and food hygiene practices. The mean score was calculated on a scale ranging from 1 to 3 wherein the score range indicated that:- Always, sometimes and never. Based on the practice followed by respondents, they were categorized on the basis of the scores obtained. The maximum and minimum scores were obtained. The respondents were divided into three categories High practice, Medium practice and Low practice based on the class interval length obtained by the difference of the maximum and minimum scores. Statistical Package for Social Sciences (SPSS) was used to analyze the data. Simple statistical analysis such as Arithmetic mean, Range and Z test was used in the study.

RESULTS AND DISCUSSION

Food safety has continued to be a concern both in developing and developed world, thus the present study was conducted to find out the food safety practices in 4 categories i.e. food purchasing practices, food preparation practices, food storage practices and food hygienic practices.

Table 1 highlighted the food purchasing practices of the respondents by asking questions on buying practices of cereals, food items and observation of nutritional values and Standardization Marks. According to the data presented in the Table 1, the overall mean score revealed that respondents follow medium level of food purchasing practices (x= 1.86). A huge difference was seen in buying practices of perishable items on daily basis by rural (x= 1.76) and urban (x= 2.80) respondents. A significant difference had been found among rural and urban households in buying packaged milk (z= 2.43, $p \leq 0.05$) where very few (x= 1.02) rural respondents were buying packaged milk as compared to the urban respondents (x= 2.65). From this study, it was also seen that only (x= 1.58) of the rural respondents were checking the expiry date on packaged food items as compared to urban respondents (x= 2.38). This result showed that there was significant difference seen among rural and urban respondents in checking expiry date (z= 1.82, $p \leq 0.05$). Here, in Table 2 suggested about the differences of food preparation practices of rural and urban respondents which revealed that overall households (x= 2.41) were following high level of safety practices during food preparation. Statistically there are no significant differences between rural and urban respondents. Almost all the households of rural and

Table 1: Distribution of the households according to their food purchasing practices (n=200)

Food purchasing practices	Mean score			z value
	Rural (n=100)	Urban (n=100)	Overall Mean Score	
Checking expiry date on packaged food items	1.58	2.38	1.98	1.82*
Checking standard marks on packaged food items	1.25	1.95	1.60	1.04^{NS}
Buying packaged pulses/ cereals	2.21	2.27	2.24	0.08^{NS}
Buying packaged milk	1.02	2.65	1.83	2.43*
Buying perishable food items on daily basis	1.76	2.80	2.28	1.55^{NS}
Checking nutritional value of packaged food items	1.00	1.52	1.26	0.77^{NS}
Overall mean score	1.47	2.26	1.86	

NS - Non Significant; * Significant at 5% level

Table 2: Distribution of the households according to their food preparation practices (n=200)

Food purchasing practices	Mean score			z value
	Rural (n=100)	Urban (n=100)	Overall Mean Score	
Washing vegetables before chopping	2.18	2.36	2.27	0.26^{NS}
Washing cereals/pulses before cooking	3.00	3.00	3.00	0.00^{NS}
Washing fruits before consuming	2.19	2.86	2.52	1.01^{NS}
Boiling milk before using	1.98	2.65	2.31	0.99^{NS}
Consuming the cooked food within 3 hours of preparation	2.58	2.21	2.39	0.55^{NS}
Avoiding use of food colors in food preparation	2.74	2.21	2.47	0.79^{NS}
Reusing leftover food	1.80	2.15	1.97	0.52^{NS}
Overall mean score	2.35	2.49	2.41	

NS - Non Significant; * Significant at 5% level

urban area (x= 3.00) were washing cereals/pulses before cooking. Urban households (x= 2.15) reuse their left over foods more than rural households (x= 1.80) and rural households consume the food immediately after cooking. From the table it was found out that most of the rural respondents (x= 2.74) were avoiding food colors in food preparation compared to urban respondents (x= 2.21).

Table 3 depicted that rural households (x= 1.58) were following low level of food storage practices than urban households (x= 2.03) whereas the overall mean score of households of both rural and urban area (x= 1.80) were showing medium level of storage practices. There was significant difference (z= 1.86, pd"0.05) seen in storing cooked and raw food separately in the refrigerator. The result also showed that respondents in both the rural and urban areas (x= 1.10) were not checking storage instructions on labels of packed food item which is one of the reason of low food safety practices. According to the data presented in Table 4, it can be concluded that urban respondents (x= 2.55) were more involved in following hygienic practices than rural respondents (x= 1.43). The overall mean score indicated that respondents follow medium level of hygienic practices. From the table-4 data it could be seen that the overall respondents (x= 1.98) were following medium level of food hygiene practices. Majority of the respondents (x= 2.80) wash hands before preparation of food. Less number of respondents (x= 1.57) of both the urban and rural respondents wash kitchen towel and napkins daily which can be the source of transmitting food borne diseases. There was significant difference seen in Cleaning knives and utensils before and after use (z= 2.29, $p \leq 0.05$) and Cleaning kitchen surfaces daily (z= 2.11, $p \leq 0.05$). There were also significant difference

Table 3: Distribution of the households according to their food storage practices (n=200)

Food purchasing practices	Mean score			z value
	Rural (n=100)	Urban (n=100)	Overall Mean Score	
Storing cereals with dry Neem leaves	2.13	1.98	2.05	0.22^{NS}
Storing pulses in air tight containers	1.63	2.35	1.99	1.07^{NS}
Storing cooked and raw food separately in the refrigerator	1.39	2.64	2.01	1.86*
Storing cooked food in steel /glass container in refrigerator	1.58	1.97	1.77	0.58^{NS}
Checking storage instructions on labels of packed food items	1.00	1.21	1.10	0.31^{NS}
Storing cooked food in refrigerator after cooling	1.35	2.16	1.75	1.20^{NS}
Storing water in a clay pot or steel container	2.01	1.92	1.96	0.13^{NS}
Overall mean score	1.58	2.03	1.80	

NS - Non Significant; * Significant at 5% level

Table 4: Distribution of the households according to their food hygienic practices (n=200)

Food hygienic practices	Mean score			z value
	Rural (n=100)	Urban (n=100)	Overall Mean Score	
Washing hands before food preparation	2.65	2.95	2.80	0.44^{NS}
Cleaning knives and utensils before and after use	1.11	2.65	1.88	2.29*
Cleaning kitchen surfaces daily	1.45	2.87	2.16	2.11*
Washing kitchen towels and napkins daily	1.24	1.91	1.57	1.03^{NS}
Keeping kitchen dustbin covered	1.05	2.36	1.70	1.95*
Removing kitchen wastes daily	1.09	2.56	1.82	2.19*
Overall mean score	1.43	2.55	1.98	

NS - Non Significant; * Significant at 5% level

seen in Keeping kitchen bin covered ($z= 1.95$, $p\leq0.05$) and Removing kitchen wastes daily ($z= 2.19$, $p\leq0.05$).

It was observed from the data that urban respondents follow better purchasing practices than rural respondents. It might be due to respondents of urban area were more literate and had more knowledge regarding food safety than rural area. The data revealed substantial difference in daily purchase of perishable food items, the distinction might be due to availability of resources, convenience and lifestyle differences between rural and urban areas. Another noteworthy disparity was purchase of packaged milk where rural respondents had showed less desire to buy packaged milk compared to urban respondents. The reason might be the easy availability of dairy farms in rural area. From the result, it could be seen that the rural respondents lag behind the urban respondents in checking expiry dates on packaged food items which depicted that urban respondents were more attentive and had more awareness regarding food safety and product quality. Similar, result had been found out in a study conducted by Maiti and Saha (2022) where they got that 64 percent of the urban respondents and 30 percent of the rural respondents checked the expiry date while buying food products. Bisht *et al.* (2023) observed in her study that more than half (57.50%) of the respondents in Ludhiana city "sometimes" checked the product information before purchasing any product and majority (81.66%) of the respondents buy grocery/food products from their local market. According to a study conducted by Ali and Kapoor (2010) they observed that consumers preferred freshness and cleanliness above all other factors followed by price, quality, variety, packaging, convenience and non seasonal availability. According to Jethi *et al.* (2020) the issue of malnutrition was

increasing among people due to lack of awareness about the right kind of diet required for the proper growth and they suggested that the problem can be tackled by including a variety of fruits and vegetables in daily food basket.

Regarding food preparation, it was depicted from the data that both the rural and urban respondents were exhibiting high level of food safety practices. One similarity had been seen among both the urban and rural households practice of washing cereals and pulses before cooking which showed the importance and awareness of cleanliness and hygiene during food preparation. Among urban respondents, it was seen that they were more inclined to use leftover foods than rural respondents. This might be due to shortage of time, comfortable lifestyle and more use of refrigerators for food storage in urban households. The data indicated that rural households consume foods before washing, the reason might be rural respondents had less knowledge regarding food borne illnesses and food safety practices. The study supported by Pradhan *et al.* (2020) where they found out that majority (73.33%) of the rural homemakers and seventy five percent of the urban homemakers had average knowledge in food safety. Similar result was found in Chellaiyan *et al.* (2018) study where they revealed that only 25 respondent practices adequate food handling practices out of 200 and only 37 percent of the respondents wash hands before and after handling raw food.

The data regarding food storage practices, it was seen that rural respondents were following low level of food storage practices compared to urban respondents. However, the overall households were following medium level of food storage practices. It might be due to less awareness of food storage practices among respondents. From the data, it could be seen that the urban households were using refrigerators for the storage of both cooked and raw foods where as rural households were using traditional methods for storage. The statistically significant difference suggested that urban respondents had better understanding of food safety practices which was reflected in their storage habits. The difference might be due to the factors such as education, awareness and access to refrigeration. In a study carried out by Fasoro *et al.* (2016) in Southwest Nigeria, respondents had followed good food safety practices and only (35.2%) of the respondents were using Refrigeration for food storage followed by sun drying and smoking. A study carried out by Sudershan *et al.* (2008) in Hyderabad reported that over Sixty percent of the respondents store their leftover cooked foods at room temperature. Improving food storage practices, especially in rural areas will lead to reduces food wastage and better food safety.

The data depicted about the revealing variations between urban and rural areas. The results showed that urban respondents were likely to be more involved in following hygienic practices than rural respondents. The overall mean score indicated that respondents were following medium level of food hygiene practices. The respondents of rural area were following low level of hygienic practices due to lack of knowledge regarding food borne diseases and unavailability of utensils for food preparation. Majority of the respondents were washing hands before food preparation, which was a crucial practice for preventing the spread of food borne illnesses. However, a significant number of overall respondents didn't wash kitchen towels daily which could serve as a potential source of food borne disease transmitter. There were significant difference seen in results in cleaning knives and utensils before and after use, cleaning kitchen surfaces daily, keeping the kitchen dustbin covered and removing kitchen waste daily. The difference suggested that there is variation in awareness among the respondents that washing before and after cooking will prevent most of the food borne illnesses. Similar result was found in a study carried out by Sudershan *et al.* (2018) in Hyderabad that all respondents (100%) wash hands before cooking, almost all (98%) wash hands after cooking and about 90 per cent of them wash hands both before and after cooking. A study conducted in a community in the Udupi area by Reshma *et al.* (2016) discovered that 75 per cent of the participants engaged in unsafe hygiene practices. In contrast to the result of this study, Mendagudali *et al.* (2016) got that majority (79%) the respondents had good food safety practices in urban area of Kalaburagi, Karnataka.

CONCLUSION

The analysis of the data revealed that rural respondents follow less food safety practices than urban respondents

which may be due to lack of awareness among people of rural areas regarding food safety practices. Further, it was noticed that majority of the households both rural and urban were not checking nutritional value of packaged food items, standard marks on packaged food items and storage instructions on labels of packed food items. It can be concluded that there is a need to educate and create awareness among people regarding various food safety practices and more emphasis should be given to rural respondents for creating awareness about the WHO's five fundamental principles of food hygiene which suggest to use safe water, keep one's environment clean, separate one's raw and cooked food, cook food completely and keep food at a safe temperature. The challenge of food security and safety remains essential to the health of the global population. Therefore, improving food safety measures will aid in reducing the burden of food borne illnesses, eradicating poverty and attending the Sustainable Development Goals.

REFERENCES

Ali, J.; S. Kapoor and J. Moorthy. 2010. Buying behaviour of consumers for food products in an emerging economy. *British Food Journal*, 112(2): 109-124.

Bisht, D.; D. Martolia and S.K. Bal. 2023. Buying Practices Followed by Homemakers of Ludhiana City. *Journal of Community Mobilization and Sustainable Development,* 18(2): 565-572.

Chellaiyan, V.G.; Jasmine; L. Fasna; Loganathan and S.V. Mallika. 2018. Food safety awareness and food handling practices among rural population of Tamil Nadu. *International Journal of Community Medicine and Public Health*, 5(4): 1441-1447.

Fosoro, A.A.; C.O. Faeji; O.I. Oni and T. Oluwadare. 2016. Assessment of Food Safety Practices in a Rural Community in Southwest Nigeria. *Food and Public Health*, 6(3): 59-64.

Jethi, R.; P. Joshi; A. Jalal; P. Nautiyal; N. Chandra and M. Arya. 2020. Nutri-gardens: Key to Address Nutritional Needs of Hill Community. *Journal of Community Mobilization and Sustainable Development*, 15(1): 259-267.

Karki, I.; N. Mahrotra and M.L. Bansal. 2009. Level of consumers' awareness regarding ISI, FPO & Agmark standards. *Indian Journal of Extension Education*, 45(4): 128-130.

Maiti, M. and T. Saha. 2022. Consumers' Awareness and Opinion Towards Food Adulteration in Selected Areas of West Bengal. *Indian Journal of Extension Education*, 58(3): 104-107.

Mendagudali, R.R.; K.D. Akka; I.A. Swati; D.T. Shedole and N.A.D. Bendigeri. 2016. Knowledge, attitude, and practices of food safety among women of Khaza bazar, the urban field practice area of KBN Institute of Medical Sciences. *International Journal of Medical Science & Public Health*, 5(3): 516-520.

Narendran, M.; P. Kulkarni; M. Renuka and M.M.R. Narayana. 2018. Does Food Safety Practices at Home Influence Food Borne Illnesses? – A Study in Urban Slum Households, Mysuru. *National Journal of Community Medicine*, 9(2): 120-124.

Pradhan, T.; T. Kumari; R. Das and C. Lenka. 2020. Knowledge and Hygiene practices of home makers on Food safety; A Comparative study in Rourkela, Odisha. *International Journal of Applied Home Science*, 7(1&2): 12-18.

Raphael, B.; N. Catherin; C.J. Navya and C.R. Saju. 2018. Domestic Food Hygiene Practices in a Rural Area of Thrissur District, Kerala, India. *International Journal of Current Research and Academic Review*, 6(4): 59-64.

Reshma; M.S. Paiand Manjula. 2016. A Descriptive Study to Assess the Knowledge and Practice Regarding Water, Sanitation and Hygiene among Women in Selected Villages of Udupi District. *Journal of Health and Allied Sciences*, 6(1): 21-27.

Singh, J. and N. Wadhawan. 2023. Effect of COVID-19 on Lifestyle Behaviour of Indian Adolescent Girls. *Journal of Community Mobilization and Sustainable Development,* 18(2): 383-391.

Sudershan, R.V.; G.M.S. Rao; P. Rao; M.V.V. Rao and K. Polasa. 2018. Food safety related perceptions and practices of mothers –A case study in Hyderabad, India. *Food Control*, 19(5): 506–513.

Sudershan, R.V.; N.R. Kumar; L. Kashinath; V. Bhaskar and K. Polasa. 2014. Foodborne Infections and Intoxications in Hyderabad India. *Epidemiology Research International*, 163: 1-5.

Vij, A. and K.S. Mann. 2022. Food consumption pattern of farming families in Punjab. *Indian Journal of Extension Education*, 58(2): 21-25.

WHO. 2022. Food safety. Available at: https://www.who.int/news-room/fact-sheets/detail/food-safety. Accessed on 3 march 2023.

WHO. World Health Day 2015: Food safety. Available at: http://www.who.int/campaigns/worldhealth-day/2015/en/. Accessed on 15 march 2023.

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Research Article

Effect of Wheat Establishment and Rice Residue Management Methods along with Vagaries of Weather on Wheat in District Ferozepur of Punjab

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ABSTRACT

Punjab Agricultural University Farm Advisory Service Centre Ferozepur conducted a study on effect of different methods of management of rice residue on grain yield and income of wheat crop. The data were collected from selected farmers on wheat cultivation practices, grain yield, lodging, frost injury and economics under different methods of rice residue management. Farmers applied higher dose of urea per hectare than the recommended dose of 225 kg ha^{-1} in different rice residue management and wheat establishment methods. Slightly higher dose of DAP was applied than the recommended dose of 137.5 kg ha^{-1} in conventional and zero tillage methods. Farmers foliarly sprayed their wheat crop with 0.5% manganese sulphate, once or twice. They unnecessarily applied bentonite sulphur to their wheat crop. They applied two or more herbicides in combination. However, they did not use herbicides in surface seeding method. Maximum lodging (91%) was recorded in conventional method of wheat sowing. Frost injury was observed only in surface seeding and happy seeder methods. Higher grain yield (53.1 q ha^{-1}), net return (87410 Rs ha^{-1}), and B: C ratio (4.4) was recorded under surface seeding method.

Keywords: Wheat, Yield, Rice, Residues, Management, Farmers, Fields

INTRODUCTION

Rice-wheat cropping system is the major cropping system in Punjab and widely adopted by farmers due to assured market of rice and wheat (Singh *et al.,* 2020; Singh and Benbi, 2020). Farmers grow rice from June to October. Cultivation of long duration varieties of rice results in late harvesting in October and produce sizeable quantity of straw which is very difficult to manage. Due to this, sowing of wheat is delayed and yield decreases. This leftover rice residue interferes with field operation for sowing of wheat. Due to lack of viable and economical way to manage rice residue, farmers burn it in field which is simple and low cost (Kaur *et al.*, 2022; Shyamsundar *et al.,* 2019; Dhanda *et al.,* 2022). With the introduction of new technology farmers are using different methods viz. Happy seeder, Super Seeder, Mulcher/Chopper, Plough, Rotavator etc. to manage left-over rice residue and sowing of wheat. A study was conducted to evaluate the effect of different methods of rice residue management and wheat sowing on grain yield and ecnomics.

MATERIALS AND METHODS

Punjab Agricultural University (PAU) Farm Advisory Service Centre (FASC), Ferozepur conducted a study on comparison of wheat performance under different rice residue management methods in Ferozepur district of Punjab state during *rabi* 2022-23. 60 Farmers were selected randomly from different villages in six blocks of Ferozepur district for the study. For the purpose of data collection a semi-structured interview schedule was developed. The data were collected through face to face interviews using interview schedule developed

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for study. The data were collected on different methods of rice residue management, seed rate, sowing date, fertilizer application, herbicide application, wheat grain yield, lodging, frost injury and economics. The data on potential yield, extension gap, technology gap and technology index were calculated (Katare *et al.,* 2011; Samui *et al.,* 2000). The data were subjected to analysis of variance (ANOVA) using SPSS (SPSS Inc., Chicago, USA). Least Significant Difference (LSD) post hoc test at 95% confidence interval separated mean differences. Difference between treatment means considered statistically significant at $p<0.05$. Agronomic practices i.e. seed rate, sowing date, fertilizer application, herbicide application recommended by Punjab Agricultural University (PAU), Ludhiana given in Table 1. Sowing of wheat with happy seeder has been done on area of about 750 acres in district Ferozepur during *rabi* 2022-23 (as per data given by department of Agriculture and Farmer Welfare, Ferozepur). About 15 per cent of area under happy seeder sown wheat was affected due to ground frost which occurred from 16 to 18 January 2023 (agrometeorological data, Table 2). Economics of wheat cultivation under different methods were calculated. The cost of cultivation and returns were calculated by taking into account the prevailing cost of inputs and prices of output. The cost of cultivation included expenses for crop production such as seed, seed treatment cost, fertilizers cost, plant protection cost, irrigation cost, human labour hours cost, harvesting cost, tractor hours cost. Interest on variable costs and marketing charges were not included. Gross return included the total value of grain yield. The gross returns, net returns and benefit cost ratio (B:C ratio) was calculated by using the formula (Kumar and Meena, 2021),

Table 1: Agronomic practices in wheat cultivation under different rice residue management methods recommended by PAU

Rice residue and wheat sowing methods	Average Seed rate (kg ha^{-1})	Date of sowing	Fertilizer					Herbicide spray DAS
			Urea (kg ha^{-1})	DAP (kg ha^{-1})	MOP (kg ha^{-1})	Mn (0.5% spray no.)	S (kg ha^{-1})	
Surface Seeding	112.5	1st fortnight November	225	162.5	Only on	4	Only on	-
Super Seeder	100	1st fortnight November	225	162.5	soil test	4	soil test basis	Within two days of sowing and 35 days after sowing
Happy Seeder	112.5	1st fortnight November	225	162.5	basis	4		-
Zero tillage	100	1st fortnight November	225	137.5		4		Within two days of sowing and 35 days after sowing
Conventional	100	1st fortnight November	225	137.5		4		Within two days of sowing and 35 days after sowing

Table 2: Agrometeorological data during the month of January 2023

Dates	Rain fall (mm)	Min Temp (°C)	Max Temp (°C)	Min RH (%)	Max RH (%)	Wind speed 3 m (kt)	Wind Gust 3 m (kt)	Sun Shine (HH.MM)	Soil Temp 70 cm (°C)
15-01-2023	0	12	18	33	99	1.2	2.5	8.3	15.6
16-01-2023	0	0.6	18.6	12	99	1.2	2.7	9	15.3
17-01-2023	0	0.6	19	20	99	1	2.6	8.2	15.1
18-01-2023	0	1.3	18.4	32	99	1.1	2.5	2.5	14.9
19-01-2023	0.5	5.1	20.5	24	99	1.2	2.6	6.1	14.9

Data Agrometeorological Unit, Krishi Vigyan Kendra, Ferozepur

B:C Ratio = Gross return (Rs ha^{-1}) / Total operational cost (Rs ha^{-1})

Gross returns (Rs) = Actual wheat grain yield (q) x market price (Rs q^{-1})

Net returns (Rs) = Gross returns Rs. per ha - total operational cost per ha

RESULTS

Farmers sowed wheat using different rice residue management methods at optimum sowing time but used more seed rate than the recommended (Coventry *et al.*, 2011a). Farmers applied 37.5, 36.1, 45.9, 46.4 and 50.0 per cent higher dose of urea per hectare (Table 3) than the recommended dose of 225 kg ha^{-1} (Table 1) (Coventry *et al.*, 2015). In comparison to the recommended dose of diammonium phosphate (DAP) 162.5 kg ha^{-1} for surface seeding, super seeder, and happy seeder methods, a slightly lower dose was applied by farmers, but a slightly higer dose was applied than the recommended dose 137.5 kg ha^{-1} for conventional and zero tillage methods (Coventry *et al.*, 2011b). Due to manganese (Mn) deficiencies in the majority of the district's soils, farmers gave 1-2 sprays of 0.5% solution of 30 per cent manganese sulphate to the wheat crop. Unnecessary application of Bentonite sulphur 90 per cent was done by the farmers in happy seeder, zero tillage and conventionally sown wheat crop. In wheat crop sown by super seeder, zero tillage, and conventional methods farmers applied two or more herbicides in combination at 30 to 60, 40 to 60, and 30 to 65 days after sowing. However, farmers did not use herbicides in surface seeding method (Table 3).

Maximum lodging (91%) was recorded in conventional method followed by super seeder method (86%) of wheat sowing. Wheat lodging was lower with surface seeding (41.2%), zero tillage (41.4%) and happy seeder methods (43.3%) as compared to super seeder (86.0%) and conventional (91.0%) methods (Table 4). Frost injury was observed only in surface seeding and happy seeder methods. The surface seeding method showed 12.1 per cent frost injury, whereas the happy seeder method showed 10 percent frost injury. Wheat grain yield ranges from 50.0 to 53.1 q ha^{-1} (mean=51.1 q ha^{-1}) under different rice residue management methods. The results revealed that wheat sown with surface seeding method at farmer's fields gave 3.1, 4.9, 6.2, and 5.9 per cent higher grain yield than super seeder, happy seeder, zero tillage and conventional methods, respectively (Table 4). Wheat sown with surface seeding method had low cost of cultivation but high net return and B: C ratio as compared to other methods. Surface seeding method recorded 5.4, 7.0, 8.7, 12.7 per cent higher net return (Rs ha^{-1}) as compared to super seeder, happy seeder, zero tillage, conventional methods (Table 5).

DISCUSSION

Farmers sown wheat by using a higher seed rate than recommended mainly in mulching method of rice residue management. In Punjab the optimum sowing time for wheat crop is the first week of November,

Table 3: Farmer's practices in wheat cultivation under different rice residue management methods at farmer's fields

Rice residue and wheat sowing methods	Average Seed rate (kg ha^{-1})	Date of sowing	Fertilizer					No of weeds per m^2	Mix herbicide spray DAS#
			Urea (kg ha^{-1})	DAP (kg ha^{-1})	MOP (kg ha^{-1})	Mn* (0.5% spray no.)	S** (kg ha^{-1})		
Surface Seeding	118.8	1st fortnight November	309.4	140.8	-		-	-	-
Super Seeder	105.8	1st fortnight November	306.3	143.3	-	1-2	-	1.2	30-60
Happy Seeder	115	1st fortnight November	328.3	143.8	-	1-2	7.5	-	-
Zero tillage	112.5	1st fortnight November	329.3	139.9	-	1-2	7.5	1	40-60
Conventional	106.3	1st fortnight November	337.5	143.8	-	1-2	7.5	1.4	30-65

* Manganese sulphate 30%, **Bentonite sulphur 90%, # DAS – Days after sowing

Table 4: Wheat lodging, frost injury and grain yield under different rice residue management methods at farmer's fields

Rice residue and wheat sowing methods	Lodging (%)	Frost injury (%)	Grain yield (q ha^{-1})
Surface Seeding (n=20.0)	41.2	12.1	53.1
Super Seeder (n=22.3)	86.0	-	51.5
Happy Seeder (n=21.4)	43.3	10	50.6
Zero tillage (n=15.7)	41.4	-	50.0
Conventional (n=20.6)	91.0	-	50.5
Mean (n=100)	60.6	11.05	51.1

Table 5: Economics analysis of different

Rice residue and wheat sowing methods	Grain yield (q ha^{-1})	Cost of cultivation (Rs ha^{-1})	Gross return (Rs ha^{-1})	Net return (Rs ha^{-1})	B:C ratio
Surface Seeding	53.1	25427.5	112837.5	87410	4.4
Super Seeder	51.5	26525.0	109437.5	82912.5	4.1
Happy Seeder	50.6	25862.5	107525.0	81662.5	4.2
Zero tillage	50.0	25862.5	106250.0	80387.5	4.1
Conventional	50.5	29775.0	107312.5	77537.5	3.6

with delays in sowing time thereafter causing grain yield reductions reported at 32.0 kg ha^{-1} day^{-1} (Coventry *et al.*, 2011a; Tripathi *et al.*, 2005). It is apparent from the study that farmers sown wheat crop at optimum time which was a main contributing factor to increase wheat grain yield above the average yield of 42.16 q ha^{-1} of Punjab. Nitrogen was mostly applied in the form of nitrogen fertilizer diammonium phosphate (DAP) and urea. Farmers used higher quantity of urea than recommended dose. However, quantity of DAP applied to surface seeding, super seeder and happy seeder methods of wheat sowing was lower than the recommended dose. Mn deficiency has been observed in Ferozepur district (Tribune, 2022). Foliar application of Mn to wheat crop through 1 to 2 sprays is a common practice. Farmers applied Bentonite sulphur to wheat crop though no deficiency of sulphur was observed. Crop lodging was 52.1 per cent and 54.7 per cent less in surface seeding method than super seeder method and conventional method in farmers' fields. This may be due to more fibrous roots developed on and near the soil surface that helped in stabilizing crop plant to prevent lodging (Anil and Singh, 2024). Maximum relative humidity close to 100% indicated that the dew point was equal to the air temperature (Table 2). Frost injury occurred in mulching methods of rice straw management i.e. surface seeding and happy seeder method. This may be due to the reason that layer of rice residue (mulch) on soil surface retard heat flux from soil surface and frost formed due to freezing of liquid water on upper surface of mulch which resulted in damage of plant tissue above the surface of mulch (Li *et al.*, 2008). Surface seeding method gave higher grain yield as compared to all other methods of rice straw management and wheat sowing (Coventry *et al.*, 2013). Less lodging enhanced water use efficiency and improved nutrients availability may be the reasons for higher wheat grain yield under surface seeding method. Higher grain yield (53.1 q ha^{-1}) and low cost of cultivation (25427.5 Rs ha^{-1}) rose the net return (87410 Rs ha^{-1}) and B:C ratio (4.4) under surface seeding method.

CONCLUSION

Farmers used higher quantity of inputs i.e. seed, fertilizer, herbicides etc. without scientific basis which increased cost of cultivation but not grain yield in all methods of wheat sowing and rice residue management. The survey shows that surface seeding method of wheat sowing has the potential to increase the wheat grain yield and income of the farmers by filling the technology gap and extension gap.

REFERENCES

Anil, K. and S. Gurbachan. 2024. Surface seeding-cum-mulching technique: An emerging option to manage crop residue. *Indian Farming,* 74(3): 13-16.

Coventry, D.R.; R.K. Gupta; A. Yadav; R.S. Poswal; R.S. Chhokar and R.K. Sharma. 2011a. Wheat quality and productivity as affected by varieties and sowing time in Haryana, India. *Field Crops Research*, 123: 214–225.

Coventry, D.R.; R.S. Poswal; A. Yadav; R.K. Gupta; B.S. Duggal and R.S. Chhokar. 2013. Enhancing farm profitability by growing wheat for chapatti quality markets in Haryana, India. *African Journal of Agricultural Research,* 8: 6265–6274.

Coventry, D.R.; R.S. Poswal; A. Yadav; R.K. Gupta; S.C. Gill; R.S. Chhokar; V. Kumar; R.K. Sharma; A. Kumar; A. Mehta; S.G.L. Kleemann and J.A. Cummins. 2011. Effect of tillage and nutrient management on wheat productivity and quality in Haryana, India. *Field Crops Research*, 123(3): 234-240. https://doi.org/10.1016/j.fcr.2011.05.016.

Coventry, D.R.; R.S. Poswal; Ashok Yadav; Amritbir Singh Riar; Yi Zhou; Anuj Kumar; Ramesh Chand; R.S. Chhokar; R.K. Sharma; V.K. Yadav; R.K. Gupta; Anil Mehta and J.A. Cummins. 2015. A comparison of farming practices and performance for wheat production in Haryana, India. *Agricultural Systems*, 137: 139-153. https://doi.org/10.1016/j.agsy.2015.04.003.

Dhanda, S.; A. Yadav; D.B. Yadav and B.S. Chauhan. 2022. Emerging Issues and Potential Opportunities in the Rice–Wheat Cropping System of North-Western India. *Frontiers in Plant Science*, 13:1-14. doi: 10.3389/fpls.2022.832683

Katare, S.; S.K. Pandey and M. Mustafa. 2011. Yield gap analysis of Rapeseed-mustard through front line demonstrations. *Agriculture Update*, 6(2): 5-7.

Kaur, M.; D.P. Malhi; G.S. Sardana; V. Bolan; N.S. Lal; R. Kadambot and H.M. Siddique. 2022. Rice residue management in the Indo-Gangetic Plains for climate and food security. A review. *Agronomy for Sustainable Development*, 42: 92.

Kumar, V and H.R. Meena. 2021. Satisfaction of dairy farmers from para-veterinary services: an exploratory study, *Indian Journal of Extension Education*, 57(3): 37–40.

Li, Q.; Y.H. Chen; M.Y. Liu; X.B. Zhou; S.L. Yu and B.D. Dong. 2008. Effects of irrigation and straw mulching on microclimate characteristics and water use efficiency of winter wheat in north China. *Plant Production Science,* 11: 161–170.

Samui, S.K., S. Maitra; D.K. Roy; A.K. Mandal and D. Saha. 2000. Evaluation of front line demonstration on groundnut. *Journal of Indian Society of Coastal Agricultural Research*, 18: 180-183.

Shyamsundar, P.; N.P. Springer; H. Tallis; S. Polasky; M.L. Jat; H.S. Sindhu; P.P. Krishnapriya; N. Skiba; W. Ginn; V. Ahuja; J. Cummins; I. Datta; H.H. Dholakia; J. Dixon; B. Gerard; R. Gupta; J. Hellmann; A. Jadhav and H.S. Jat. 2019. Fields on fire: alternatives to crop residue burning in India. *Agriculture and Environment*, 365(6453): 536–538. https://doi.org/10.1126/science.aaw4085

Singh, P. and D.K. Benbi. 2020. Nutrient management impact on net ecosystem carbon budget and energy flow nexus in intensively cultivated cropland ecosystem of north-western India. *Paddy and Water Environment*, 18(4): 697-715. https://doi.org/10.1007/s10333-020-00812-9

Singh, V.; G.S. Dhillon and P.S. Sidhu. 2020. Effect of various rice residue management practices on performance of wheat in southwestern region of Punjab. *Journal of Pharmacognosy and Phytochemistry*, 9(3): 958-962.

Tribune. 2022. Wheat in Malwa belt deficient in manganese. The Tribune, Punjab, December 12, 2022

Tripathi, S.C.; D. Mongia; R.K. Sharma; A.S. Kharub and R.S. Chhokar. 2005. Wheat productivity at different sowing dates in various agroclimatic zones of India. *SAARC Journal of Agriculture*, 3: 191–201.

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Research Article

L-Dopa in Faba Bean and other Indigenous Legumes of North East India as a Potential Bioactive Compound for Therapeutic Applications

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ABSTRACT

L-Dopa is a bioactive compound with significant therapeutic potential and is prominently found in Faba beans and other indigenous legumes of North East India. This review explores the multifaceted role of L-Dopa, particularly in the context of its application in treating Parkinson's disease. Faba beans (*Vicia faba)*, recognized for their high L-Dopa content, offer a sustainable source of this compound, which is crucial for dopamine synthesis and alleviating Parkinson's symptoms. The accumulation of L-Dopa in various parts of the faba bean plant, such as leaves and seeds, is influenced by environmental factors like drought and nitrogen stress, as well as processing methods, which can significantly affect its yield and stability. Recent advancements in extraction techniques have improved the efficiency and sustainability of L-Dopa isolation, making it more accessible for therapeutic use. This review also highlights the potential of faba bean by-products, such as pod valves, which exhibit higher L-Dopa concentrations and additional therapeutic properties due to their rich polyphenolic content.

Keywords: L-Dopa, Parkinson's disease, Polyphenolic content

INTRODUCTION

Parkinson's disease is the second most common neurological ailment, following Alzheimer's disease (Yadav *et al.*, 2013). Parkinson's disease is primarily characterized by the degeneration of dopaminergic neurons and the creation of Lewy bodies in the substantia nigra pars compacta portion of the brain (Forno, 1996). A number of factors, including age, heredity, exposure to excessive amounts of iron, pesticides, fungicides, and toxins, are important in the development of Parkinson's disease. Microglial activation, excitotoxicity, oxidative stress, neuroinflammation, and mitochondrial dysfunction are all factors in the degeneration mechanism of dopaminergic cells, which finally results in apoptosis (Mizuno *et al.*, 2001).

The current standard of care for Parkinson's disease is the use of levo dihydroxyphenylalanine (L-Dopa) as a precursor of dopamine (Etemadi *et al.*, 2018). The nonprotein amino acid L-Dopa, which is produced from L-tyrosine (Randhir and Shetty, 2004) and found in animals and some plants (Gautam *et al.*, 2012) can however, have a number of adverse consequences, such as nausea, vomiting, low blood pressure, drowsiness and restlessness. Legumes have a comparatively high L-Dopa content, especially those in the Fabaceae family (Inamdar *et al.*, 2013). The ingestion of *Vicia faba* and other legumes has been shown to enhance patients' motor abilities (Raguthu *et al.*, 2009). Another well-known species from the genus *Mucuna*, *Mucuna pruriens*, is commercialized for the extraction of L-Dopa and has been effectively used to treat Parkinson's disease (Ingle, 2003). In India, the genus *Mucuna* includes nine species and four variants (Patil *et al.*, 2015). Unfortunately, despite their important features, the majority of species have not been investigated. The prevalence of Parkinson's disease is

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steadily increasing and so is the need for L-Dopa. Therefore, it is crucial to identify new possible sources of L-Dopa. This review explores the therapeutic applications of L-Dopa, the environmental factors affecting its accumulation, advancements in extraction techniques, and the potential of utilizing faba bean by-products.

Therapeutic Applications of L-Dopa in Parkinson's Disease

The immune system uses inflammation as a defense against microbial infections and to trigger the production of anti-inflammation chemicals. Long-term neuro inflammatory is the cause of several chronic illnesses, including Parkinson's disease and Alzheimer's disease (Nemetchek *et al.*, 2017). Numerous medications are in the market to treat inflammatory diseases. Nevertheless, prolonged usage of these medications can result in gastrointestinal disorders and immunosuppression (Cai *et al.*, 2014). Researching novel anti-inflammatory compounds that may reduce inflammation is a crucial step in this path. Anthocyanidins, polyphenols, terpenoids, carotenoids, flavonoids, glucosinolates, isoflavonoids and phytoestrogens are all secondary metabolites are abundant in plants. The anti-inflammatory and antioxidant properties of these compounds are advantageous to health (Hemalata *et al.*, 2015). By generating reactive oxygen and nitrogen species, free radicals generated during cellular metabolism contribute to the pathophysiology of Parkinson's disease (Uttara *et al.,* 2009). Because of the polyunsaturated fatty acids in the cell membrane, the low activity of catalase, superoxide dismutase, and glutathione peroxidase, and the increased amount of iron that produces free radicals, brain cells are particularly susceptible to oxidative stress (Kasture *et al.* 2013). The contributions of oxidative stress and mitochondrial dysfunction to the development of Parkinson's disease are demonstrated by studies on animal models of the disease, cell culture, postmortem brain tissue, and human genetics. Oviedo-Silva and co-workers (2018) stated that Parkinson's disease (PD), the second most common neurodegenerative disease in the elderly, is treated with L-Dopa (L-3,4-dihydroxyphenylalanine), a precursor of dopamine (the happiness hormone) that can cross the blood-brain barrier and cause disability due to an imbalance between dopamine and acetylcholine in the brain (Topal and Bozoglu, 2016). Numerous medicinal plants with high levels of antioxidant activity have been identified and are used in the Indian Ayurvedic system to treat neurodegenerative illnesses. So the therapeutic application of L-Dopa in treatment of Parkinson's Disease is highly in demand.

L-Dopa in different legumes

Mucuna pruriens (velvet bean) is known to have the highest L-Dopa content among legumes, with concentrations ranging from 4 per cent to 6 per cent in dried seeds, though processing methods such as boiling can reduce this to about 1.5 per cent. It has long been used in Ayurvedic medicine for treating neurodegenerative conditions, particularly Parkinson's disease, due to its ability to alleviate motor symptoms. Studies in animal models and human trials have demonstrated that velvet bean extracts can improve motor performance similarly to pharmaceutical L-Dopa, sometimes with better tolerance. However, concerns remain regarding its high alkaloid content, including hallucinogenic compounds, and its potential to accelerate dyskinesia in Parkinson's patients when used long-term. *Vicia faba* (broad bean) contains lower L-Dopa levels, around 0.5 per cent in fresh beans and 0.07 per cent in dried forms. Historically cultivated in Mesopotamia, broad beans have been reported to improve motor function in Parkinson's patients, with some anecdotal cases suggesting prolonged "on" periods and reduced dyskinesia after consumption. However, excessive intake can lead to adverse effects, as seen in cases of severe dyskinesia and systemic reactions. A significant concern with broad beans is their high content of vicine and convicine, which can induce hemolytic anemia in individuals with glucose-6-phosphate dehydrogenase (G6PD) deficiency, making them potentially hazardous for certain populations. *Phaseolus vulgaris* (common bean), including green bean varieties, has the lowest L-Dopa content among the three legumes, with about 0.25 per cent (Rijntjes, 2019). Though widely cultivated and consumed globally, common beans have received less attention in Parkinson's research. Some studies suggest their potential neuroprotective effects, but their impact on dopamine metabolism and motor symptoms remains largely unexplored. Unlike velvet bean and broad bean, common beans do not have widespread historical medicinal use for neurological conditions,

though recent agricultural research aims to enhance their L-Dopa content through selective breeding. Their lower L-Dopa concentration and broader nutritional benefits make them a more balanced dietary option, though they may not be as effective as velvet or broad beans in managing dopamine-related disorders (Cohen *et al.*, 2022).

It is estimated that the global demand for L-Dopa can reach 250 Mt annually (Katayama and Kumagai, 2010), with a market value of over $100 billion (Koyanagari *et al.*, 2005; Patil *et al.,* 2013; Inamdar *et al.,* 2013). First isolated from *Vicia faba* seeds, L-Dopa is a secondary metabolite. In addition to broad beans, levodopa has also been found naturally in *Stizolobium deeringianum Phaseolus vulgaris* and *Mucuna pruriens*. In India, *Mucuna pruriens* beans have long been utilized as a successful herbal remedy for Parkinson's disease (Katzenschlager *et al.*, 2004).

L-Dopa is accumulated by various faba bean sections at varying rates and patterns (Etemadi *et al.,* 2014). Parkinson patients may keep a comparatively high number of plants for ingestion because fresh faba beans are not always available in all places. There are other ways to process plants, such as grinding frozen tissues and powdering dry plants. The degree to which processing affects the L-Dopa concentration in faba bean plants is unknown, though. In earlier research it is stated that, soaking in alkaline solutions and cooking legumes can degrade L-Dopa (Echeverria and Bressani, 2006; Vadivel and Pugalenthi, 2010). According to Ramya and Thakur (2007), dry seeds have a L-Dopa content of almost 0.07 per cent. Since Velvet beans can contain up to 9 per cent weight of L-Dopa, they are thought to be the richest source of this secondary metabolite (Pugalenthi and Vadivel, 2007). The limited geographic distribution of velvet beans in tropical regions of Asia and Africa limits their utility as a source of L-Dopa, despite their high dopamine precursor content. So faba bean is the most common source of L-Dopa; it produces over 4.5 million tons annually, mostly in South America, Asia, and Europe (FAO, 2016). Compared to velvet beans, faba may be a more intriguing source of L-Dopa due to its greater geographic distribution.

Advancements in Extraction Techniques

Since L-Dopa can oxidize quickly in the presence of moisture or air oxygen and lose some of its action, the literature has consistently examined quantitative determination of L-Dopa in its dose form. This has led to the development of a number of analytical techniques, including the HPLC technique with diode array, fluorescence, electrochemical and UV detection (Michotte *et al.*, 1987; Betto *et al.*, 1988; Titus *et al.*, 1990; Husain *et al.*, 1994; Kafil and Dhingra, 1994; Cannazza *et al.*, 2005 ; Li *et al.*, 2010 ; Issa *et al.*, 2011; Sravanthi *et al.*, 2013; Raut and Charde, 2014), H-NMR analysis, chemiluminescence, spectrofluorimetry, ion-exchange column chromatography, HPTLC (Seki and Wada, 1975), gas chromatography (Mennickent *et al.*, 2007), radioimmunoassay, titrimetric (Riceberg *et al.,*, 1974), voltametric determination, electrochemistry methods, potentiometry (Zhang *et al.*, 2001), LC-MS-MS (Badawy *et al.*, 1996) etc. Unfortunately, the majority of these approaches lack the simplicity required for everyday applications since they are complicated. They typically require perfect control throughout the experiment and large, costly, or complex apparatus (Günendi and Pamuk,1999).

Since UV-Vis spectrophotometry and colorimetric assays offer instantaneous, quick, accessible, affordable, and extremely precise procedures, their application has grown significantly in recent years, particularly in the field of pharmaceutical analysis. Since L-Dopa derived from natural sources, particularly *Mucuna pruriens* L., has demonstrated more potency than synthetic products, there is a great need to develop effective techniques for detecting L-Dopa in herbal extracts (Ramya and Thaakur, 2007). There are already a number of spectroscopic techniques that use different chromogenic reagents to detect L-Dopa or other catecholamines in non-herbal sources. They primarily rely on the interaction of amino acid with the appropriate reagent or the oxidation of hydroxyl groups (Afkhami and Khatami, 2003).

When Raina and Khatri (2011), used high-performance thin-layer chromatography (HPTLC) to measure the amount of L-Dopa in *Mucuna pruriens* germplasm, they discovered values ranging from 2.23 to 5.36 per cent. Using high performance liquid chromatography (HPLC), Burbano and Co-workers (1995), found that the L-Dopa content of young pods of *V. faba* cultivars ranged from 60 to 67.5 mg g^{-1} (dry weight). According to the study of Etemadi and

Co-workers (2018), on the distribution of L Dopa in faba bean plant tissues, immature seedlings had the highest concentration (13.3 mg g^{-1}), and as the plants grew older, their content dropped proportionately. The leaves had the highest L-Dopa concentration (10.5 mg g^{-1}) when the plants were collected at physiological maturity followed by flowers, juvenile pods, mature seeds, and roots. Using the HPTLC-UV approach, Oviedo-Silva (2018) discovered amounts in fava bean sprouts of up to 125 mg g^{-1}. The primary disadvantage of spectrophotometric detection using HPLC and HPTLC is the absence of a clear identification, which may result in imprecise quantification. When combined with mass spectrometry, HPLC significantly increases the sensitivity and specificity of quantitative analytical techniques. So Pavón-Pérez (2019) has been developed a new LC-MS/MS technique for a precise and focused assessment of L-Dopa in faba beans. Once the procedure was validated, it was used to assess how tyrosine affected the amount of L-Dopa in plants with growth.

Influence of Environmental Factors and Processing Methods

Large concentrations of L-Dopa have led to the development of a number of methods to increase it, including seed germination, drying seeds with UV or microwave treatment, and solid state bioconversion systems that use plant cell and tissue culture and the food-grade fungus *Rhizopus oligosporus* (Randhir and Shetty, 2004). The L-Dopa concentration and phenolic antioxidant activity can both be markedly enhanced by each of these circumstances. Extraction efficiency and stability of L-Dopa from bean leaves and seeds depend a great deal on processing conditions and environmental influences. Environmental stresses, including drought stress, have been reported to influence the contents of L-Dopa in plants. For example, research on faba bean (*Vicia faba* L.) has shown that drought stress might elevate L-Dopa accumulation in other tissues, specifically young leaves and flowers, though it might reduce overall biomass at the same time, potentially impacting total yield (Etemadi *et al.,* 2018). Processing techniques are also important in deciding the yield and quality of L-Dopa extracts. Conventional methods of extraction, such as boiling, autoclaving, and roasting, tend to result in a loss of L-Dopa content through heat degradation. But certain methods, like roasting under acidic pH, have been proven to increase L-Dopa concentration. For instance, acid pH roasting of *Mucuna pruriens* seeds has been shown to raise L-Dopa content over untreated seeds (Tesoro *et al.*, 2022).

The selection of extraction solvent has a significant effect on the efficiency and stability of L-Dopa. Acidified solvents are generally used to avoid oxidation and degradation of L-Dopa during extraction. Some recent research has investigated the utilization of natural acidic extracts, e.g., *Phyllanthus emblica* (Indian gooseberry) water, as alternative solvents. These plant solvents not only create the acidic conditions needed to stabilize L-Dopa but also exhibit antioxidant activity that can further contribute to extract stability. For example, co-extracting seeds of *Mucuna pruriens* with *Phyllanthus emblica* water was found to result in higher content and greater long-term stability of extracts than those obtained with the traditional acidified water method (Vilairat, 2022). In addition, novel extraction methods like ultrasound-assisted extraction (UAE) have been studied to enhance the yield of L-Dopa. UAE uses ultrasonic waves to break cell walls in plants, allowing for the release of L-Dopa into solvent. The technique has been used to increase the efficiency of extraction while minimizing processing time and consumption of solvent. Nevertheless, parameters like sonication time and temperature need to be well optimized to avoid possible degradation of L-Dopa (Tesoro *et al.*, 2022).

CONCLUSION

L-Dopa, an essential precursor for the synthesis of dopamine, is still a cornerstone in Parkinson's disease therapy. Although synthetic L-Dopa has been the mainstay treatment, plant-based sources, especially from faba bean (*Vicia faba*) and other native legumes, provide a viable alternative given their bioavailability and possible other health benefits. The fact that L-Dopa is present in various plant tissues such as seeds, leaves, and pod valves highlights the need to maximize extraction methods and reveal the impact of environmental conditions on its accumulation. Progress in extraction and analytical techniques, like HPLC, HPTLC, and LC-MS/MS, has greatly enhanced the efficiency and accuracy of L-Dopa measurement,

enabling its sustainable use from plant sources. Additionally, processing techniques like germination and bioconversion provide scope for increasing L-Dopa content with reduced degradation. Nonetheless, notwithstanding increasingly extensive evidence for the therapeutic activity of L-Dopa-abundant legumes, more work is needed to standardize the extraction procedures, enhance the bioavailability, and determine long-term clinical effects.

With the growing incidence of Parkinson's disease and the shortcomings of synthetic L-Dopa, it is crucial to investigate other plant sources. Faba bean and native legumes of North East India are underexploited but promising reservoirs of L-Dopa, capable of fulfilling increasing global needs. Agronomic management, genetic enhancement, and biotechnological strategies should be the focus of future studies to maximize L-Dopa yield, thus aiding in the creation of sustainable, plant-derived therapeutics for neurodegenerative diseases.

REFERENCES

Afkhami, A. and H.A. Khatami. 2003. Determination of some catecholamines based on their reaction with periodate. *Journal of Analytical Chemistry*, 58(1): 135-138.

Badawy, S.S.; Y.M. Issa and A.S. Tag Eldin. 1996. Potentiometric determination of l dopa, carbidopa, methyldopa, and aspartame using a new trinitrobenzene sulfonate selective electrode. *Electroanalysis,* 8(11): 1060-1064.

Betto, P.; G. Ricciarello; M. Giambenedetti; C. Lucarelli; S. Ruggeri and F. Stocchi. 1988. Improved high-performance liquid chromatographic analysis with a double detection system for L-dopa, its metabolites, and carbidopa in plasma of parkinsonian patients under L-dopa therapy. *Journal of Chromatography A,* 459: 341-349.

Burbano, C.; C. Cuadrado; M. Muzquiz and J.I. Cubero. 1995. Variation of favism-inducing factors (vicine, convicine, and L-DOPA) during pod development in *Vicia faba* L.. *Plant Foods for Human Nutrition*, 47(3): 265-274.

Cai, C.; Y. Chen; S. Zhong; B. Ji; J. Wang; X. Bai *et al.* 2014. Anti-inflammatory activity of N-butanol extract from *Ipomoea stolonifera* in vivo and *in vitro*. *PLoS One*, 9(4): e95931.

Cannazza, G.; A. Di Stefano; B. Mosciatti; D. Braghiroli; M. Baraldi; F. Pinnen and C. Parenti. 2005. Detection of levodopa, dopamine, and its metabolites in rat striatum dialysates following peripheral administration of L-DOPA prodrugs by means of HPLC–EC. *Journal of Pharmaceutical and Biomedical Analysis,* 36(5): 1079-1084.

Cohen, P.A.; B. Avula; K. Katragunta and I. Khan. 2022. Levodopa content of Mucuna pruriens supplements in the NIH dietary supplement label database. *JAMA Neurology*, 79(10): 1085–1086.

Echeverria, G.C.L. and R. Bressani. 2006. Effect of different cooking treatments of *Mucuna* beans on its L-DOPA content. *Archivos Latinoamericanos de Nutrición*, 56(2): 175–184.

Etemadi, F.; M. Hashemi; B. Xing and H. Mashayekhi. 2014. Accumulation trend of L-DOPA in different parts of fava bean varieties. *Proceedings of ASA, CSSA, and SSSA International Annual Meeting*, November 2–5, Long Beach, California, USA.

Etemadi, F.; M. Hashemi; R. Randhir; O. ZandVakili and A. Ebadi. 2018. Accumulation of L-DOPA in various organs of faba bean and influence of drought, nitrogen stress, and processing methods on L-DOPA yield. *The Crop Journal*, 6(4): 426–434.

FAO (Food and Agriculture Organization of the United Nations). 2016. *Agriculture Database*. Available online: http://www.fao.org/faostat/en/#data/QC (accessed on 22 February 2025).

Forno, L.S. 1996. Neuropathology of Parkinson's disease. *Journal of Neuropathology and Experimental Neurology*, 55(3): 259–272.

Gautam, M.; M. Chandel and W. Azmi. 2012. Therapeutic role of L-DOPA produced as a secondary metabolite from different legumes and plant sources. *Annals of Phytomedicine*, 1(2): 1–8.

Günendi, G. and F. Pamuk. 1999. Thin layer chromatographic separation and quantitation of L-dopa and L-tyrosine in mixtures. *Turkish Journal of Chemistry,* 23(3): 269-274.

Hemalata, S.K.; M.N. Shiva and Kameshwari. 2015. Anti-inflammatory activity in *Urginea wightii* (*Lakxmin*) Kunth, Hyacinthaceae. *International Journal of Pure and Applied Bioscience*, 3(1): 249–253.

Husain, S.; R. Sekar and R.N. Rao. 1994. Enantiomeric separation and determination of antiparkinsonian drugs by reversed-phase ligand-exchange high-performance liquid chromatography. *Journal of Chromatography A,* 687(2): 351-355.

Inamdar, S.A.; S.N. Surwase; S.B. Jadhav; V.A. Bapat and J.P. Jadhav. 2013. Statistically optimized biotransformation protocol for continuous production of L-

DOPA using *Mucuna monosperma* callus culture. *Springer Plus*, 2: 570.

Ingle, P.K. 2003. L-DOPA bearing plants. *Natural Product Radiance*, 2(3): 126–133.

Issa, Y.M.; M.E. Hassoun and A.G. Zayed. 2011. Application of high-performance liquid chromatographic method for the determination of levodopa, carbidopa, and entacapone in tablet dosage forms. *Journal of Liquid Chromatography and Related Technologies*, 34(19): 2433-2447.

Kafil, J.B. and B.S. Dhingra. 1994. Stability-indicating method for the determination of levodopa, levodopa–carbidopa, and related impurities. *Journal of Chromatography A,* 667(1-2): 175-181.

Kasture, S.; M. Mohan and V. Kasture. 2013. *Mucuna pruriens* seeds in treatment of Parkinson's disease: pharmacological review. *Oriental Pharmacy and Experimental Medicine*, 13(2): 165–174.

Katayama, T. and H. Kumagai. 2010. L-DOPA, microbial production. In: Flickinger, M.C. (ed.) *Encyclopedia of Industrial Biotechnology: Bioprocess, Bioseparation and Cell Technology*. Hoboken, New Jersey, USA: John Wiley and Sons, Inc., pp. 1–4.

Katzenschlager, R.; A. Evans; A. Manson; P.N. Patsalos; N. Ratnaraj; H. Watt; L. Timmermann; R. Van der Giessen and A.J. Lees. 2004. Mucuna pruriens in Parkinson's disease: a double blind clinical and pharmacological study. *Journal of Neurology, Neurosurgery, and Psychiatry*, 75(12): 1672–1677.

Koyanagari, T.; T. Katayama; H. Suzuki; H. Nakazawa; K. Yokozei and H. Kumagai. 2005. Effective production of 3,4-dihydroxyphenyl-L-alanine (L-DOPA) with *Erwinia herbicola* cells carrying a mutant transcriptional regulator TyrR. *Journal of Biotechnology*, 115(3): 303–306.

Li, S.F.; H.L. Wu; Y.J. Yu; Y.N. Li; J.F. Nie; H.Y. Fu and R.Q. Yu. 2010. Quantitative analysis of levodopa, carbidopa, and methyldopa in human plasma samples using HPLC-DAD combined with second-order calibration based on alternating trilinear decomposition algorithm. *Talanta,* 81(3): 805-812.

Mennickent, S.; M. Nail; M. Vega and M. de Diego. 2007. Quantitative determination of L DOPA in tablets by high-performance thin-layer chromatography. *Journal of Separation Science,* 30(12): 1893-1898.

Michotte, Y.; M. Moors; D. Deleu; P. Herregodts and G. Ebinger. 1987. Simultaneous determination of levodopa, carbidopa, 3-O-methyldopa, and dopamine in plasma using high-performance liquid chromatography with electrochemical detection. *Journal of Pharmaceutical and Biomedical Analysis,* 5(7): 659-664.

Mizuno, Y.; N. Hattori; H. Mori; T. Suzuki and K. Tanaka. 2001. Parkin and Parkinson's disease. *Current Opinion in Neurology*, 14(4): 477–482.

Nemetchek, M.D.; A.A. Stierle; D.B. Stierle and D.I. Lurie. 2017. The ayurvedic plant *Bacopa monnieri* inhibits inflammatory pathways in the brain. *Journal of Ethnopharmacology*, 197: 92–100.

Oviedo-Silva, C.A.; M. Elso-Freudenberg and M. Aranda-Bustos. 2018. L-DOPA trends in different tissues at early stages of *Vicia faba* growth: Effect of tyrosine treatment. *Applied Sciences*, 8(12): 2431. doi:10.3390/app8122431.

Patil, R.R.; A.R. Gholave; J.P. Jadhav; S.R. Yadav and V.A. Bapat. 2015. *Mucuna sanjappae* (Aitawade and Yadav): a new species of *Mucuna* with promising yield of anti-Parkinson's drug L-DOPA. *Genetic Resources and Crop Evolution*, 62(1): 155–162.

Patil, S.A.; O.A. Apine; S.N. Surwase and J.P. Jadhav. 2013. Biological sources of L-DOPA: an alternative approach. *Advances in Parkinson's Disease*, 2(3): 81–87.

Pavón-Pérez, J.; C.A. Oviedo; M. Elso-Freudenberg; K. Henríquez-Aedo and M. Aranda. 2019. LC-MS/MS method for L-DOPA quantification in different tissues of *Vicia faba*. *Journal of the Chilean Chemical Society*, 64(4): 4651-4653.

Pugalenthi, M. and V. Vadivel. 2007. L-DOPA (L-3,4-dihydroxyphenylalanine): A non-protein toxic amino acid in *Mucuna pruriens* seeds. *Food*, 1: 322–343.

Raguthu, L.; S. Varanese; L. Flancbaum; E. Tayler and A. Di Rocco. 2009. Fava beans and Parkinson's disease: useful "natural supplement" or useless risk? *European Journal of Neurology*, 16(Suppl. 3): e171.

Raina, A.P. and R. Khatri. 2011. Quantitative determination of L-DOPA in seeds of *Mucuna pruriens* germplasm by high-performance thin-layer chromatography. *Indian Journal of Pharmaceutical Sciences*, 73(4): 459.

Ramya, K.B. and S. Thaakur. 2007. Herbs containing L-DOPA: An update. *Ancient Science of Life*, 27(1): 50–55.

Randhir, R. and K. Shetty. 2004. Microwave-induced stimulation of L-DOPA, phenolics and antioxidant activity in fava bean (*Vicia faba*) for Parkinson's diet. *Process Biochemistry*, 39(11): 1775–1784.

Raut, P.P. and S.Y. Charde. 2014. Simultaneous estimation of levodopa and carbidopa by RP-HPLC using a fluorescence detector: its application to a pharmaceutical dosage form. *Luminescence,* 29(7): 762-771.

Riceberg, L.J.; H. Van Vunakis and L. Levine. 1974. Radioimmunoassays of 3,4,5-trimethoxyphenethylamine (mescaline) and 2,5-dimethoxy-4-

methylphenyl-isopropylamine (DOM). *Analytical Biochemistry,* 60(2): 551-559.

Rijntjes, M. 2019. Knowing your beans in Parkinson's disease: A critical assessment of current knowledge about different beans and their compounds in the treatment of Parkinson's disease and in animal models. *Parkinson's Disease*, 2019: 1349509.

Seki, T. and H. Wada. 1975. Chromatographic separation of catecholamines on a weakly acidic ion-exchange resin. *Journal of Chromatography A,* 114(1): 227-231.

Sravanthi, D.; M. Anusha; S. Madhavi; S. Firdose and B.N. Nalluri. 2013. Simultaneous estimation of levodopa and carbidopa in bulk, pharmaceutical dosage forms, and dissolution sample analysis by RP-HPLC-PDA method. *Journal of Chemical and Pharmaceutical Research,* 5(11): 422-428.

Tesoro, C.; F. Lelario; R. Ciriello; G. Bianco; A. Di Capua and M.A. Acquavia. 2022. An overview of methods for L-Dopa extraction and analytical determination in plant matrices. *Separations*, 9(8): 224.

Titus, D.C.; T.F. August; K.C. Yeh; R. Eisenhandler; W.F. Bayne and D.G. Musson. 1990. Simultaneous high-performance liquid chromatographic analysis of carbidopa, levodopa, and 3-O-methyldopa in plasma and carbidopa, levodopa, and dopamine in urine using electrochemical detection. *Journal of Chromatography B: Biomedical Sciences and Applications,* 534: 87-100.

Topal, N. and T. Bozoglu. 2016. Determination of L-DOPA (L-3,4-dihydroxyphenylalanine) content of some faba bean (*Vicia faba* L.) genotypes. *Journal of Agricultural Sciences*, 22(2): 145–151.

Uttara, B.; A. Singh; P. Zamboni and R. Mahajan. 2009. Oxidative stress and neurodegenerative diseases: a review of upstream and downstream antioxidant therapeutic options. *Current Neuropharmacology*, 7(1): 65–74.

Vadivel, V. and M. Pugalenthi. 2010. Studies on the incorporation of velvet bean (*Mucuna pruriens* var. *utilis*) as an alternative protein source in poultry feed and its effect on growth performance of broiler chickens. *Tropical Animal Health and Production*, 42(7): 1367–1376.

Vilairat, C. 2022. Development of an extraction method of Mucuna pruriens seeds for levodopa production using Phyllanthus emblica water as a natural solvent. *Chulalongkorn University*.

Yadav, S.K.; J. Prakash; S. Chouhan and S.P. Singh. 2013. Mucuna pruriens seed extract reduces oxidative stress in nigrostriatal tissue and improves neurobehavioral activity in a paraquat-induced Parkinsonian mouse model. *Neurochemistry International*, 62(6): 1039–1047.

Zhang, L.; G. Chen; Q. Hu and Y. Fang. 2001. Separation and determination of levodopa and carbidopa in composite tablets by capillary zone electrophoresis with amperometric detection. *Analytica Chimica Acta,* 431(2): 287-292.

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Research Article

Accessing the Relationship Between Adoption and Yield Enhancement in Turmeric (*Curcuma Longa* L.) Cultivation

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ABSTRACT

Turmeric (*Curcuma longa* L.), the ancient and sacred spice of India known as, "Indian saffron" is an important commercial spice crop grown in India and specially in agroclimatic condition of Rajasthan state. It is a native of India and is domesticated in South-East Asia. This paper examines farmers' adoption of improved turmeric cultivation practices and their relationship with personal profiles in the Udaipur district, of Rajasthan state. This study encompassed 100 turmeric growers from the Jhadol and Gogunda panchayat samities (Blocks), using a pre-structured interview schedule for data collection. The results indicated that 63.00 per cent of respondents possessed a medium level of adoption group. Whereas, 21.00 per cent of respondents were observed in low level of adoption group and remaining 16.00 per cent respondents were observed in high level of adoption group about improved turmeric cultivation practices. Further, among the various categories of turmeric growers, it was observed that 68.00 per cent and 56.00 per cent farmers were placed in medium level of adoption group in Jhadol and Gogunda panchayat samities (blocks), respectively. It was observed that type of house and caste of respondents from both panchayat samities has non-significant relationship with their adoption about improved turmeric cultivation practices. The analysis further revealed a significant positive correlation between adoption levels and factors such as family type. It showed the role of positive correlation and family type in adoption level and improving the condition of turmeric cultivation in Udaipur district of Rajasthan particularly in Jhadol and Gogunda panchayat samities.

Keywords: Turmeric growers, Adoption, Relationship, Correlation coefficient, Udaipur

INTRODUCTION

Turmeric (*Curcuma longa*) is a perennial herbaceous plant and comes from Zingiberaceae family (Kamal and Yousuf, 2012). It is known as Indian saffron, because widely used as a more reasonable substitute to the costly saffron spice and also known halodhi in Assanese (Sachan *et al.*, 2018). From ancient time turmeric powder used as medicine in India and China (Chattopadhyay *et al.*, 2004). Turmeric (*Curcuma longa*) originated in the Indo-Malayan region (Purseglove, 1968) and is broadly scattered across the tropical regions, spreading from Asia to Africa and Australia. It, known for its radiant yellow color, has been used as both a spice and a medicinal ingredient from Vedic culture (Jikah and Edo, 2004). Turmeric cultivation heavily relies on agricultural methods. And successful turmeric cultivation requires a precise balance of environmental conditions. The turmeric plant thrives in well-drained loamy soils under a warm and humid climate (Tudu *et al.,* 2024). India leads global turmeric production, contributing 80 per cent production with 1.1 million tonnes annual production (Anon, 2023). In the fiscal year 2024, In India major producing states are Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Madhya Pradesh and West Bengal (Anon, 2024). In Rajasthan state, Udaipur district has the

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second-largest producer of turmeric, with a cultivation area of 55 hectares and a production of 102 metric tonnes in the year 2020-21 (Source: Rajasthan Agricultural Statistics at a Glance 2020-21, Commissionerate of Agriculture, Govt. of Rajasthan, Jaipur). The agro-climatic condition in Udaipur district is particularly favorable for turmeric cultivation. Its medical value is increased by its function in promoting digestive health and reducing gastrointestinal symptoms. Turmeric contains numerous essential primary metabolites such as proteins, carbohydrates, vitamins, and minerals, while its also source of secondary metabolites, including curcumin, flavonoids, alkaloids, and terpenoids, exhibit diverse bioactive properties such as antioxidant, antimicrobial, anti-inflammatory, anticancer, and antiviral effects (Lestari and Indrayanto, 2014). This study examines the adoption of improved turmeric cultivation practices among farmers in the Udaipur district of Rajasthan, covering 100 turmeric farmers or growers from Jhadol blocks and Gogunda blocks. A significant positive correlation was observed between adoption levels and factors such as family type, while house type and caste showed no significant relationship. Many other important challenges like plant protection knowledge, transportation, market availability, and land holding size highlight the need for further research on improving turmeric farming, and turmeric producing farmers condition in Rajasthan state. With keeping this context in mind, this study entitled "Accessing the Relationship Between Adoption and Yield Enhancement in Turmeric (*Curcuma Longa* L.) Cultivation" was formulated to explore this important topic in Jhadol block and Gogunda block of Udaipur district of Rajasthan.

MATERIALS AND METHODS

This study was conducted in the two panchayat samiti of Udaipur district of Rajasthan, as it has the largest area under turmeric cultivation in jurisdiction of the MPUAT during 2020-21, and its agro climatic conditions are most appropriate for its cultivation. Two panchayat samitis including Jhadol and Gogunda, which have the most significant areas of turmeric cultivation, were selected for this study. From each panchayat samiti, five villages were identified based on their maximum turmeric farming areas, resulting in ten villages being included in the investigation. Ten farmers were randomly selected from each town, leading to 100 turmeric growers participating in this study. An ex-post-facto analysis was employed for this investigation. A personal interview technique was employed to collect data from the selected respondents. The statistical analysis was performed on the mean values using R-Studio version 04.04.02. The statistical techniques used are described below: standard deviation, percentage, and frequency, mean per cent score (MPS*),* and pearson correlation coefficient, and Z-test.

Standard deviation: Standard deviation was used to categorize the respondents into different groups and to determine the variability of the data in the study, using the formula provided by Karl Pearson (1894).

$$SD = \sqrt{\frac{\sum X_i^2}{n} - \left(\frac{\sum X_i}{n}\right)^2}$$

Where, SD = Standard deviation

$\sum Xi^2$ = Sum of square of the observations

$\sum Xi$ = Sum of value of the observations

n = Number of respondents

Percentage and frequency: The percentage and frequency distribution of respondents was worked out for categorizing the respondents with regards to personal characteristics and study variables.

***Mean per cent score (MPS)*:** It was calculated by dividing the total obtained score of the respondents and multiplying by 100.

$$\text{Mean per cent score} = \frac{\text{Total score obtained}}{\text{Maximum obtainable score}} \times 100$$

Correlation coefficient: The correlation coefficient ('r' value) was used to measure the relationship between dependent and independent variables using the formula provided by Al-Jibouri *et al.* (1958).

$$r = \frac{\sum (XY) - \frac{\sum X \sum Y}{n}}{\sqrt{\left[\sum X^2 - \frac{(\sum X)^2}{n}\right]\left[\sum Y^2 - \frac{(\sum Y)^2}{n}\right]}}$$

Where, r = Correlation Coefficient

X = Independent variable

Y = Dependent variable

n = Total number of respondents

Z-test (Standard Normal Deviate test): This test was used to observed significance of difference between two sample mean for large sample (*i.e.* n>30) according to formula provided by Sheskin (1997).

RESULTS AND DISCUSSION

Adoption of an innovation depends on many factors which employ influence on the farmers decision. It is assumed that if an individual (farmer) has more knowledge about different aspects of agricultural technologies, they are likely to adopt innovations at a faster rate. Keeping this point in mind an attempt has been made to know the level of adoption of improved turmeric cultivation practices in this study area. The data presented in Table 1 indicates that out of 100 respondents, majority (63.00%) respondents fell in medium level of adoption group. Whereas, 21.00 per cent of respondents were observed in low level of adoption group and remaining 16.00 per cent respondents were observed in high level of adoption group about improved turmeric cultivation practices. These findings are conformity with the findings of Afrad *et al.* (2020), and Sharma *et al.* (2015).

Further, among the various categories of turmeric growers, it was observed that 18.00 per cent and 26.00 per cent farmers were observed in low-level adoption group in Jhadol and Gogunda panchayat samities, respectively. While, 68.00 per cent and 56.00 per cent farmers are present in medium level of adoption group in Jhadol and Gogunda panchayat samities, respectively. About 14.00 per cent and 18.00 per cent farmers are observed in high-level of adoption group in Jhadol and Gogunda panchayat samities, respectively. The findings are confirmed with the research findings of Rathore *et al.* (2016) and Chigadolli *et al.* (2019).

In this investigation, aspect wise level of adoption of turmeric growers was worked out. For this mean per cent score of each practice was calculated. Data present in table 2 further shows that "Irrigation schedule" with total MPS 29.75 and was ranked first with similar ranking pattern for respondents of both panchayat samities, it was at first place with MPS 29.75 and 30.00 in respondents of Jhadol and Gogunda panchayat samities, respectively. "Soil and field preparation" ranked second with overall MPS 28.10. While, respondents of Jhadol panchayat samiti it was assigned third place with MPS 28.40 and in respondents of Gogunda panchayat samiti was assigned second place with MPS 27.80.

It was noted that level of adoption of recommended "Harvesting of crop" was stands at third position with MPS 26.25. While, panchayat samiti wise MPS were 29.50 (second rank) and 23.00 (fourth rank) for respondents of Jhadol and Gogunda panchayat samities, respectively. Kumar *et al.* (2014) also showed similar type of result in respect of harvesting of crop. "Seed and sowing" ranked fourth with overall MPS 26.12. While, in respondents of Jhadol panchayat samiti it ranked at fourth with MPS 25.12 and in respondents of Gogunda panchayat samiti, it ranked at third place with MPS 27.12.

The statement of adoption about "manures and fertilizers application" stands at fifth position with MPS 22.65. While, in respondents of Jhadol panchayat samiti with MPS 23.50 and respondents of Gogunda panchayat samiti with MPS 21.75. It stands at fifth rank for both panchayat samities. "Seed storage" with total MPS 21.25 and was ranked sixth. Whereas, respondents of Jhadol and Gogunda both Panchayat samities stands at sixth position with MPS 21.50 and 21.00, respectively.

Further analysis that adoption regarding recommended "Curing and marketing of crop" ranked

Table 1: Distribution of respondents on basis of their level of adoption about improved turmeric cultivation practices

Adoption Level	Jhadol Panchayat Samiti (n_1=50)		Gogunda Panchayat Samiti (n_2=50)		Total (n=100)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Low (<16.06)	9	18.00	13	26.00	21	21.00
Medium (16.06 to 27.01)	34	68.00	28	56.00	63	63.00
High (>27.01)	7	14.00	9	18.00	16	16.00
Total	50	100	50	100	100	100

Table 2: Aspect-wise extent of adoption of farmers about improved turmeric cultivation practices

Adoption level	Jhadol Panchayat Samiti (n_1=50)		Gogunda Panchayat Samiti (n_2=50)		Total (n=100)	
	MPS	RANK	MPS	RANK	MPS	RANK
Improved varieties	15.80	8	15.26	8	15.53	8
Soil and field preparation	28.40	3	27.80	2	28.10	2
Seed and Sowing	25.12	4	27.12	3	26.12	4
Manures and Fertilizer application	23.50	5	21.75	5	22.65	5
Irrigation schedule	29.75	1	30.00	1	29.75	1
Plant protection measure	05.00	9	06.25	9	5.68	9
Harvesting of crop	29.50	2	23.00	4	26.25	3
Curing and Marketing of crop	18.00	7	18.00	7	18.00	7
Seed storage	21.50	6	21.00	6	21.25	6

MPS = Mean per cent score

seventh with overall MPS 18.00. Whereas, MPS and rank for respondents of both Panchayat samities were 18.00 and seventh, respectively.

The data showed in Table 2 reveals that adoption of respondents about "improved varieties" was at eighth position with overall MPS 15.53. With similar ranking pattern for respondents of both panchayat samitis, it was at eighth place with MPS 15.80 and 15.26 in respondents of Jhadol and Gogunda panchayat samities, respectively. "Plant protection measures" ranked 9th with overall MPS 05.68. Whereas, MPS were 05.00 and 06.25 with nineth position for respondents of Jhadol and Gogunda panchayat samities, respectively.

To find out the significance differences between the farmers of selected panchayat samiti with respect to their adoption, the 'Z' test was applied. Table 3 shows that the calculated value of 'Z' (0.22) is less than its tabulated value at 5% level of significance. Thus, the null hypothesis (NH_0) is accepted, and the research hypothesis is rejected. So, we conclude that there is no significant difference between the turmeric growers of two selected panchayat samiti with respect to the adoption of improved turmeric cultivation practices.

Table 3: Comparison of Adoption between turmeric growers of selected Panchayat Samiti

Category of sample	Mean	S.D.	'Z' Value
Respondents of Jhadol Panchayat Samiti	21.66	5.30	0.22
Respondents of Gogunda Panchayat Samiti	21.42	5.67	

NS- non-significant

To determine the correlation between farmers' profiles and their adoption levels, a t-test was used, and the interpretation was made based on Pearsons's coefficient of correlation. The result showed in Figure 1 indicated that family type showed significant positive correlation with adoption of farmers at 5% level of significance with r-value of 0.236. Because financially good and awarded family types are able to adopt new

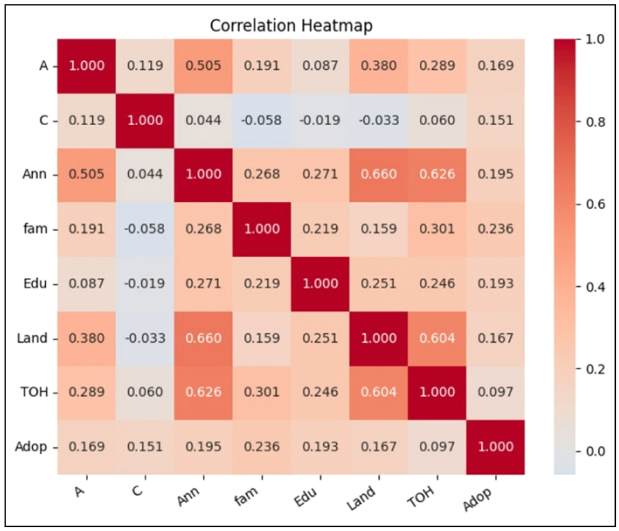

Figure 1: Relationship between personal characteristics of turmeric growers with their adoption

Abbreviations: A= Age; C= Caste; Ann= Annual income of farmers; fam= Family type; Edu; Education level; Land= Land holding; TOH= Type of house; and Adop= adoption

technology fastest. It showed that family type play impotent role in the accelerating the adoption level of agricultural technology.

Furthermore, Figure 1 depicts that Age, caste, annual income, family type, and education level had non-significance relationship with adoption recommended improved turmeric cultivation practices**.** Hence, the null hypothesis for these characters was therefore accepted while stated that there was no significant relationship between all the characteristics except family type and adoption of farmers about improved turmeric cultivation practices. This result has some similarities with the results showed by Panigrahi *et al.* (2021); Patel *et al.* (2004) and Makarau *et al.* (2013).

CONCLUSION

This study showed that most of the farmers had limited adoption of improved turmeric cultivation practices**.** In the Gogunda block, most farmers had medium level of adoption (56%), while the Jhadol block also had medium level of adoption but slightly higher adoption compared to the Gogunda block (68%). Adoption about irrigation schedule was highest, while plant protection measure was the lowest. No significant difference existed in adoption levels between both panchayat samitis including Gogunda and Jhadol. Factors influencing adoption including age, family type, annual income of farmers, land holding, education level and source of information, while caste and housing type did not matter. To improve adoption in low-ranking areas like plant protection and improved varieties, targeted training programs are recommended, focusing on education and access to information relevant to the needs of Jhadol and Gogunda blocks. Strengthening information dissemination and farmer support systems will help boost the adoption of better practices.

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Authors Contribution

SK and SSS conceptualized the experiments and designed the methodology. SK, VK, and AG went on survey and collected the data. SK, SSS, and AG analyzed the data, software implementation, and wrote the original manuscript. SK, SSS, and VK contributed to the interpretation of results of the manuscript. All authors have read and approved the final manuscript.

REFERENCES

Afrad, M.S.I.; M.R. Akter; M.E. Haque and M. Zakaria. 2020. Adoption of Spices Cultivation Technology by the Growers in Shibganj Upazila under Bogura District of Bangladesh. *The Agriculturists,* 18(1): 81-93. https://doi.org/10.3329/agric.v18i1.49461

Al-Jibouri, MA.; F.A. Miller and H.P. Robinson. 1958. Genotypicand environmental variances in an upland cotton cross of interspecific origins. *Journal of Agronomy*, 50: 633–637.

Anonymous. 2021. Rajasthan Agricultural Statistics at a Glance, Commissionerate of Agriculture, Government of Rajasthan, Jaipur.

Anonymous. 2023. Turmeric outlook. Agricultural Market Intelligence Centre, Professor Jayashankar Telangana State Agricultural University.

Anonymous. 2024. Estimated volume of turmeric produced across India in financial year 2024. Statista.

Chattopadhyay, I.; K. Biswas; U. Bandyopadhyay and R.K. Banerjee. 2004. Turmeric and curcumin: Biological actions and medicinal applications. *Current Science*, 87: 44-53.

Chigadolli, M.; B. Krishnamurthy; H.K. Pankaja and K. Nishita. 2019. A study on Extent of Adoption of Improved Cultivation Practices by Turmeric Growers in Belagavi District, Karnataka, India. *International Journal of Current Microbiology and Applied Sciences,* 8(3): 2411-2418.

Jikah, A.N. and G.I. Edo. 2024. Turmeric (*Curcuma longa*): an insight into its food applications, phytochemistry and pharmacological properties. *Vegetos*, https://doi.org/10.1007/s42535-024-01038-4

Kamal, M.Z.U. and M.N. Yousuf. 2012. Effect of organic manures on growth, rhizome yield and quality attributes of turmeric (*Curcuma longa* L.). *The Agriculturists*, 10(1): 16-22.

Kumar, S.; C. Kamcham; M. Chanchan; N.G. Singh; S.S. Gurikar; S.R. Singh and I. Ch. 2025. Determination of Optimum Size of Seed Rhizome of Planting Material on Growth, Yield, Quality and Profitability of Turmeric. *Plant Archives*, 25(1): 2833-2837.

Kumar, S.; H. Lal and H.S. Bunkar. 2014. Extent of Adoption of recommended coriander production technology by the farmers. *Indian Journal of Extension Education Rural Development*, 22(1): 177-179.

Lestari, M.L.A.D. and G. Indrayanto. 2014. Curcumin. pp 113–204.

Makarau, S.B.; A. Damina; M.I. Daneji and A.O. Garba. 2013. Socioeconomic factors influencing the adoption of ginger (*Zingiber officinale*) farming technologies in Samaru zone of the Kaduna state agricultural development project. *International Journal of Humanities and Social Science Invention*, 2(7): 39-44.

Panigrahi, A.; S. Modak and C. Padhy. 2021. Willingness to adopt the recommended practices of organic turmeric among Kandhamal farmers of Odisha. *Journal of Agricultural Extension, Economics & Sociology*, 39(8): 80-87. DOI: 10.9734/AJAEES/2021/v39i830628

Patel, V.T.; M.R. Prajapati; N.V. Choudhary and K.M. Joshi. 2004. Knowledge and adoption of recommended cumin production technology by the farmers of North Gujarat. *Society of Extension Education,* 37: 37-40.

Pearson, K. 1894. On the dissection of asymmetrical curves. *Philos Tr R Soc S-A,* 185: 719–810.

Purseglove, J.W. 1968. Tropical Crops: Monocotyledons. London: Longman.

Rathore, R.S.; R.L. Solanki and B.S. Kumpawat. 2016. Adoption of improved chilli (*Capsicum annum L.*) cultivation technology among the farmers of district Chittorgarh. *South Asian Journal of Food Technology and Environment,* 2(2): 381-383.

Sachan, A.K.; S. Kumar; K. Kumari and D. Singh. 2018. Medicinal uses of spices used in our traditional culture: Worldwide. *Journal of Medicinal Plants Studies*, 6(3): 116-122.

Sharma, A.; S.N. Sharma and S.B. Tambe. 2015. Adoption of chilli production technology among the chilli growers in Sehore District of Madhya Pradesh. *Indian Journal of Extension Education*, 51(1&2): 95-98.

Sheskin, D.J. 1997 Handbook of Parametric and Nonparametric Statistical Procedures, 2nd Edition. Boca Raton, FL: CRC Press.

Tudu, H.; S. Pradhana; T. Das and B.K. Das. 2024. Turmeric Cultivation and Medicinal Benefits: Special Reference to Kandhamal District of Odisha, India. *Asian Journal of Agricultural and Horticultural Research,* 11(3): 75-90. https://doi.org/10.9734/ajahr/2024/v11i3331

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Research Article

IPR and Plant Sciences: In Protection of Innovations Through PPVFRA, GI Tags, and Access-Benefit Sharing

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ABSTRACT

Intellectual Property Rights (IPRs) play a pivotal role in protection innovations and creations of the human mind, encompassing products, processes, and ideas that drive human progress and commercial growth. By protecting novel things of creativity and technological development, IPRs foster innovation across diverse fields, including plant sciences. On the basis of application majority of existing IPR categories, including patents, copyrights, geographical indications (GIs), trade secrets, trademarks, and industrial designs, provide a robust framework for protecting intellectual properties. Specifically, plant breeder rights (PBRs), granted for the development of new crop varieties identified through Distinctness, Uniformity, and Stability (DUS) characterization, which protect innovations meeting criteria of novelty, non-obviousness, and industrial applicability, are critical to advancing agricultural research and development. IPRs provide legal support to protect discoveries, facilitate commercialization, and promote sustainable innovation. On both national and international scales, IPRs enable effective management of agricultural and industrial advancements while addressing global challenges. In plant sciences, mechanisms like Protection of Plant Varieties and Farmers' Rights Act (PPVFRA), geographical indication (GI) tags, and access-benefit sharing agreements serve as vital mechanism for protecting and promoting innovations. These mechanisms ensure the equitable distribution of benefits derived from genetic resources while fostering sustainable agricultural practices. Effective IPR policies and management strategies are integral to advancing plant science, addressing food security, and sustainable agricultural development.

Keywords: IPR, Patent, Copyright, Plant Breeder Rights, PPVFRA

INTRODUCTION

Intellectual Property Rights (IPRs) play a pivotal role in protection innovations and creations of the human mind, encompassing products, processes, and ideas that drive human progress and commercial growth. It is territorial rights that permit the owner to buy, sell, or license their Intellectual Property, much like physical property. However, to claim the benefits of IPR, one must register them with a legal authority in a presentable or tangible form (Anonymous, 2005a). Protects human innovations and creations using some laws. They have profound roots in fundamental concepts that define people and society, such as money, ownership, human values, and natural rights. The historical interplay of these ideas has resulted in shifts in views, which have led to changes in government regulation of these ideas in the form of laws, as well as changes in how the laws have been drafted, interpreted, and updated. The rules governing plant intellectual property rights are covered by this generalisation (Ryder, 2005). In this study. We proposition to examine the history of IPR for plants in India in the context of general PPVFRA, Geographical Indications, and other IPR histories, in order to evaluate the benefits and downsides of plant

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IPR. The primary focus of the discussion will be Indian laws, demonstrating knowledge of those laws at the national level in the nation. Major existing IPR categories, such as patents, copyrights, geographical indications (GIs), trade secrets, trademarks, and industrial designs, provide a robust framework for protecting intellectual properties (Anonymous, 2005b). Specifically, plant breeder rights (PBRs), granted to develop new crop varieties that are identified through Distinctness, Uniformity, and Stability (DUS) characterization, which protect innovations meeting criteria of novelty, non-obviousness, and industrial applicability, are critical to advancing agricultural research and development. In plant sciences, mechanisms like the Protection of Plant Varieties and Farmers' Rights Act (PPVFRA), geographical indication (GI) tags, and access-benefit sharing agreements serve as vital mechanism for protecting and promoting innovations. These mechanisms ensure the equal distribution of benefits gained from genetic resources while fostering sustainable agricultural practices. For the advancement of plant research, food security, in addition sustainable agricultural development, effective IPR regulations also management techniques are essential.

Plant Sciences related Major IPR's in India

1. Protection of Plant Variety and Farmers' Rights Act, 2001: Recognising and protecting farmers' rights for their contributions to the preservation, enhancement, and accessibility of plant genetic resources (PGR) for the development of novel plant varieties has been deemed essential in order to support the development of new plant varieties, offer for the establishment of an efficient system for protecting plant varieties, and protect the breeders and farmers rights. Additionally, in order to promote investment in research and development (R&D) for the creation of novel plant varieties, it is imperative to safeguard the rights of plant breeders in order to advance agricultural development. Such protection is anticipated to encourage the growth of the seed industry, confirming farmers' access to high-quality planting materials and seed. After ratifying the agreement on Trade Related Aspects of IPR, India must make arrangements to implement the agreement. India passed the PPVFRA-2001, to implement the aforementioned goals. The Protection of Plant Varieties and Farmers' Rights Authority was created for the purposes of this Act and is situated at the NASC Complex, New Delhi.

Plant variety registration procedure under PPV & FR Act, 2001

Under Section 14, the following entities are eligible to apply for registration: (1) Any person that clams to be the breeder or their successor, assignee, or authorized representative. (2) Any farmer or group of farmers. (3) Any university or publicly funded agricultural institute (e.g., ICAR/CAUs/SAUs) claiming to be the breeder of a variety.

Furthermore, under Article 16.1, in the case of SAUs, the applicant will be the university, with the scientist(s) indicated as the breeder(s).

Eligibility criteria for registration: Following prerequisites must be completed:

Such a variation is given a denomination accompanied by a announcement that the variety is free of any genes or gene sequences related to terminator technology. Comprehensive passport information on the parents' lines, including their location in India and any information about any contributions made by farmers, villages, communities, institutions, or organisations to the breeding, evolution, or development of the variety. Variety features with descriptions for Novelty, DUS. a statement confirming that the genetic material used to create this variety was obtained legally. When applying for registration, a breeder or other individual must state whether they have used genetic material maintained by rural or tribal households to develop the variety.

Eligible varieties for protection under PPVFRA: Under PPVFRA following Varieties are eligible for protection: Extant varieties including Newly bred/ developed varieties (Novel), Essentially Derived Varieties (EDV), Genetically Modified (GM) Varieties.

Not eligible varieties for protection under PPVFRA: A variety cannot be protected if restricting its economic use is required to uphold public morals, public order, the health of people, animals, and plants, or to prevent significant environmental harm. Varieties with terminator technology that belong to species or genera not included in the Central Government of India's announcement are also prohibited.

Farmers' rights:

The Act, grants farmers the following rights that is unique only to India among all signatories to TRIPS and WTO and the sole reason for India not acceding to UPOV Act 1991:

Right to register varieties: Under this Act, a farmer who has created a new variety is eligible for registration and other protections as a plant breeder.

***Right on seed*:** It is permissible for a farmer to conserve, use, sow, resow, exchange, share, or sell his agricultural products, including seeds of varieties protected by this Act. However, he is not allowed to sell branded seeds of varieties protected by this Act.

***Right for reward and recognition*:** To be considered for the Plant Genome Saviour Award, Reward, or Recognition, an individual farmer or a farmers group engaged in the conservation and enhancement of plant genetic resources–such as landraces and wild relatives of economically valuable plants–must develop varieties from their plant material that qualify for registration under this Act.

Protection of innocent infringement: A farmer who violates section 65 of the PPVFR Act of 2001 will not face charges if they can demonstrate in court that they were unaware of the rights' existence at the time of the infringement.

Fee exemption: A farmer or group of farmers is not required to pay any fees for inspecting documents or obtaining copies of any decision, order, or document under this Act. They are fully exempt from all charges typically associated with variety registration, variety testing and further services provided by the PPVFRA; as well as for judicial matters involving violations or other cases in tribunals, courts, etc.

Reasonable seed price: Farmers are entitled to reasonably priced and remunerative seed of registered varieties. In the event that this requirement is not fulfilled, the breeder may lose their exclusive ownership of the variety in accordance with the clause pertaining to compulsory licensing, and they will be required to grant a licence to any qualified individual for the variety's seed production, distribution, and sales. The majority of plant variety protection laws include provisions requiring protected varieties to be licensed in order to guarantee farmers have access to enough seed.

Authorization of farmers' variety: To produce and commercialise an essentially derived variety (EDV) from a farmer's variety, permission must be granted with the approval of the farmer or group of farmers who contributed to its conservation and development. Through this process, farmers can discuss authorisation terms with breeders, including benefit-sharing and royalties.

Right for compensation: The breeder of a variety registered under this Act must disclose the expected performance under specified conditions to a farmer who purchases propagating material of that variety. The farmer may file a claim for compensation with the Authority if the propagating material does not operate as intended under the specified circumstances. Following notice of the problem, the Authority would give the breeder a chance to file an opposition before ordering the breeder to compensate the farmer as it sees suitable.

In order to facilitate the IPR registration of farmers' varieties, the Authority's Registry equates farmers to plant breeders under the Act, carries out nationwide training and awareness campaigns, and recognizes farmers and farmer communities for their contributions to germplasm conservation and variety development.

Plant breeders' rights: Registration provides the exclusive authority to produce, sell, market, export, or import a plant variety and its denomination. However, this right is balanced by farmers' rights, which permit them to use seeds of registered varieties without branding. Breeders' Right is one of the pivotal provisions of this Act with far reaching implications in the context of Indian agriculture and global scenario. The breeder alsaer of the registered variety is necessary.

Award/rewards and recognition to farmers'/ farming communities under PPVFRA: Under Section 45(2) of the Act, Rule 70(2)(a) of the PPVFR Rules, 2003, farmers and farming communities–especially those from tribal and rural areas–have the right to receive support and recognition for their role in conserving, improving, and preserving the genetic resources of economically important plants and their wild relatives. This includes communities in agro-biodiversity hotspots, with rewards and assistance provided through the National Gene Fund. To

implement these provisions, the Plant Genome Savior Community Award was launched in 2009–10, with up to 05 awards granted each year. Additionally, 10 farmers are honored with the Plant Genome Saviour Farmer Reward, while twenty farmers receive the Plant Genome Saviour Farmer Recognition certificates. The various awards and recognitions presented to farmers are outlined in Figure 1. The awardees are selected by a committee of experts or scientists, chaired by a distinguished scientist or SMS (Annual Report, PPVFRA, 2023-24).

Figure 1: Overview of the Plant Genome Savior awards, rewards and recognition

Significance: PPVFRA play a vital role in promotes innovation in plant sciences at national level. This act ensures equitable benefit distribution from the plant genetic resources. This act also responsible for encourages sustainable agricultural practices in all types of crops including cereal crops, pulses crops, oil seed crops, and horticultural crops etc. Its showed suitable impact and supports for sustainable agricultural development. PPV & FR Act, 2001 play a key role in advances plant science through effective IPR policies at national level.

2. Geographical indications: Geographical Indications (GIs) are an essential part of intellectual property rights, providing legal recognition to products whose unique attributes, characteristics, or reputation stem from a specific geographical location. They serve as markers of quality, protect natural resources, promote economic growth, and preserve traditional knowledge and local cultures (Stewart Lockie and David Carpenter, 2010). Their importance goes beyond economic gains and includes cultural preservation, sustainability, and consumer confidence. In addition to promoting fair trade practices, GIs increase market competitiveness by separating genuine regional products from imitations.

Definition and legal framework: A Geographical Indication (GI) is a label applied to goods that come from a certain area and have qualities or a reputation that are inherently associated with that area. The World Intellectual Property Organisation (WIPO) claims that geographical indications (GIs) serve as a specific type of intellectual property protection, guaranteeing that the label can only be used by authorised producers in the defined territory (WIPO, 2022).

The World Trade Organization's agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) serves as the main international legal framework that regulates GIs. TRIPS Article 22 offers universal protection for items with a defined geographical origin, whereas Article 23 extends stronger protection to wines and spirits, forbidding the misuse of GI labels even if deceptive phrasing is avoided (WTO, 2021). In order to supplement these international agreements, numerous nations have created domestic laws. For instance, India implements the Geographical Indications of Goods (Registration and Protection) Act, 1999, whereas the European Union uses the Protected Designation of Origin (PDO) and Protected Geographical Indication (PGI) frameworks (Calboli and Ng-Loy, 2017). These regulatory frameworks are intended to protect the integrity of regionally significant products and prevent misrepresentation in global markets.

Economic and cultural significance: GIs play an significant role in monetary development by increasing brand recognition and producing value for local producers. Because of their perceived authenticity and quality, products with GI classification sometimes fetch higher prices. For example, Champagne's GI protection in France assures that only sparkling wines made in the Champagne region using traditional methods can carry the name, safeguarding its global market value and cultural significance (Guy, 2007).

Similarly, in India, Darjeeling tea is protected by GI, preserving the integrity of the production process

and limiting the spread of imitation products. As customers increasingly look for genuine and superior regional products, studies show that GI products have a substantial positive impact on employment and tourism (Calboli and Ng-Loy, 2017). GIs provide economic benefits across numerous industries by creating job opportunities, enhancing export possibilities, and differentiating products in an increasingly competitive global marketplace. In addition to providing financial benefits, GIs protect traditional knowledge and artisanal craftsmanship, which aids in cultural preservation. Many GI products incorporate centuries-old production practices that are an essential element of a region's legacy. For instance, Italy's Parmigiano Reggiano cheese is made using traditional methods that add to the region's culinary and cultural character (European Commission, 2021). GIs contribute to the preservation of regional traditions by providing their legal protection and preventing industrialised mass production from diluting their cultural importance.

Consumer protection and market challenges: The capacity of GIs to shield customers from false or deceptive product promises is one of its main benefits. Customers can be guaranteed that a product is authentic, comes from a place of origin, and meets quality criteria by buying one that has earned GI certification. Customers' faith in local brands is strengthened by this transparency. Despite their advantages, GIs encounter numerous problems. The GI status registration process is frequently difficult, expensive, and time-consuming, especially for small-scale manufacturers who might not have the financial or legal means to handle the formalities. Furthermore, since unauthorised use of GI labels and counterfeit goods are still common in international marketplaces, enforcing GI rights requires international collaboration. The varying degrees of GI protection in various jurisdictions present another difficulty. While some nations execute their laws strictly, others lack effective enforcement systems, which encourage the growth of counterfeit goods. For instance, disparities between national GI standards make it controversial to continue using the term "Parmesan" to refer to cheese made outside of Italy (Guy, 2007). Enforcement efforts might be greatly improved and such disparities could be reduced by fortifying international legal frameworks and harmonizing GI protection standards.

***The role of GIs in sustainable development*:** Geographical indications support ecologically friendly production practices and biodiversity preservation, which both support sustainable development. A large number of GI-certified goods are produced or grown utilising conventional methods that put an emphasis on resource preservation and ecological balance. For example, Hawaii uses sustainable farming methods to produce Kona Coffee, which reduces chemical use and preserves soil health (WIPO, 2022). GI frameworks that promote sustainability can contribute to the development of a more moral and ecologically aware global economy. Additionally, by guaranteeing fair trade policies and equitable economic advantages, GIs strengthen local communities. Small-scale farmers and craftspeople can improve their market positioning and bargaining strength by obtaining legal recognition for their goods. Economic empowerment boosts rural economies, fosters community resilience, and stops big business from exploiting traditional knowledge. By giving local producers a competitive edge in domestic and foreign markets, GI certification helps reduce poverty in many developing nations. Table 1 showed few examples of registered GIs, the proprietors of which are government or supported by government institutions according Vinayan (2017) while Table 2 showed some important examples of GIs from North

Table 1: Examples of registered GIs according to Vinayan (2017)

Geographical area	GI's
Monsooned Malabar	Robusta Coffee
Mango Malihabadi	Dusseheri
Malabar	Pepper
Coorg Green	Cardamom
Nilgiri	Tea
Darjeeling	Tea
Assam	Tea
Monsooned Malabar	Arabica Coffee
Guntur	Sanam Chilli
Udupi	Brinjal
Mysore	Jasmine
Appemidi	Mango
Alleppey	Green Cardamom
Udupi	Jasmine
Byadagi	Chilli

Table 2: Examples of GIs from North East India

Geographical area	GI's
Meghalaya	Khasi mandarin
	Lakadong turmeric
Tripura	Queen pineapple
Mizoram	Mizo chilli
	Mizo Ginger
Manipur	Kachai lemon
	Tamenglong orange
	Chak-Hao
Nagaland	Naga Mircha/chilli
	Naga tree tomato
	Naga cucumber
Assam	Kaji Nemu
	Tezpur litchi
	Chokuwa rice
	Bhoot Jolokia
Arunachal Pradesh	Singpho tea
	Khamti rice

East India. There are some major examples of GIs from across the country in different categories including Banarasi silks, Paschmina shawls, Kashmir carpets, Basmati rice, Hyderabad pearls, Kerala Nendran bananas, Mysore silk, and Nagpur oranges etc.

***Future prospects and policy considerations*:** As globalization increases market competitiveness, the relevance of geographical indications in differentiating real regional products grows. To enable more efficient GI enforcement and protection procedures, international collaboration can be strengthened through improved trade agreements and diplomatic discussions. To ensure that all parties can profit from the financial benefits of GI protection, policymakers must also simplify the GI registration procedure to make it easier for small and medium-sized businesses. Market regulation may be further enhanced by the incorporation of digital technologies into GI monitoring and enforcement. In supply chains, for example, blockchain technology may improve traceability and transparency, lowering the possibility of GI fraud and counterfeiting. Furthermore, raising consumer knowledge through labelling programs and education efforts can enhance the legitimacy and marketability of GI-certified.

3. Access and benefit sharing: The Convention on Biological Diversity (CBD) plays a key role in regulating the international use and exchange of genetic resources (GRs), addressing the concerns of developing countries regarding fair and equitable benefit sharing. In response, the Nagoya Protocol on Access and Benefit Sharing (ABS) was established, requiring legal documentation and agreements to ensure authorized access and use of GRs from countries that have ratified the Protocol (Anonymous, 2010). Genetic resources can be defined as all materials that are available for improvement of a cultivated plant species (Becker, 1993). Everyone should have the right to participate in and benefit from the research and development (R&D) of genetic resources, including their genetic and biochemical properties, especially through the responsible use of biotechnology. Access and Benefit Sharing refers to the just and equitable distribution of benefits resulting from the access to and use of plant genetic resources (PGR) and the traditional knowledge linked to them (Normand, 2004). ABS establishes a framework in

Table 3: Trends in last five years with respect to filling of IP applications

Application	2018-19	2019-20	2020-21	2021-22	2022-23
Patents	50659	56267	58503	66440	82811
Designs	12585	14290	14241	22699	22698
Trade Marks	323798	334805	431213	447805	466580
Copyrights	18250	21905	24451	30988	29466
GIR	32	42	58	116	211
Semiconductor Integrated Layout Designs (SCILD)	0	0	5	1	23
Total	405324	427309	528471	568049	601789

Source: Annual Report 2022-23, IPR, GOI

Table 4: Comparison of Revenue (2020-21, 2021-22 and 2022-23)

Year	2020-21 (Rs Lakh)	2021-22 (Rs Lakh)	2022-23 (Rs Lakh)
Patents	62384	66749.31	72910.76
Designs	655	769.12	852.8
Trade Marks	39671	41776.58	44465.09
Copyrights	248.81	323.85	241.07
GIR	5	8.35	13.68
PIS/RGNIPM	12.35	20.48	20.66
Total	102727	109323.84	118504.05

Source: Annual Report 2022-23, IPR, GOI

which users of genetic resources enter into agreements or arrangements with the providers of those resources. This system enables providers to regulate access, if they choose to, and to obtain a share of the benefits resulting from the use of those plant genetic resources, if they so wish. Providers grant consent to access the genetic resources they control, and can impose conditions on sharing the benefits from that access. Users can range widely–from research institutions to cosmetic industries–who utilize genetic resources or related traditional knowledge to advance their activities or innovations. *Non-financial benefits* may comprise technology transmission of research and development outcomes. Financial gains may involve licensing charges or royalty payments, typically arising from research aimed at commercial applications.

Trends of filling of IPR applications and revenue generation: Table 3 showed trends of applications in different categories including patent, design, Trade Mark, Copyright, GIR and SCILD at national level from 2018-19 to 2022-23. It is indicating that trends for application falling in IP applications continually increasing because peoples are aware about the importance and benefits of the intellectual properties. Table 4 showed the revenue generated from different types of the intellectual properties from 2020-21 to 2022-23. This trend indicating continues increasing in revenue generated from all the categories of intellectual properties showed in Table 4.

REFERENCES

Annual Report. 2023–24. Protection of Plant Varieties and Farmers' Rights Authority New Delhi-110012. pp 1-219. www.plantauthority.gov.in

Anonymous. 2005a. New Delhi: Commercial Law Publisher (India) Pvt. Ltd. The Copyright Act1957 as amended up to 1999 along with Copyright Rules 1958 and International Copyright Order1999.

Anonymous. 2005b. New Delhi: Commercial Law Publisher (India) Private Ltd. The Patents Act,1970 as amended by Patents (amendment) Act 2005.

Anonymous. 2010. Convention on Biological Diversity, About the Nagoya Protocol, (Accessed 27 February 2019), https://www.cbd.int/abs/about/default.shtml.

Becker, H. 1993. Pflanzenziichtung. Stuttgart: Verlag Eugen Ulmer.

Calboli, I.; and W.L. Ng-Loy. 2017. *Geographical Indications at the Crossroads of Trade, Development, and Culture: Focus on Asia-Pacific*. Cambridge University Press.

European Commission. 2021. *Protection of Geographical Indications in the EU*. https://ec.europa.eu

Guy, K.M. 2007. *When Champagne Became French: Wine and the Making of a National Identity*. Johns Hopkins University Press.

Normand, Valerie. 2004. Access to genetic resources and the fair and equitable sharing of benefits arising out of their utilization: developments under the Convention on Biological Diversity. pp 33-141.

Stewart Lockie and David Carpenter. 2010. Agriculture, biodiversity and markets Livelihoods and agroecology in comparative perspective. Earthscan Ltd, Dunstan House, 14a St Cross Street, London EC1N 8XA, UK

World Intellectual Property Organization (WIPO) 2022. *Geographical Indications*. https://www.wipo.int

World Trade Organization (WTO). 2021. *TRIPS Agreement and Geographical Indications*. https://www.wto.org

Vinayan, S. 2047. Geographical indications in India: Issues and challenges-An overview. *J World Intellect Prop*erty, pp 19–132. https://doi.org/10.1111/jwip.12076

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Research Article

Success and Sustainability of Watershed Management Projects in Rainfed Agro-ecosystem in North West Himalayan Region

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ABSTRACT

The community based participatory watershed management approach adopted in India to address land degradation and to cope up with threat of water scarcity and depleting biodiversity. Watershed based approaches helped in increasing agricultural productivity and showed substantial improvements in rural livelihoods. This study was conducted to identify the indicators responsible for sustainability of community led watershed management projects in rainfed areas in the country. Data was collected from 240 respondents (farmers-200, officials- 40) taken through simple random sampling technique. Friedman test was deployed to quantify the contribution of individual factor in sustainability of community based watershed management programmes. Findings showed that all the influential factors were sub-divided under following major indicators namely; technological, economical, institutional, social and political sustainability of community led watershed management projects and then they were analyzed. Result showed that factors like cost effectiveness of technology, people's participation, creation of awareness about the watershed, local institutions building, ethical and transparent dealing, signing of memorandum of understanding etc. are crucial factors for sustainability of watersheds. Development agencies should be keep these factors in mind before going for planning and implementation of watershed management projects which is ultimately helps in success and sustainability of community led watershed development projects.

Keywords: Community-led-watershed management, Technological, Economical, Institutional, Social and Political sustainability, Rainfed agro-ecosystem, Sustainability indicators

INTRODUCTION

Rainfed farming in Indian agriculture occupies around 51 per cent of India's net sown area, contributing around 40 per cent of food grain production (MoAFW, 2021) and supporting 40 per cent of the India's population (Venkateswarlu, 2011). Main features of rainfed farming are low and erratic rainfall, low level of input use and technology adoption, land degradation and low draft power availability (Mayande and Katyal, 1996). In addition, lack of timely inputs, inadequate credit availability leads to low and unstable productivity of the crops and net profit to the farmers which ultimately leads to low employment with high incidence of poverty (Joshi *et al.* 2008). Climate change has further exaggerated the situation in rainfed areas because more than 50 per cent population is entirely dependent on agriculture for livelihood which causing disproportionate use of natural resources (Jasna *et al.,*

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2014). Due to degraded land, complex, diverse and risk prone agro-ecosystem, food production is the major livelihood concern in the North West Himalayan region. Generally, rainfed agriculture is practiced by the farmers in North West Himalayan region and has limited scope for irrigation. In *Rabi* season, the crop growth is completely dependent on winter rains and any weather aberrations may lead to entire crop failure (Roy *et al.,* 2019).

The importance of watershed management in rainfed agro-ecosystems for natural resource management and livelihood promotion cannot be ignored and many of these problems of fragile and marginal rainfed areas can be solved by adopting watershed development approach (Ahluwalia 2005; Kumar *et al.,* 2007 and Wani *et al.,* 2006). There is a dire need to demonstrate watershed management practices in rainfed areas which may helps in significant improvements in rural livelihoods (Turton, 2000). The permanent solution to attain "water prosperity" in the rainfed regions lays in the adoption of watershed management measures by our farming community (Jain, 2004). Watershed development progammes have multiple benefits in terms of increasing yields of rainfed crops, cropping intensity, employment generation and protecting environment (Reddy *et al.,* 2001; Renfro, 2005) with integrated use, regulation and treatment of water and land resources (Oswal, 1999; Jensen *et al.*, 1996). Therefore, government gives enough emphasis on the sustainable development of rainfed areas through watershed development approach.

The most extensively used definition of sustainability is that "it is the ability of the project through the efforts of institutions, to maintain a level of benefits to a static or expanding population after donor assistance has ceased" (Hodgkin *et al.,* 1994). Watershed development officials also ensures the participation of people at all stages, through active involvement of NGOs and coordinated efforts by the concerned government departments (Iyer and Ray, 2005) and local people's participation is must for success of sustainable watershed development projects (Pretty and Ward, 2001). In addition, the reasons for non-sustainability of watershed-based approaches are insufficient funding with inconsistent policies at higher level, use of inappropriate technology, inadequate local organizations and support with poor institutional setup and coordination (Sheng, 2000). At the community level issues like perceived lack of ownership, lack of education on water supply and sanitation, poor management system are major concerns to low sustainability rates of project (Harvey and Reed, 2007). By keeping all the above points in mind, in this paper efforts have been made to assess the different indicators responsible for sustainability of soil and water conservation projects in North-Western Himalayan region which is dominated by small and marginal farmers' population.

MATERIALS AND METHODS

The present study was conducted in Dehradun and Tehri Garhwal districts of Uttarakhand, India. Four watershed projects implemented by the ICAR-Indian Institute of Soil and Water Conservation, Dehradun as its outreach programme were selected. The selected watershed projects were Kalimati under IVLP (Institution Village Linkage Programme), Pasauli under TDET (Technology Development, Extension and Training), Sainji and Almas under NATP (National Agricultural Technology Programme). Ex-post facto research design was used in the study. Fifty farmers from each watershed area (total-200) were selected for the present study. Besides this 40 officials from line departments of state government working locally were also interviewed. Hence, total sample size comprises of 240 respondents (farmers-200 and officials-40). The respondents were selected through both purposive and random sampling techniques. Primary data was collected by survey method using well-structured interview schedule developed for the purpose.

Primary data was collected through case studies, in-depth group discussions and participatory rural appraisal exercises. Secondary data was collected through literature and reports published by ICAR-IISWC and reference material available on internet. Five point continuum Likert scale from strongly agree (5) to strongly disagree (1) was used. For measuring perception of farmers on technological, economical, institutional and social sustainability of watershed projects, for each 6-8 indicator statements were selected. The contribution of each factor in terms of sustainability was quantified through Friedman test. When the Friedman's test leads to significant results,

then at least one of the samples is different from the other samples.

The test statistic is given by $Q = \frac{SS_k}{SS_e} \sim \chi^2_{(k-1)}$, where k is the number of related groups, $SS_k = n\sum_{j=1}^{k}\left(\frac{\sum_{i=1}^{n} r_{ij}}{n} - \frac{\sum_{i=1}^{n}\sum_{j=1}^{k} r_{ij}}{nk}\right)^2$, $SS_e = \frac{1}{n(k-1)}\sum_{i=1}^{n}\sum_{j=1}^{k}\left(r_{ij} - \frac{\sum_{i=1}^{n}\sum_{j=1}^{k} r_{ij}}{nk}\right)^2$, r_{ij} represents the rank of j^{th} observation from group i.

RESULTS AND DISCUSSION

Different dimensions of sustainability of the watershed projects were identified in terms of technological, economical, institutional, social and political. Further, for measuring, respective dimension of sustainability, indicator statements were selected. Results of the study have been presented and discussed under the broad headings of technological, economical, institutional, social and political sustainability.

The selection of appropriate site and identification of technology were the critical factor at the initial phase of the watershed development programme. Table 1 depicts that the 'The watershed is suitable to farmers' needs and interest (demand driven)' was the most effective intervention (mean rank=4.98) perceived by the respondents followed by alliance with research institutes for expert consultation and access to suitable and updated technology (mean rank=4.64). New techniques helped in improving soil health and checking soil erosion (mean rank=4.49) was the third most important factor of technological sustainability. At the initial stage of watershed program, institute arranged all type of technical support to the farmers (mean rank=4.45). Watershed is appropriate as per farmers situations (mean rank=4.43) was the next important factors of sustainability as rainfed areas were characterized by low level of technology adoption, low level of input use, low and unpredictable rainfall with degraded land.

Easy and timely availability of local labour and material (mean rank=4.39) was the next important factors of sustainability. Maintenance and restoration of resources by the community itself in the watersheds after withdrawal of funding agency also helped in sustainability of watersheds (mean rank=4.34). Farm publication and literature related to technological knowhow provided by the institute to the farmers have also contributed in sustainability of technological interventions (mean rank=4.28). The details of Friedman test for the technological sustainability are also given in Table 1. The test statistics value obtained was 32.341 and its level of significance was 0.000 which indicates that difference among above mentioned factors were highly significant.

Table 1: Contribution of individual factors in technological sustainability as perceived by respondents (N=240)

S. No.	Technological Sustainability	Mean Rank*	Rank	Friedman test		
				Test statistics	df#	Asymp. Sig.
1	The watershed is suitable to farmers need and interest (demand driven)	4.98	I	32.341	7	0.000
2	Alliance with research institute for expert consultation and access to suitable and updated technology	4.64	II			
3	New techniques helped in improving soil health and checking soil erosion	4.49	III			
4	Institute has arranged technical support at the initial stage of watershed development	4.45	IV			
5	Watershed is appropriate as per farmers situations (location specific)	4.43	V			
6	Easy and timely availability of local labour and material	4.39	VI			
7	Maintenance and restoration of watersheds by the community itself after withdrawal of funding agency.	4.34	VII			
8	Brings out farm publication and literature related to technological knowhow for the community.	4.28	VIII			

*Mean rank based on Friedman test; #df denotes degree of freedom

Economic sustainability means the degree to which watershed projects are able to generate sufficient funds through economically viable technologies (Vishnudas *et al.,* 2005) in the long run to meet its operational and maintenance costs without adversely affecting environmental, cultural and social aspects of the community. The findings on Table 2 depicts that the 'Net irrigated area has increased due to watershed development' was the most effective factor (mean rank=4.85) for economic sustainability of watershed projects as perceived by the respondents followed by cost effectiveness of technology (mean rank=4.77).

Productivity of various crops has increased due to availability of irrigation water throughout the year was the next important factor of economic sustainability (mean rank=4.74). Overall income of farmers was also increased in study areas because of introduction of suitable horticultural and livestock based interventions in selected watershed areas (mean rank=4.58). Voluntary contribution in cash or kind for watershed development was the next important factor in economic sustainability of watershed projects (mean rank=4.46). Watershed development in study areas, helped in checking migration by creating employment opportunities for the communities (mean rank=4.24). Before implementation of watersheds projects people of study areas migrated in other states in search of job. Due to improved overall income lead to increased household assets (mean rank= 4.23). Institute provided free of cost technical support and advice to water management society after the withdrawal of funding agency (mean rank= 4.13), also helped in economic sustainability of watershed projects. Details of Friedman test for the economical sustainability are given in Table 2. The test statistics value obtained was 37.978 and its level of significance was 0.000 which indicates that difference among above mentioned factors was highly significant. In a similar line, Erin and Aruna (2013) found that in watershed evaluation, increase agricultural production sustainably, restore ecosystem services, increase in income and employment are the important factors.

Institutional sustainability means involvement of local institutions in decision making process and setting rules and policies to perform in long run. These institutions should be functional at grass root level (Tucker, 2003) to meet the demand of community and have responsibility of effective and efficient management of available resources that is perquisite for successful watershed management (Sharma, 2000). The findings in Table 3 depicts that 'participatory approach followed by staff during planning and designing to implementation and post project management of watersheds.' was the most effective factor (mean rank=5.05) for institutional sustainability of watershed projects as perceived by the respondents followed by creation of water management society (mean rank=4.69). Strict rules and regulations formed by water management society was the third most important factors of institutional sustainability (mean

Table 2: Contribution of individual factors in economical sustainability as perceived by program respondents (N=240)

S. No.	Economic Sustainability	Mean Rank*	Rank	Friedman test		
				Test statistics	df#	Asymp. Sig.
1.	Net irrigated area has increased due to watershed development.	4.85	I	37.978	7	0.000
2.	Cost effectiveness of technology.	4.77	II			
3.	The productivity of crops has increased due to availability of irrigation water throughout the year.	4.74	III			
4.	Overall income has increased due to introduction of suitable horticultural and livestock based interventions.	4.58	IV			
5.	Voluntary contribution in cash or in kind for watershed development.	4.46	V			
6.	Employment generation.	4.24	VI			
7.	Increase in household assets.	4.23	VII			
8.	Institute has provided free of cost technical support and advice to water management society after the withdrawal of funding agency.	4.13	VIII			

*Mean rank based on Friedman test; #df denotes degree of freedom

Table 3: Contribution of individual factors in institutional sustainability as perceived by programme respondents (N=240)

S. No.	Institutional Sustainability	Mean Rank*	Rank	Friedman test		
				Test statistics	df#	Asymp. Sig.
1	Participatory approach followed by staff during planning and designing to implementation and post project management of watersheds.	5.05	I	50.870	7	0.000
2	Creation of water management society.	4.69	II			
3	Strict rules and regulations of the society and objective monitoring and evaluation.	4.55	III			
4	Trust on the department and effective linkage between the agencies involved.	4.47	IV			
5	Capacity building and empowerment of the weaker sections of community.	4.45	V			
6	Women members have access to information and have say in decision making process.	4.41	VI			
7	Local institution building involving all sections of community.	4.39	VII			
8	Provides extension support to the farmers (training program, demonstration, meeting, exposure visit etc.)	4.00	VIII			

*Mean rank based on Friedman test; #df denotes degree of freedom

rank=4.55). In the present study, strong linkage and convergences developed by the institute with different agencies involved (mean rank=4.47) which helps in sustainability. Capacity building of the grass root level institutions through organization of "Do-how" trainings by the scientists were carried out as and when needed (mean rank=4.45). Capacity building was the top priority training need of the Watershed Development Team members and also it was interesting to note that equity and transparency was found to be the least priority training need (Bihari *et. al.,* 2017).

Generally women members are left out in watershed management activities; but in present study women were actively associated in decision making process (mean rank=4.41) as they play a crucial role in the management of natural resources. Local institutions viz. water management society and self help groups (SHGs) were also formed by involving weaker section of society (mean rank=4.39); this has lead to equality in the society and better management of watershed and natural resources in the study area. Apart from this, the scientists of the institute have sufficiently interacted with the farmers through training, field days, focussed group discussion, etc. (mean rank=4.00) which helps in confidence building between scientist and farmers.

The details of Friedman test for the institutional sustainability are also given in Table 3. The test statistics value obtained was 50.870 and its level of significance was 0.000 which indicates that difference among above-mentioned factors were highly significant. The findings were supported by Joshi *et al.* (2008).

For developing a sustainable watershed project; values, customs, belief and attitudes of stakeholders should be considered and incorporated at the beginning of project. The findings in Table 4 depicts that the 'Ethical and transparent dealing' was the most effective factor (mean rank=5.59) for social sustainability of watershed projects as perceived by the respondents followed by all section of society works in watershed (mean rank=5.55). It is necessary to ensure that watershed committees truly represent the interests of the community, have been formed with the consent of the community and not by an external agency (Joshi *et al.,* 2004) and should have clarity on roles, tasks and responsibilities for different groups (Kakade and Hegde 1998). Equitable access to assets was the third most important factor (mean rank=5.44) whereas awareness among community (mean rank=5.01) was the fourth and agreement over cropping pattern (mean rank=4.98) was the fifth most important factor in social sustainability of the projects. Mutual understanding in

Table 4: Contribution of individual factors in social sustainability as perceived by programme respondents (N=240)

S. No.	Social Sustainability	Mean Rank*	Rank	Friedman test		
				Test statistics	df#	Asymp. Sig.
1	Ethical and transparent dealing	5.59	I	90.713	7	.000
2	All section of society works in watershed	5.55	II			
3	Equitable access to assets	5.44	III			
4	Creates awareness among community	5.01	IV			
5	Make agreement over cropping pattern	4.98	V			
6	Mutual understanding in selection of activities	4.77	VI			
7	Build consensus in benefit sharing	4.74	VII			
8	Supported each other view for common purpose	4.73	VIII			

*Mean rank based on Friedman test; #df denotes degree of freedom

selection of activities (mean rank=4.74) was the fifth followed by consensus in benefit sharing (mean rank=4.74) was the sixth most important factor in social sustainability of the projects.

The study showed that farmers have supported each other's views (mean rank=4.73) for common cause irrespective of their caste and religion and get united for common cause of water harvesting and natural resources management through watershed development. The details of Friedman test for the social sustainability are also given in Table 4. The test statistics value obtained was 90.713 and its level of significance was 0.000 which indicated that difference among above mentioned factors were highly significant. These findings are consistent with Cendon *et al.* (2022).

It is widely accepted that collaboration between institutions and local political structures are critical for sustaining the watershed programme. The findings in Table 5 depicts that the local people have been consulted in the planning and implementation and post project management of watershed programme and Memorandum of Understanding (MoU) signed between the implementing agencies and the farmers was the most effective factor (mean rank=5.08) for political sustainability of watershed programme as perceived by the respondents followed by no political interference in the use of water (mean rank=4.56). Signing a MoU can help to establish a clear and legally binding framework for cooperation and can serve as a tool for coordinating and aligning efforts for effective and sustainable watershed management (GoI, 2008).

Coordination committee formed to solve conflicts related to watershed management (mean rank=4.53) was the third most important factor followed by no clash over site selection (mean rank=4.44) was the fourth most important in political sustainability of watershed management. In the present study area watershed site was selected by considering following factors i.e. local people's participation and their consent,

Table 5: Contribution of individual factors in political sustainability as perceived by programme respondents (N=240)

S. No.	Political Sustainability	Mean Rank*	Rank	Friedman test		
				Test statistics	df#	Asymp. Sig.
1	MoU is signed between institute and beneficiaries for implementation.	5.08	I	42.502	5	.000
2	No political interference	4.56	II			
3	Formation of coordination committee to solve conflicts	4.53	III			
4	No clash over site selection	4.44	IV			
5	Do not challenge each other for key position in committees	4.43	V			
6	Do not steal water for personal gain.	4.42	VI			

*Mean rank based on Friedman test; #df denotes degree of freedom

maximum area under serious resource degradation and site suitability for constructing watershed structures. No competition for key position in watershed management committee (mean rank=4.43) and no fighting for personal gain (mean rank=4.42) was the sixth most important factor in political sustainability of watershed management programme. The details of Friedman test for the political sustainability are also given in Table 5. The test statistics value obtained was 42.502 and its level of significance was 0.000 which indicates that difference among above mentioned factors were highly significant. The similar factors were mentioned in the NGWDP guidelines issued by the Government of India (2021).

CONCLUSION

In recent years, watershed development programme has emerged a potential approach for improving agricultural productivity and mitigating natural resource degradation in the rainfed and drought-prone areas of the country. Success of the watershed development programme lies in its proper execution and completion but sustainability of the programme lies in transparency observed by the project officials and also inculcated among the farmers of the project area. Government of India introduced NGWDP (New generation watershed development projects) WDC PMKSY 2.0 during 2021 for benefitting farmers and the project development plan shall be guided by the need to achieve higher incomes for farmers, expanded livelihood options for landless, equity in distribution of benefits, community ownership and management, and ecologically sustainable action plan. Important sustainability factors came out from this study like cost effectiveness of technology, people's participation, creation of awareness about the watershed, local institutions building, ethical and transparent dealing, signing of memorandum of understanding etc. are to be kept in mind while implementation of watershed projects. Development agencies should be keep these factors in mind before going for planning and implementation of watershed management projects which is ultimately helps in success and sustainability of community led watershed development projects. In the rainfed areas, doubling farmers' income through at small and marginal landholders' level is quite difficult. So, along with watershed approach there is a dire need to adopt PPME (Procurement, Processing, Marketing and Export) model at the Government level, where government agencies should be given responsibility of procuring the farm produce and making the business out of it (Bihari *et al.,* 2019). Marketing component of PPME Model has shown that beneficiary farmers had high level of marketing knowledge & awareness in comparison to non beneficiaries because the beneficiary farmers were sensitized about minimum support price of different commodities and they also started grading, packing and purchasing of their produce for higher margin of benefits (Bihari *et al.,* 2020). Development of cost effective technology by involving local institutions is also very crucial for sustainable management of watershed and the conservation of natural resources. For effective, efficient and sustainable watershed development it is necessary to involve local community in all stages and each one should harness the benefits of watershed projects. Therefore, it can be suggested that watershed development works should be need based and participatory for its success and sustainability. The factors identified in present investigation can be used to evaluate watershed projects in similar context.

REFERENCES

Ahluwalia, S.M. 2005. Reducing Poverty and Hunger in India: The role of agriculture, annual Report Essay. IFPRI 2004-2005. DOI: http://dx.doi.org/10.2499/0896297519.E02

Bihari, B.; L. Singh; R. Bishnoi and S. Kumar. 2017. Prioritization of training needs and constraints faced by watershed field functionaries and farmers. *Indian Journal of Agricultural Sciences,* 87(5): 30-36.

Bihari, B.; M. Singh; R. Bishnoi and P.K. Mishra. 2019. Issues, challenges and strategies for doubling the farmers' income in India – A review. *Indian Journal of Agricultural Sciences,* 89(8): 1219–1224.

Bihari, B.; M. Singh; R. Bishnoi; T. Roy; L. Singh; S. Kumar; L. Chand; D.M. Kadam; S.S. Shrimali; U.K. Maurya; M. Muruganandam; S.K. Sharma; R. Kumar and A. Malik. 2020. Impact of scientist-farmer interface in rainfed agro-ecosystem of North West Himalayan region: A case of Farmer FIRST Project in Doon Valley. *Indian Journal of Agricultural Sciences,* 90(3): 650–658.

Cendon, F.; Ylenia and P. Raffaella. 2022. Ethics in Water Resource Management: Roles, Frameworks, and Principles. 10.1007/978-3-319-95846-0_154.

Erin Gray and Arjuna Srinidhi. 2013. "Watershed Development in India: Economic valuation and

adaptation considerations" Working Paper. Washington, DC: World Resources Institute. Available online at http://www.wri.org/publication/watershed-development-india-economicvaluation-adaptation-considerations.

Government of India. 2008. Common guidelines for watershed development projects.

Government of India. 2021. Guidelines for new generation watershed development projects (WDC-PMKSY 2.0), department of Land resources, Ministry of rural development, Government of India.

Harvey, P.A. and R.A. Reed. 2006. Community-managed water supplies in Africa: sustainable or dispensable? *Community Development Journal*, 42(3): 365-378.

Hodgkin, J. and WASH Project Sponsors. 1994. The Sustainability of donor Assisted Rural Water Supply Projects. *Water and Sanitation for Health Project. WASH Technical Report No. 94*. Washington, DC.

Iyer, K.G. and U.N. Ray. 2005. *"Concept of Watershed Development"* in Watershed Management and Sustainable Development, Kanishka Publishers, New Delhi, (2005), p 16.

Jain, P.C. 2004. Permanent solution for water scarcity Watershed Management, *Kerla Speaking,* pp 17-19.

Jasna, V.K.; S. Som; R. Burman; R.N. Padaria and J.P. Sharma. 2014. Socio-economic impact of climate resilient technologies. *International Journal of Agricultural Science and Food Technology*, 5(3): 185-190.

Jensen, J.; S. Seth; T. Sawney and P. Kumar. 1996. Watershed Development, proc. Danida's International Workshop on Watershed Development, Watershed Development Coordination Unit, New Delhi, India.

Joshi, P.K.; A.K. Jha; S.P. Wani; T.K. Sreedevi and F.A. Shaheen. 2008. Impact of Watershed Program and Conditions for Success: A Meta-Analysis Approach. Global Theme on Agroecosystems Report no. 46. Patancheru 502 324, Andhra Pradesh, India; International Crops Research Institute for the Semi-Arid Tropics. 24 pp.

Joshi, P.K.; P. Vasudha; B. Shiferaw; S.P. Wani; J. Bouma and C. Scott. 2004. Socioeconomic and policy research on watershed management in India: Synthesis of past experiences and needs for future research. Global Theme on Agroecosystems Report no. 7. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. 88 pp.

Kakade, B.K. and N.G. Hegde. 1998. Sustainability Indicators in Watershed Management. In Proc. of the National Workshop on Watershed approach for managing degraded land in India challenges for the 21st century: GOI/DFID/ODI (pp. 295-302).

Kumar, K.B.M. and S.B. Hosamani. 2007. An Economic Evaluation of NWDPRA and Sujala Watershed Programme in Northern Karnataka-A Comparative Study, M.Sc., thesis, UAS Dharwad, India.

Mayande, V.M. and J.C. Katyal. 1996. Low Cost Improved Seeding Implements for Rainfed Agriculture. Technical Bulletin. 3, CRIDA, Hyderabad p. 26.

MoAFW. 2021. https://agricoop.nic.in/en/divisiontype/rainfed-farming-system retrieve on 07.09.2021.

National Academy of Agricultural Sciences, Natural resources. 2009. In *State of Indian Agriculture* (eds Rai, M. *et al.*), NAAS, New Delhi, 2009, p. 248.

Oswal, M.C. 1999. Watershed Management for dry land management, Associated Publishing Agriculture, New Delhi, 12(5): 23.

Pretty, J. and H. Ward. 2001. Social capital and the environment. *World Development,* 29(2): 209-227.

Reddy, V.R.; M.G. Reddy; S. Galab and B.O. Springate. 2001. Report on Watershed Development and Livelihood Security: An Assessment of Linkages and Impact in Andhra Pradesh, India. CESS/University of Leeds, Draft report

Renfro, R.Z. 2005. The Value of Participation in Development-Relevance to Soil and Water Conservation. (Available at: http://www.adbi.org).

Roy, T.; S. Kumar; L. Chand; D.M. Kadam; B. Bihari; S.S. Shrimali; R. Bishnoi; U.K. Maurya; M. Singh; M. Muruganandam; L. Singh; S.K. Sharma; R. Kumar and A. Mallik. 2019. Impact of Pusa hydrogel application on yield and productivity of rainfed wheat in North West Himalayan region. *Current Science,* (00113891), 116(7).

Sharma, K.C. 2000. Watershed Management, Self Help Groups and Inter-Institutional Linkages.

Sheng, T.C. 2000. Planning for sustainable watershed management. Guide to the Papers of Ted C. Sheng. Series 1: Publications. Finding aid: http://lib.colostate.edu/archives/finding/aids/ water/wtcs/html.

Tucker. 2003. Institutionalization of the participatory approach under the watershed programme- A menu of mechanism and instruments. *A Journey Though Watersheds,* I(6): 1-4.

Turton, C. 2000. Enhancing livelihoods through participatory watershed development in India, Overseas Development Institute, London, UK.

Venkateswarlu, B. 2011. Rainfed agriculture in India: issues in technology development and transfer. Model training course on Impact of Climate Change in rainfed agriculture and adaptation strategies, CRIDA, Hyderabad, India, 22–29 November 2011.

Vishnudas, S.; H.H. Savenije and P. Van Der Zaag. 2005. A conceptual framework for sustainable watershed management. In ICID 21st European Regional Conference, Frankfurt/Oder, Germany, and Slubice, Poland (pp. 15-19).

Wani, S.P.; Y.S. Ramakrishna; T.K. Sreedevi; T.D. Long; W. Thawilkal; B. Shiferaw; P. Pathak and A.V.R. Kesava Rao. 2006. Issues, concepts, approaches and practices in the integrated watershed management: Experience and lessons from Asia in Integrated Management of Watershed for Agricultural Diversification and Sustainable Livelihoods in Eastern and Central Africa: Lessons and experiences from semi-arid South Asia. Proceedings of the International Workshop held during 6-7 December 2004 at Nairobi, Kenya. pp. 17–36.

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Research Article

Knowledge of Rural Credit among Farmers of Udaipur Districts, Rajasthan

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ABSTRACT

The present study to assess the knowledge of rural credit of farmers was conducted in Badgaon and Girwa Panchayat Samities of Udaipur Rajasthan. Sample of 200 farmers was selected randomly and interview technique was used for data collection. Frequency, Percentage, mean per cent scores were used for analysis of data. Findings reveals that more than half of farmers (57.5%) had poor knowledge about rural credit while 24% had average knowledge of rural credit and only 18.5% of respondents had good knowledge.

Keywords: Credit, Farmers, Knowledge, Rajasthan, Rural

INTRODUCTION

The majority of Indian population lives in villages and relies on agriculture for their livelihood. Small and marginal farms as well as unprofitable farms have been issues for Indian agriculture since marginal and small farmers make up a sizable portion of the rural population. Farmers need to invest a substantial amount of money annually to ensure a good crop. In order to boost their output and augment their personal and household earnings, farmers require credit. Credit is a component of the financial intermediation system, which transfers resources between individuals, households, and businesses and distributes them over time. To improve the institutional rural credit system, the government has launched a number of initiatives. The Indian government has started implementing a number of policy initiatives to increase farmers' access to institutional credit sources. These policies have placed a strong emphasis on progressive institutionalization in order to give all farmers timely and sufficient credit support, with a focus on small and marginal farmers as well as the weaker segments of society, to enable them to adopt improved agricultural practices and modern technology in order to increase agricultural productivity and production. Credit is powerful development tool but like any instrument, its effectiveness depends on how it is used and above all how well it is known to target groups. To have effective credit delivery and efficient utilization of rural credit, it is therefore necessary to examine to what extent the farmers are aware of rural credit facilities. The present paper study attempts to study the knowledge of rural credit among farmers of Udaipur district, Rajasthan".

MATERIALS AND METHODS

The present study was conducted in two randomly selected panchayat samities of Udaipur District (Rajasthan) viz., Badgaon and Girwa. From each of the two selected panchayat samities, four villages were selected randomly. From each village, 25 farmers were selected randomly, thereby making a total sample of 200 respondents. Data were collected with the help of personal interview schedule. Frequency, percentage and Mean Percent Score were used for analyzing the data statistically.

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RESULTS AND DISSCUSSION

Rural credit plays an important role in improving the economic and social situation of the farmers. Therefore basic knowledge about of the rural credit is very important for the utilization of rural credit. Rural credit refers to government and bank initiatives to assist rural residents by offering them simple financing at affordable interest rates and with minimal paperwork. Data in Table 1 clearly show that most of the respondents (98.5%) were aware of the meaning of rural credit.

Table 1: Knowledge of the respondents regarding rural credit and sources (n=200)

Item	Frequency	Percentage
Meaning of rural credit	197	98.5
Sources of institutional credit		
Banks	164	82
Primary agriculture co-operative society	33	16.5
Grameen Sahkari Samiti	24	12
Large Area Multi-Purpose Societies (LAMPS)	21	10.5
SHG	32	16
FPO	30	15
Purpose of getting credit		
Production purpose	154	77
Consumption purpose	62	31
Advantage of rural credit		
Low interest rate	104	52
No chance of fraud	43	21.5
Easy for repayment	51	25.5
No need of any guarantee collateral security	27	13.5
Avoid cheating by moneylenders	51	25.5

There are various source of rural credit. Formal or institutional source of credit include cooperatives, commercial banks, regional rural banks, Primary Agriculture Credit Societies (PACS), Large Area Multi-Purpose Societies (LAMPS), Gram Sahkari Samiti, Self Help Groups (SHGs) and Farmer Producer Organizations (FPOs). Regarding the source of institutional credit, majority of the respondents (82%) reported bank whereas 10.5-16.5 per cent respondents were aware of Primary Agriculture Co-Operative Society, SHGs, FPO, Gram Sahkari Samiti and Large Area Multi–Purpose Credit Society. Bank provides loan for consumption and production purposes. Loan for consumption include personal loan, home loan, vehicle and educational loan and loan for production purpose include loan for new machine, implements, seed and fertilizers etc. Majority of the respondents (77%) knew that credit can be taken for production purpose while 31 per cent respondents knew that bank provides credit for consumption purpose (25%) also. Data in Table 1 regarding the advantage of rural credit depict that more than half of the respondents (52%) reported low interest rate while about one fourth respondents knew that rural credit is easy for repayment (25.5%), avoid cheating by money lenders (25.5%) and there is no chances of fraud. No need of collateral security was known to 13.5 per cent respondents.

Similar findings were revealed by Rana (2015) who reported that most of the respondents (94%) knew the concept of rural credit. The advantage i.e. credit is provided at low interest rate, no chance of fraud in getting the loan from bank, avoid cheating by moneylender, convenience in repayment of bank loan were reported by 40-65 percent respondents.

Many bank programs, such as the Kisan Credit Card (KCC), home loan, Kisan gold card, loan for agriculture implements, and vehicle loan, are available to rural residents. An economical lending option for Indian farmers is the Kisan credit card, farmers who would otherwise have to continuously go through laborious bank credit screening procedures can now have cash credit facilities through Kisan Credit Card. A four-year extension is available, and repayment may be postponed in the event of a poor crop season. A home loan is available to anyone who want to build or buy a house. Banks also offer the Kisan Gold Card, which extends hassle-free financing to farmers and/or agriculturalists against gold ornaments and/or gold wares to increase their liquidity to meet crop production expenses, investment expenses related to agriculture and/or allied agricultural activities. Additional loans for agricultural implements are available for the purchase of heavy agricultural machinery, such as tractors and power tillers.

Table 2: Knowledge of the respondents regarding credits schemes and subsidy (n=200)

Item	Frequency	Percentage
Credit schemes		
Home loan	33	16.5
Vehicle loan	11	5.5
Agriculture implements loan	73	36.5
Kisan credit card	47	23.5
Kisan gold loan	23	11.5
Dairy farm loan	13	6.5
Subsidy		
Concept	91	45.5
Different types of subsidies		
Agriculture implements	55	27.5
Domestic gas	19	9.5
Animal purchase	35	17.5

Data in Table 2 regarding the knowledge of farmers about different credit schemes indicate that more than one third of respondents (36.5%) had knowledge of agriculture implements loan, 23.5 per cent of respondents were aware about the Kisan credit card loan, 16.5 per cent respondents knew about home loan, 11.5 per cent respondents stated Kisan gold loan. Few respondents stated that banks provide dairy farm loan (6.5%) and vehicle loan (5.5%). Regarding concept of subsidy, less than half of the respondents (45.5%) were aware of the term subsidy. Different types of subsidy is provided by the banks. It was found that more than one fourth of the respondents (27.5%) knew about subsidy on agriculture implements while subsidy on animal purchase and domestic gas was known to 17.5 and 9.5 per cent respondents, respectively.

A loan is an arrangement with a bank that permits an individual or group to obtain credit or borrow funds as needed. It's a credit arrangement where the loan has a set payback period. For example- short-term, medium-term, and long-term loan.

Data in Table 3 show that the majority of the respondents (74%) knew about the short-term credit i.e. credit for 1 to 2 years while more than half of the respondents (57.5%) mentioned about medium-term loan (2 to 5 years). Very few respondents (6%) reported about the long term loan i.e. for more than 5 years.

Table 3: Knowledge of the respondents about bank loan (n=200)

Item	Freq-uency	Percen-tage
Duration of bank loan		
Short term	148	74
Medium term loan	115	57.5
Long term loan	12	6
Duration of repayment (depend upon policy and schemes)	63	31.5
Frequency of repayment of credit (every month)	125	62.5
Amount of monthly installments	122	61
Bank interest rate	110	55

Duration of repayment, monthly installment also depends on policy and schemes of institution lending credit. Table 3 indicates that less than one third of the respondents (31.5%) mentioned about the duration of repayment of credit i.e. it depends upon the credit scheme while 62.5 per cent respondents knew about the frequency of repayment of credit i.e. it has to be paid every month. Majority of the respondents (61%) were aware of the monthly installment i.e. it is fixed as per the amount of loan and duration of loan. More than half of the respondents (55%) knew about the interest rate of credit in different schemes of bank.

A certain process must be performed in order to transfer a bank loan. When clients apply for a bank loan, they must complete out an application that the bank provides. Name, address, family members, type of account, loan amount, length of repayment, interest rate, terms and conditions that apply to the specific loan, amount of monthly installments, etc. are all included in this application form. The application must be submitted to banks with all fields filled out**.**

Data in Table 4 indicate that majority of the respondents (79%) were aware of application form provided by the bank. Procedure of receiving credit from the bank includes filling of application form, submission of application form with documents, verification of documents with application form and sanctioning of credit. About three fourth of the respondents knew about the filling of application form (76%) and submission of application form with

Table 4: Knowledge of the respondents regarding bank loan procedure (n=200)

Item	Frequency	Percentage
Application form	158	79
Steps of receiving credit		
Filling application form	152	76
Submission of application form with documents	150	75
Verification of application form with documents	118	59
Sanctioning of credit	118	59
Documents required for loan		
Voter identification	148	74
Aadhar card	148	74
Domicile certificate	59	29.5
Ration card	140	70
Need of collateral security for taking loan		
Equitable mortgage of residential property	142	71
Equitable mortgage of land	142	71
Third party guarantee	45	22.5

documents (75%) while 59 per cent respondents were aware of verification of application form and documents and sanctioning of credit. Regarding various documents required for loan, majority of the respondents (74%) mentioned voter identification card (74%), Aadhar (74%) and ration card (70%) while only 29.5 per cent knew about domicile certificate. Regarding need of collateral security for taking loan, data in Table 4 reveal that majority of the respondents (71%) knew about the equitable mortgage of residential property and land while 22.5 per cent respondents were aware about third party guarantee.

Table 4 reveals that only 15 per cent respondents had knowledge about Primary agriculture credit society, 8.5 per cent respondents were aware about the type of loan i.e. short term whereas, 6 per cent respondents were aware about the process of taking loan. Data indicated that only 10.5 per cent respondents had knowledge about Large area multi-purpose credit society, 5 per cent of the respondents were aware about the short term loan and 3.5 per cent of respondents knew the process of taking loan. Regarding Farmer Producer Organization, 15 per cent of the respondents knew about only concept but not aware of type and process of taking loan. When asked about self – help group, 30 per cent respondents knew about the concept but few respondents were aware about type of loan (7%) and process of taking loan (2%).

An effort was made to categorize the respondents on the basis of their knowledge about the rural credit. Overall knowledge was categorized in poor, average and good categories. It is clear from Figure 1 that more than half of the respondents (57.5%) had poor knowledge about rural credit while 24 per cent respondents had average knowledge of rural credit and only 18.5 per cent respondents had good knowledge. The reason behind such findings may be the low educational level and low socio political participation of the respondents.

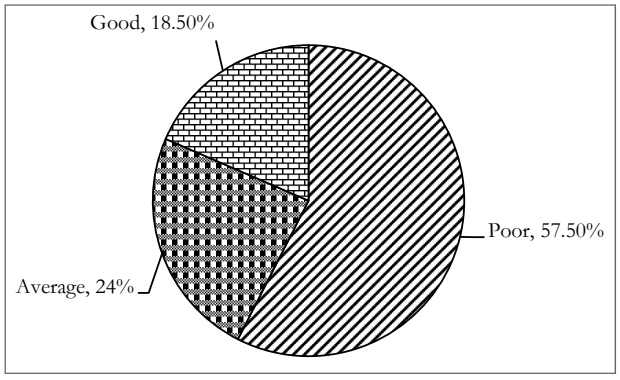

Figure 1: Overall knowledge of the respondents regarding rural credit

Similar findings were reported by Glady and Ramesh (2021) worked out awareness metrics on agriculture credit schemes with special focus on farmers and mentioned that the uneducated farmers of Orthanadu Taluk of Thanjavur, Tamilnadu were lacking in awareness about the available schemes in India.

CONCLUSION

The study revealed that a significant percentage of farmers had poor knowledge of rural credit, while a smaller percentage had average or good knowledge. This underscores the need for targeted educational initiatives to improve rural credit literacy among farmers in the region. The findings emphasize the importance of enhancing farmers' awareness of rural credit and its various schemes and procedures.

REFERENCES

Glady, V.P. and K. Ramesh. 2021. Awareness metrics on agriculture credit schemes with special focus on farmers of Orthanadu Taluk of Thanjavur, Tamilnadu. *Natural Volatiles & Essential Oils Journal,* 8: 10572-10579.

Palsaniya, R. 2024. Utilization of rural credit by the farmers of Udaipur district, Rajasthan, M.Sc. Thesis submitted to Maharana Pratap University of Agriculture and Technology, Udaipur.

Rana, P. 2015. Knowledge and utilization of rural credit by rural women. M.Sc. thesis Submitted to Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan.

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Research Article

Value Chain Analysis of Horticultural Crops: An Approach for Understanding Stakeholders' Role and Involvement in the Horticultural Production System

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ABSTRACT

India covers a various agro-climatic condition and it gives India a chance to enrich their agricultural economy through fruit production, export and generate nutrition for the people. Therefore, an attempt is made in the present study to examine the marketing channels of mango and banana by identifying stakeholders of value chain and analyzing them according to their importance and influence in the value chain. The study also covers problems and constraints faced by the stakeholders of mango and banana value chain in West Bengal, India. The stakeholders and their extension needs have been identified along the with possible mitigation strategies. The study proposes to include all the stakeholders under extension services considering the role, importance and contributions to address the issues of every node of the value chain holistically.

Keyword: Horticulture, Pluralistic extension, Value chain, Stakeholder analysis

INTRODUCTION

In India, the annual rate of growth of net value added of agro-industries at constant prices amplified from 5.15 per cent during the pre-reform period (1985–1990) to 8.3 per cent during the post-reform period (1991–96) (Gandhi *et al.,* 2001). With the introduction of the National Horticulture Mission (NHM) by the central government in 2005–06, there was a spurt in area and production of fruits and vegetables from 11.8 million hectares in 2004-05 to 16 million hectares in 2015-16 (Government of India, 2017). But benefitting from commercialization opportunities is not void of challenges. Meagre access to credit, insufficient infrastructural facilities, and poor access to market information has increased transaction costs and farmers lack strong bargaining power to negotiate with traders (Barrett, 2008; Tollens, 2006). However, commercialization through coordinated practices along value chain could increase farmers competitiveness, even for those with efficient production level (Food and Agricultural Organization, 2013). A massive post-harvest loss of the perishable horticultural produce occurs due to the absence of proper value chain management. Linking smallholder farmers to markets to vend their products provide them with the opportunity for more income and a sustainable livelihood that improves smallholder farmers well-being and poverty reduction (Maponya *et al.,* 2014). According to Machethe (2004), commercialization of agriculture leads to higher income and formation of more job opportunities. This is possible through decent policies, good distribution network, improvement of feeble marketing structures, infrastructure development, upsurge access to finance, access to market and increase access to market information for smallholder farmers (Poulton *et al.,* 2006).

A good distribution network will certainly provide a competitive advantage for any product (Rushton, 2001). Competitive advantage is formed through the creation of ever-increasing value as a result of

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cooperation between organizations involved in the distribution activities of any company's products (Walters and Rainbird, 2004). Intermediaries offer the importance of cost and the advantage of time in the wide product distribution. The consideration of price also disturbs the effectiveness of distribution channels used. Porter defines value as the maximum amount an individual is willing to pay to procure a good or avoid something undesirable from a provider (Porter, 1985). Alternatively, Pitelis (2009) describes value as the "perceived worthiness of a subject matter to a socioeconomic agent that is exposed to and/or can make use of the subject matter in question." This definition considers "subject matters" which is independent to "willingness to pay". Value is the characteristic of a performance, facility, and attribute, and all other aspects of goods and services to which consumers are willing to give their resources (Prahalad and Ramaswamy, 2004). Value chain defines a portion of an economic system where producers are linked to technical, economic, institutional and social relationships. The concept of value chain was developed by Michael Porter in his influential 1985 book titled "Competitive Advantage" (Ferris *et al.,* 2014). A value chain originally represents a set of events that a focal firm operating in a specific industry performs in order to deliver a valuable product or service for the market (Porter, 1985). A value chain is then widened to describe a sequence of organizational activities that creates, delivers, and captures value at each step, starting from the processing of raw materials to ending with the end product in the hands of the end users.

Value chain management can be described as the process of managing all sequences of the integrated activities and information to transfer value along the whole supply chain. Porter (1985) explains that value chain analysis is a strategic analysis tool that is used to better understand competitive advantage, to identify where customer value increases or decreases cost, and to better understand the company's relationships with suppliers, customers, and other companies in the industry. The value chain identifies and links a range of strategic actions of any association (Kaplinsky and Morris, 2001). Womack *et al.,* (1990) defined value chain analysis as "a technique widely applied in the fields of operations management, process engineering and supply chain management, for the analysis and subsequent improvement of resource utilization and product flow within the manufacturing processes". Alternatively, Shank and Govindarajan (1992) simply defined it as a tool for understanding the value chains that make up a product. The value chain includes the activities that occur because of the relationship with the suppliers (supplier linkages) and relationships with the consumers (consumer linkages). These activities are separated but very dependent on each other (Porter, 1996). Fearne *et al.* (2012) stated that the approach of value chain analysis is the frontier in building sustainable corporate value. The value chain framework has been adopted as a influential analysis tool for the strategic planning in individual business units and extended to the whole supply chain. Walters and Lancaster (2000), for instance, applied value chain strategy to devise significant activities that add value in the product development process and delivery across different players. Furthermore, Francis *et al.* (2008) applied the value chain analysis method to study the beef foodservice sector. The analysis showed that the collaboration between producers and processors could remove undesirable wastes.

The value chain provides understanding on how products flow (measure of input-output relationships along the chain and ensure consistency of physical flows along the chain), financial flows (value added net benefits at each activity), and the information flow (prices, quantity and quality feedback of produce), all actors involved in an economic activity which utilizes inputs and services to develop output destined to ending consumer (Ferris *et al.,* 2014). The concept of value chain, therefore, showcases the entire range of activities from initial production stage to final market destination with a stress of value addition at each stage (Webber and Labaste, 2007; Ricketts *et al.,* 2014; Norton, 2014). In the case of value chain research on almost all kinds of agriculture or horticulture based commodities, farmers always remain under the focus light. Due to their most vulnerable socio-economic condition, they seem like the main concern of the chain. Researchers care most about farmers problems and are always trying to figure out how to increase producers' share only. But to get an effective value chain focused on just one stakeholder is not enough. It is required to provide equivalent importance to all the other stakeholders engaged in the chain along with the

producer and properly analysis all of their problems to identify the effective solution. So that all the stakeholders of the value chain can get an equivalent share of the consumers' rupees and make the chain most effective.

Horticultural crops mostly fruits and vegetables have a great importance in world economy and it consider as the raw material for several industries but the value chain management of horticultural crops are more complexes than others non perishable goods due to its high perishable nature, seasonality, bulkiness etc. The actors of the fruits and vegetables value chain should have proper knowledge about the cold storage facilities, fluctuations in demand and prices, increasing consumer concerns for food safety & quality, skill full post harvest handling etc. to kept the product fresh and maintain its virgin quality. In this study, we have tried to explore the value chain map of mango and banana. This study has also emerged out the extension intervention required for the mango and banana value chain.

MATERIALS AND METHODS

Identifying actors or stakeholders in value chain is relevant since it helps to identify constraints and possible solutions that exist at different levels in the value chain, and to identify location and position of the poor in the value chain (Ferris *et al.,* 2014). A stakeholder is an individual or group with an interest in the success of an organization in fulfilling its mission – delivering intended results and maintaining the viability of its products, services and outcomes over time. Stakeholders' engagement differs significantly across location of the project (Jenny *et al.,* 2016).

Nadhika and Krishnankutty (2017) stated stakeholder analysis is the identification of a project's key stakeholders, an assessment of their interest, and the way in which these interests affect project riskiness and viability. It is linked to both institutional appraisal and social analysis: drawing on the information deriving from these approaches but also contributing to the combining of such data in a single framework (Overseas Development Administration, 1995). It contributes to project design through the local framework and by helping to identify appropriate form of stakeholder participation.

For this study, two horticultural crops, mango and banana are selected. As Malda and Nadia districts of West Bengal are leading producers of mango and banana respectively in India, mango producers from Malda district and banana producers from Nadia district were the target population for the study. Araidanga village of Ratua-I block in Malda district was selected as a research area for mango value chain and Habibpur market near Ramlaxmitala village of Ranaghat-I block in Nadia district was selected as a research area for banana value chain. Respondents were selected through snowball sampling method.

The information like production situation, cost of production, marketing system, marketing channel, mode of selling, quality, grading and packaging, income from mango and banana cultivation, price determination system, information sharing system, supporting organization, means of market information and production and marketing problems related data were collected from the farmers using a structured schedule. An interview schedule was designed for primary data collection. The interview time was fixed as per the farmer's convenience. Regular checking and validation were done immediately after filling the interview schedule. The traders were also interviewed in the same manner. After collection of necessary information, stakeholder analysis was done.

RESULT AND DISCUSSION

Stakeholders are broadly categorized into two categories- i) Primary stakeholder and ii) Secondary stakeholder. Primary stakeholders are those who are ultimately affected by the project either in positive way or in negative way. Secondary stakeholders take part in the process of delivering aid to the primary stakeholders.

Major stakeholders in the horticultural production system

i) Nursery developers: Provide good quality planting materials to the farmers.

ii) Input suppliers: Supply inputs such as fertilizers, pesticides, machinery etc.

iii) Growers: They can be either the land owners, leased contractors, farmer cum merchants who are involved in cultivation activities.

iv) Land owners: Owners of the land who lease out the land on contract basis for a particular period of time. They are unaware about the marketing of the produce from their field.

v) Pre-harvest contractor: They take fields for lease on contract basis for a pre fixed rate and undertake the harvesting activities and market the produce.

vi) Collection agent: They own individual collection units or sheds. They procure products directly from the producers. Sometimes, they are farmers themselves, and they market their produce through their shed along with the produce of other farmers.

vii) Traders: They are large merchants from different parts of India. They procure products either directly from large farmers or through the collectors and distribute to the distant market suppliers.

viii) Wholesalers: They collect the produce from the traders at the terminal market and supply the produce to retailers and processors.

ix) Retailers: They are the vegetable & fruit stall owners, roadside vendors and supermarkets from where the consumers buy the products. They may sell the produce as such or after value addition and processing.

x) Processors: They convert the raw product into value added products such as pulp, jams, jellies, juice, pickle and other canned products.

xi) Exporters: Exporters are involved in international trade. They supply high quality products to other countries by taking into account their quality implications.

xii) Consumers: They are the end users from within the locality to other country. With change in the area, the preference of the consumer also changes.

xiii) Development personnel: They are extension workers of institutions such as horticultural department, agricultural universities, KVK, NGO, regional research stations etc. who provide services to the farmers and other stakeholders.

xiv) Local body members: They are mainly involved in political and organizational activities wherein policies regarding various aspects of value chain are formulated by them.

Major roles and involvement of the stakeholders–

i) Primary role of the stakeholders is to develop and meet strategic objectives of the project by contributing their experience and perspective.

ii) They act as suppliers of raw materials and services.

iii) Stakeholders play the role of effective coordinator of the project.

iv) They identify demand for the services and play an important role to monitor and evaluate the project.

i) Stakeholder analysis of mango value chain

In this study the farmers, aratdars, wholesalers, retailers and consumers are the primary stakeholder of the project. They are directly related with the project and would be directly affected by the project. Government of West Bengal (Department of Horticulture) and money lenders are the secondary stakeholder of the project.

Prioritization of stakeholders based on their 'Importance to' and 'Influence' on the project

The degree of importance and influence of the stakeholders depicted in Table 1 & 2 are plotted on a two by two matrix. The stakeholders are represented by their respective serial number of the stakeholder table. The matrix thus prepared appears as below (Figure 1 & 2).

From Figure 1, it can be said-

a) laborer of the mango orchard, local mango sellers, guards of mango orchard, harvesting tool makers and local aam-satta and pickle sellers belong to

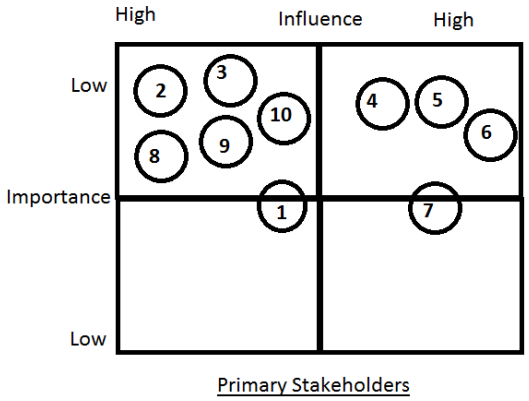

Figure 1: Stakeholders prioritization matrix (primary stakeholder)

Table 1: Primary stakeholder analysis of mango value chain

Primary stakeholders of the project	Role in implementation	Interest in initiative	Impact of initiative in the project	Importance of initiative success	Influence over initiative
Mango farmer	To cultivate mango, to lease it.	To get more project by producing mango.	+	High	Medium
Labours	To provide services for maintaining mango orchard.	To get employed throughout the season.	+	High	Low
Local mango seller	To sell mango locally.	To get maximum project.	+	High	Low
Aratdar	To gather mango from local farmers and trading.	Get maximum value of mango and store them properly.	+	High	High
Transporter	Transport of mango from aratdars to various markets.	Fast and proper transport of mango.	+	High	High
Wholesaler	Selling mango to small scale mango sellers.	To sell large amount of fruit to gain interest.	+	High	High
Pesticide and fertilizer seller	To sell Pesticide and fertilizer for better quality production.	To get maximum no of buyers.	+	Medium	High
Guards of mango orchard	To prevent thieves of mango and protect the garden.	To earn their livelihood in peak mango season.	+	High	Low
Harvesting tool maker	To sell tools needed for harvesting of mango.	To earn livelihood in the harvesting season.	+	High	Low
Mango pickle and aam-satta seller	To process the fruit for edible purposes.	To sell the processed fruit.	+	High	Low

Table 2: Secondary stakeholder analysis of mango value chain

Secondary stakeholders of the project	Role in implementation	Interest in initiative	Impact of initiative in the project	Importance of initiative success	Influence over initiative
Govt. of West Bengal (Dept. of Horticulture)	To provide various aids and subsidies for better growing of mango.	To get reasonable income of the state from mango orchards and from mango export.	+	High	Very high
Money lender	To provide money to the farmers.	To get extra profit from mango farmers.	-	Low	High

stakeholders who have low degree of influence on the project but high importance for its success;

b) local market wholesalers (aratdars), urban market wholesalers and transporters belong to Box B stakeholders, who have high degree of influence on the project and also high importance for its success;

c) pesticide and fertilizer seller have both the characteristics of Box B and Box C. They have medium importance of initiative success but high influence over the initiative;

d) farmers have both the characteristics of Box D and Box A. They have a medium importance of initiative success and medium influence over initiative.

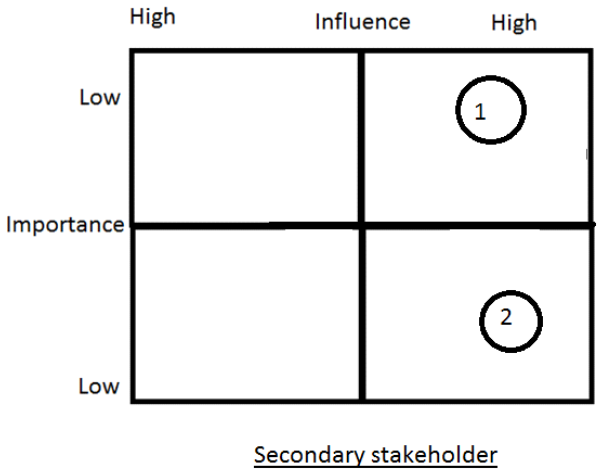

Figure 2: Stakeholders prioritization matrix (secondary stakeholder)

Table 3: Primary stakeholder analysis of banana value chain

Primary stakeholders	Impact on the chain	Importance of initiative success	Influence over initiative	Problems faced by the stakeholders
Input dealers	+	High	High	i) Lack of knowledge about the exact dose of chemical application without hampering the quality of the product.
Farmer/producer	+	High	Medium	i) Lake of knowledge about desuckering and propping of banana plant. ii) Dehandling of false hands of bunch to increase the growth of others healthy bunch. iii) Lack of awareness about proper time and quantity of input application. iv) Inferior information about pest and disease management which reduce product quality.
Labours	+	High	Low	i) Improper handeling increase the number of damaged fruit due to high fragility of ripe banana. ii) In case of banana, price varies based on grade of the fruit. iii) Lack of knowledge about effective grading may cause huge loss.
Trader/pre-harvest contractor	+	High	Very High	i) Excessive wastage during low marketing demand. ii) High transportation cost. iii) Improper knowledge about post harvest handling.
Aratdar/broker	+	High	Very High	i) Lack of knowledge about ripening technique.
Transporter	+	Medium	Low	i) Lack of proper infrastructure to save bananas from pressure and friction with other objects. ii) Lack of knowledge about proper packing material.
Wholesaler	+	High	High	i) Very less knowledge regarding ethylene ripening technique of banana.
Retailer	+	High	High	i) Lack of training regarding wrapping of banana with aluminium foil to increase its self life, keep them cool and protected from the light.
Consumer	+	High	Medium	i) Consumers have no information about standard price; so they often take the product with more price than its actual cost.
Maintenance and harvesting tool maker	+	Medium	Low	i) Often equipment's are not properly sterile to inhibit spreading of infection.

Table 4: Secondary stakeholder analysis of banana value chain

Primary stakeholders	Impact on the chain	Importance of initiative success	Influence over initiative	Problems faced by the stakeholders
Govt. of West Bengal (Dept. of Horticulture)	+	High	Very high	i) Lack of infrastructure and awareness regarding high quality commercial cultivation. ii) Number of effective tissue culture lab for good quality planting material is very less. iii) Irrigation is not available to all the farmers. iv) Communication gap between researcher, extension agent and farmers.
Money lender	–	Low	High	

From Figure 2, following conclusions can be made-

a) Among the secondary stakeholders, Government of West Bengal (Department of Horticulture) belongs to Box B; who have high degree of influence on the project and high importance for its success.

b) Money lenders belong to Box C; who have high influence hence can affect the project outcome but their targets are not the targets of the project.

Prioritization of stakeholders based on their 'Importance to' and 'Influence' on the project

From Figure 3 and 4, it can be said-

a) Input dealers, teaders/pre-harvest contractors, aratdars or brokers, wholesalers, retailers and Govt. of West Bengal (Dept. of Horticulture) belong to stakeholders who have high degree of influence on the project and high importance for its success.

Table 5: Services and supports needed by the stakeholders of mango value chain

Actors	Services Needed		
	Informational	**Infrastructural**	**Skill Oriented**
Producers	i) Supplying market information through Gram Panchayets. ii) Supplying information about varieties with higher demands. iii) Use of modern communication tools. iv) Provision of agricultural loans.	i) Good roads from farm gates to local markets. ii) Construction of market shades and storage facilities. iii) Supplying good quality planting materials.	i) Training of modern cultural practices. ii) Training operations to build skillful labours. iii) Training regarding use of advanced harvesting tools, pest management, removal of latex etc. iv) Training for proper propagation methods.
Wholesalers	i) Post harvest handling methods. ii) Information about demand of the market and export chances. iii) Precautions needed at the time of transportation. iv) Provision of bank loans. v) Use of ICT	i) Providing market facilities. ii) Good motorable roads. iii) Cold storages to store fruit a longer times. iv) Constructing processing factories. v) Constructing regulated markets. vi) Proper supply of electricity.	
Retailers	i) Supply information about advanced packaging systems to attract consumers. ii) Information to reduce handling losses. iii) Supply information to increase shelf life of the fruit. iv) Information about market demand and market competitiveness.	i) Cleaning and waxing centers to make the fruit attractive. ii) Construction of processing factories. iii) Construction of regulated markets. iv) Proper supply of electricity. v) Good market conditions.	
Consumers	i) Supply of information about standard and properly graded products.	i) Good market condition. ii) Availability of properly graded and standard processed fruit products. iii) Proper pricing for value added products. iv) Construction of regulated markets.	
Labours	i) Proper sorting and grading methods. ii) Information about advanced picking tools.	i) Supply of advanced picking tools. ii) Proper weighing measures.	i) Training for use of advanced picking tools. ii) Training needed for proper sorting and grading of the fruit. iii) Training needed for proper maintenance of the orchard.
Picking tools and packaging material makers	i) Information about the type of picking tools and packaging materials needed.	i) Supply of inputs for making of suggested packaging materials and picking tools.	i) Learn them how to make advanced tools suggested and packaging materials.
Local aamsatta and pickle sellers	i) Information needed for preparing aamsatta and other pickles. ii) Information about market price of the aamsatta and other pickles. iii) Information about demand of the aamsatta and pickle in urban markets.	i) Forming groups of the local aamsatta and pickle sellers. ii) Providing ideas and machineries needed to prepare aamsatta and pickles locally. iii) Construction of processing factories and creating employment chances.	i) Training for preparation of the value added products. ii) Training for maintaining quality and hygiene of the value added products.

b) Labourers engaged in mango production and marketing remain in Box B stakeholders, who have high degree of importance but low influence on the project.

c) Producers and consumers remain between Box A and Box B with have high importance and medium influence.

d) Transporter and harvesting tool maker belongs to Stakeholders are falling in Box B and Box D with medium importance and low influence and Money lender is placed in Box C with low importance and high Influence.

Role of extension in problem management

Today's agricultural marketing system is going through a rough period as there is no proper management in the market system. The shortcomings of public sector extension arrangements in India are well documented

Table 6: Services and supports needed by the stakeholders of banana value chain

Actors	Services Needed		
	Informational	**Infrastructural**	**Skill Oriented**
Input dealers	i) Required awareness about local pest and diseases, their symptoms and control measure. ii) Knowledge about chemical composition & doses of fertilizer & plant protection chemical. iii) Information about consumer need and preference.	i) Increase in Govt. subsidy on major fertilizer and plant protection chemical to make their price within farmer's effort	i) Training on uses of optimum dose of fertilizer and plant protection chemical in local basis. ii) Training on consumer motivating skill.
Producers	i) Information dissemination about location specific high yielding varieties with good marketing demands. ii) Timely supply of marketing information (e.g. marketing demand, price up and down, future demand etc.) to make more profit. iii) Disseminating effective knowledge on modern technologies used in banana cultivation. iv) Generate farmers knowledge about tissue culture method of banana cultivation. v) Create awareness about credit related Govt. facilities for banana producer.	i) Supplying healthy, high yielding planting materials. ii)Improve irrigation facilities and availabilities of electricity. iii) Constructed more roads to improve connectivity from farmer's field to Arat or wholesale market. iv) Increase market shades and storage facilities. v) Developed crop insurance and credit policies for banana producers.	i) Training on tissue culture method of banana cultivation. ii) Demonstration on healthy rhizome selection, pre-sowing treatment and removal of extra sucker from standing plant's surrounding. iii) Training on earthing up and optimum fertilizer and plant protection chemical use. iv) To improve farmer's skill to protect pre-mature fruits from sucking insect attack. iv) Training regarding use of advanced harvesting tools for banana
Aratdars/ Brokers	i) Information about local and export demand. ii) Required proper knowledge about cleaning, grading, mass handling and packaging for transport	i) Improve storage capacity with low temperature facility.	i) Training on effective grading skill and export market preference.
Traders/ pre-harvest contractors/ Wholesalers	i) Required knowledge about post-harvest handling technique of banana. ii) They must have knowledge about banana ripening procedure. iii) Information about market demand and export chances of banana. iv) Needed proper knowledge about transportation handling to reduce jerking damage.	i) Increased number of cold storage with low temperature and mass storage facilities. ii) Required good motorable road, connecting all possible market of the produce. iii) Established regulated markets with proper infrastructure. iv) Reduced price fluctuation and commission charge	i) Training on mass handling capacity. ii) Workshop on ripening chamber making and effective ripening procedure. iii) Training on proper storage maintenancei. v) Demonstration on cart board packaging and using banana leaves for reducing transportation damage
Retailers	i) Needed information about consumer test and preference. ii) Supply knowledge about advanced packaging technique to attract consumers. iii) Information to increase self-life of banana and making fruit attractive and fresh to the consumer. iv) Knowledge to reduce handling losses. v) Effective knowledge about consumer handling technique.	i) Construction of regulated markets. ii) Provided low interest credit to increase business size. iii) Controlled price fluctuation and commission charge. iv) Proper supply of electricity.	i) Training on post-harvest handling and waste reduction technique. ii) Demonstration on how to increase self-life of banana. iii) Training on consumer choice and consumer handling technique.
Consumers	i) They must have awareness about fresh well ripening fruit and its slandered market price.	i) Regularly fixed purchasing price. ii) Availability of properly graded & standard processed fruit products.	i) Training on quality of fruit, its nutritive value, when it start to rotten etc.
Labourers	i) Knowledge about Proper sorting and grading methods. ii) Information about advanced packaging tools and technique. iii) Awareness about their right and facilities.	i) Govt. should increase wage rate for unskilled agricultural labourer. ii) Provided credit for their child education, starting small business etc.	i) Demonstration on advanced use of picking tools and technique. ii) Training needed for effective grading skill of the fruit. iii) Training needed for proper intercultural operation and harvesting technique and tools.
Transporters	i) Knowledge about road condition, product durability, jerking reduction technique etc.	i) Govt. should provide credit subsidies and low interest loan to purchase an advance quality transport track with cold storage and proper aeration facilities.	i) To learn them how to drive well with fragile produce and make jerking proof packaging technique.

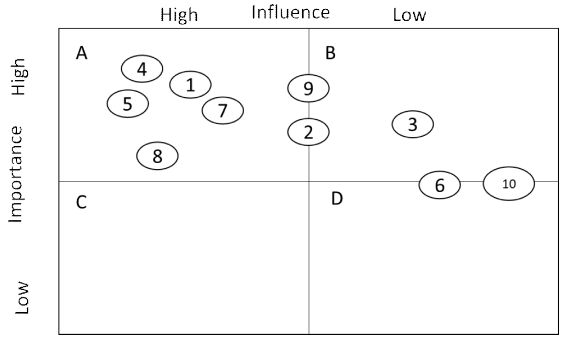

Figure 3: Stakeholders prioritization matrix (primary stakeholder)

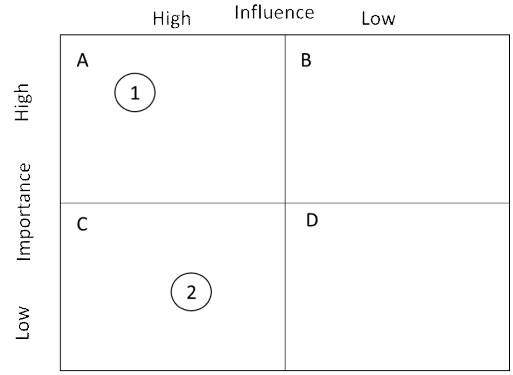

Figure 4: Stakeholders prioritization matrix (secondary stakeholder)

and some reform measures have been implemented (Farrington *et al.,* 1998). But unfortunately, planning and evaluation of such programmes is based on a very narrow view of the proper role of extension, equating it to an agency for technology dissemination.

Previously extension was a concept of seed to seed management, but today's market situation needs a seed to table management system. All the stakeholders are important part of the system, there should be strategies for all. Traders are not getting information like actual market demand, market opportunities, price opportunities, risk management etc. There are not enough storage facilities, transportation is a big problem in rural India, and handling of goods during transportation is also poor. So, there must be an all round approach including all the stakeholders of the value chain for overall development of the mango value chain.

CONCLUSION

From the above discussion it can be seen that the growing agricultural marketing system of India is facing some problems and the farmers are not getting the right prices of their produces. There is considerable possibility of duplication of effort, getting contradictory information and resultant confusion gaps among farmers and organizations. Qualities of messages from non-public agencies are not always up to the mark and there is considerable lack of effective coordination among agencies as there is no strong platform for coordination. As motives and objectives of all stakeholders are not always aligned with farmers, pluralistic approach is sometime making the extension system more complex for farmers. Different models of funding and incentive arrangements should be made to support coordination amongst advisory networks of public-private partnership extension. Comparative analysis of forms of public-sector involvement in the regulation should be done in regular interval to prevent mismatch between organizational agendas and problems due to hidden agendas. One of the most significant challenges is lack of leadership and conflict resolution mechanism which is largely averting effective collaboration as there are efforts of collaboration without imbibing the spirit. Political and economic sustainability should be maintained. The study revealed that there are multiple actors and differential technology needs at different stages of value chain of different crops. Extension professional and researchers should identify those needs and develop technologies accordingly. In order to implement this pluralistic extension we have to undertake orientation and sensitization activities about the value chain to the researchers, policy makers and extension specialists. We should invest not only farmers and infrastructures, but also create network of stakeholders and subsequently investing on these networks too. Pluralistic extension should include robust and sustainable mechanism that will accommodate all these stakeholder networks and cater their needs with priorities and optimization.

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REFERENCES

Barrett, C.B. 2008. Smallholder market participation: Concepts and evidence from eastern and southern Africa. *Food Policy,* 33(4): 299–317.

Farrington, J.; V. Sulaiman and S. Pal. 1998. Improving the effectiveness of agricultural research and extension in India: An analysis of institutional and socio-economic issues in rain fed areas. National Centre for Agricultural Economics and Policy Research, New Delhi.

Fearne, A.; M.G. Martinez and B. Dent. 2012. Dimensions of sustainable value chains: Implications for value chain analysis. *Supply Chain Management: An International Journal,* 17(6): 575-581.

Ferris, S.; P. Engoru and E. Kaganzi. 2014. Making market information services work better for the poor in Uganda. *Cahiers Agricultures,* 23(4-5): 336–343.

Food and Agricultural Organization. 2013. The food security through commercialization of agriculture programme in the Caribbean region. Food and Agriculture Organization of the United Nations. Rome.

Francis, M.; D. Simons and M. Bourlakis. 2008. Value chain analysis in the UK beef foodservice sector. *Supply Chain Management: An International Journal,* 13(1): 83–91.

Gandhi, V.; G. Kumar and R. Marsh. 2001. Agroindustry for rural and small farmer development: Issues and lessons from India. *International Food and Agribusiness Management Review,* 2: 331–344.

Horticulture Statistics at a Glance. 2017. Horticulture Statistics Division, Department of Agriculture, Cooperation and Farmers Welfare; Ministry of Agriculture & Farmers welfare, Government of India.

Jenny, P.; K. Alice; L. Campbell; W. Dianne; H. Michele; W. Mark; B. Sarah; A. Emma and P. Charley. 2016. Engaging parents in schools and building parent-school partnerships: The role of school and parent organization leadership. *International Journal of Educational Research,* 79: 128-141.

Kaplinsky, R. and M. Morris. 2001. A Handbook for Value Chain Research, Brighton, United Kingdom, Institute of Development Studies, University of Sussex.

Machethe, C. 2004. Agriculture and poverty in South Africa: Can agriculture reduce poverty. Overcoming Underdevelopment Conference.

Maponya, P.; D. Modise; E.V. Heever; S. Mahangu; N. Baloyi; A. Maluleke; D. Chauke; R. Mkhari; J. Carstens; M.V. Walt; L. Sole; M. Duba; J. Malebana and M. Mphahlele. 2014. The establishment of vegetable and fruit markets and nurseries: A case study in the Waterberg district, Limpopo province, South Africa. *Journal of Agricultural Science,* 6(7): 38-47.

Nadhika, K. and J. Krishnankutty. 2017. Stakeholder analysis for farmer inclusive value chain development in mango. *Journal of Extension Education,* 29(1).

Norton, R. 2014. Agricultural value chains: A game changer for small holders. Devex.

Overseas Development Administration. 1995. Guidance note on how to do stakeholder analysis of aid project and programme. Social Development Department.

Pitelis, C.N. 2009. The co-evolution of organizational value capture, value creation and sustainable advantage. *Organization Studies* 30(10): 1115–1139.

Porter, M.E. 1985. Competitive advantage – Creating a sustaining superior performance. The Free Press, New York.

Porter, M.E. 1996. What is strategy? *Harvard Business Review,* 74(6): 61–78.

Poulton, C.; A. Dorward and J. Kydd. 2006. Overcoming market constraints on pro-poor agricultural growth in Sub-Saharan Africa. *Development Policy Review,* 24(3): 243–277.

Prahalad, C.K. and V. Ramaswamy. 2004. The future of competition: Co-creating unique value with customers. Harvard Business School Press, Cambridge.

Ricketts, K.D.; C.G. Turvey and M.I. Gómez. 2014. Value chain approaches to development. *Journal of Agribusiness in Developing and Emerging Economies,* 4(1): 2–22.

Rushton, A.; P. Chroucher and P. Baker. 2010. The Handbook of Logistics and Distribution Management, 4th Eds. Kogan Page, London.

Shank, J.K. and V. Govindarajan. 1992. Strategic cost management: the value chain perspective. *Journal of Management Accounting Research,* 4(1): 179–197.

Tollens, E.F. 2006. Market information systems in sub-Sahara Africa: Challenges and opportunities. *Information Systems Journal,* pp 12–18.

Walters, D. and G. Lancaster. 2000. Implementing value strategy through the value chain. *Management Decision* 38(3): 160–178.

Walters, D and M. Rainbird. 2004. The demand chain as an integral component of the value chain. *Journal of Consumer Marketing,* 21(7): 465–475.

Webber, M. and P. Labaste. 2007. Using value chain approaches in agribusiness and agriculture in Sub-Saharan Africa. Washington, DC: The World Bank.

Womack, J.P.; D. Jones and D. Roos. 1990. The machine that changed the world, Macmillan, New York.

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Research Article

Constraints in Adoption of Recommended Production Technologies of Chilli in Punjab

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ABSTRACT

The present study was undertaken to know the constraints faced by chilli growers in adoption of recommended production technologies in Punjab. A sample of 120 chilli growers was selected randomly from four districts of Punjab for the present study. The data were collected by personally interviewing the chilli growers with the help of interview schedule. Study revealed that the majority of the respondents were matriculate, possessed medium operational land holding and medium level of extension contacts. Although majority of respondents sought advice from pesticide dealers, most of them regularly consulted progressive or fellow farmers for acquiring farm information on chilli cultivation practices. WhatsApp, newspaper and YouTube were emerged as important sources of information for chilli growers. It was indicated that almost half of the growers had 12-21 years of experience in chilli cultivation and only 18.33 per cent of them acquired training on vegetable cultivation. Major constraints encountered by chilli growers were scarcity of labour at the time of picking, fluctuation in market prices or no support price fixed by government on the crop, costly hybrid seed, problems in identifying the pests or diseases, inadequate knowledge on post-harvest practices and poor quality of fruit produce due to rains were the most severe constraints as perceived by the chilli growers.

Keywords: Chilli growers, Constraints analysis, Marketing, Punjab state

INTRODUCTION

Chilli [*Capsicum annum* L.] is one of the most important commercial vegetable cum spice crop grown in India (Singh *et al.,* 2020). There are more than 400 different varieties of chillies found all over the world. It is also called hot pepper, cayenne paper, sweet pepper, bell pepper etc. India is the only country that is rich in many varieties with different quality factors. In daily life, chillies are the most important ingredient in many different cuisines around the world as it adds pungency, taste, flavor and colour to the dishes and chillies are in high demand on the global market. It has almost become an integral part of the diet of both the rich and the poor in India. India is not only the world's largest producer of chillies, but also the world's largest consumer. India is recognised as the 'Land of Spices or Spice Bowl of the World' (Jha and Das, 2019). Being a tropical and subtropical crop, chilli needs a warm and humid climate to thrive. Though chilli can be grown in a variety of soils, well-drained loamy soils with high organic matter are ideal for cultivation (Reddy *et al.,* 2018). Chillies are rich in vitamins, especially in vitamins A and C. They are rich in magnesium and iron. It is also reported that they have the power to boost the immune system and lower cholesterol (Goudappa *et al.,* 2012). Globally, chilli crop is cultivated on an area of around 20.20 million hectares with a production of 37.62 million tonnes (Thakur *et al.,* 2020). In India, chilli occupied an area of 410.90 thousand hectares, with a production of 4363.17 thousand tonnes (Anonymous, 2021a). India is meeting approximately 25 per cent of the world chilli requirements and is considered to be the leader in chilli exports, followed

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by China with 24 per cent (Verma *et al.,* 2018). With a record annual production of 13.76 million tonnes, India is the world's greatest producer of chillies, followed by China with a production of 3.00 million tonnes. India also leads in having the maximum area covered under chilli cultivation (Geetha and Selvarani, 2017). In the state of Punjab, area under chilli crop was 8.78 thousand hectares and 17.63 thousand tonnes, with an average yield of about 20.09 quintals per hectare (Anonymous, 2021b).

There is great potential to increase production of this crop in the future, if growers are oriented towards entrepreneurship and the adoption of modern technology. Scientists have developed the scientific chilli production practices, but all the farmers may not be adopting the practices to their fullest extent. A wide gap between the potential production and the actual yield harvested by the farmers has been observed. Non-adoption of farm technology might be due to inappropriateness, ignorance, unwillingness and inability of the farmers (Singh, 1979). There can be several other constraints faced by chilli growers in their cultivation which leads to their low productivity. These constraints also need to be analyzed in order to formulate appropriate interventions. Therefore, in order to facilitate the adoption of any production technology among farmers, it is necessary to analyze faced by chilli growers in Punjab state.

MATERIALS AND METHODS

The study was conducted in Punjab state during the year 2022-23. Out of 23 districts in Punjab, four districts namely Jalandhar, Sangrur, Patiala and Tarn Taran were randomly selected for the present study. A list of chilli growers was prepared from information available with the State Department of Horticulture or *Krishi Vigyan Kendras* (KVKs) of the selected districts. From each selected district, 30 farmers were selected randomly with the help of random number table method. Thus, the total sample size for the present study was 120 farmers. To understand the different constraints in the adoption of production technology of chilli, a structured schedule was developed after reviewing relevant studies and discussion with the farmers. The interview schedule was pretested in non-sampled area to remove any ambiguities and necessary modifications were made as the response pattern of the farmers Extent of adoption was measured in terms of percentage of number of farmers adopting recommended practices to total number of farmers growing chilli. The responses to the constraints were measured on dichotomous scale in the form of yes/ no. The collected data was tabulated and analysed by using frequency and percentage. The mean score was calculated by the following formula:

$$X = \frac{\Sigma Xi}{N}$$

Where Xi = observation score
N = Total number of observations
X = Mean Score

RESULTS AND DISCUSSION

It consists of the items related to socio-personal characteristics of the respondents viz., age, education, occupation, family type, operational land holding, number of family members, experience of chilli cultivation, training exposure, mass media exposure and extension contacts. The information pertaining to socio-personal characteristics of the chilli growers has been furnished in the following Table 1. It was also revealed that half of chilli growers (50.83%) belonged to age group between 43-59 years and were from joint families. Most (49.17%) of the respondents were educated up to matric level while 40.83 per cent of the farmers were medium farmers, holding a land of 10-25 acres and majority (73.33%) of them had less area under chilli crop upto 1-9 acres. It was found that 47.50 per cent of the farmers had two members engaged in chilli cultivation. The study further envisaged that 48.33 per cent of the growers had 12-21 years of experience in chilli cultivation and only 18.33 per cent of them acquired training on vegetable cultivation.

Mass media plays an important role in adoption process. It refers to the communication tool for the farmers to gain adequate knowledge and brings more exposure to new technologies. It was assessed in terms of use of Print media such as newspaper, PAU kheti sandesh, Changi kheti, package of practices and social media like YouTube, Facebook, Whatspp and PAU website for seeking agricultural information. Among print media majority of respondents consulted newspaper with mean score of 2.04 followed by PAU package of practices (mean score 1.83) and Changi

Table 1: Distribution of respondents according to their socio-personal characteristics (n=120)

Characteristics	Categories	Frequency (f)	Percentage (%)	Mean ± S.D.
Age (years)	26-42	33	27.50	46.91±11.10
	43-59	61	50.83	
	60-76	26	21.67	
Education	Illiterate	12	10.00	10.19±3.78
	Primary	4	3.33	
	Matric	59	49.17	
	Senior secondary	34	28.33	
	Graduate	11	9.17	
Family type	Nuclear	52	43.33	-
	Joint	68	56.67	
Operational land holding (acres)	Marginal (<2.5)	3	2.50	16.92±16.37
	Small (2.5-5.0)	14	11.67	
	Semi-medium (5-10)	36	30.00	
	Medium (10-25)	49	40.83	
	Large (>25)	18	15.00	
Total area under chilli (acres)	1-9	88	73.33	8.20±7.03
	10-18	29	24.17	
	19-27	3	2.50	
No. of family members engaged in agriculture	One	42	35.00	1.89±0.92
	Two	57	47.50	
	Three	21	17.50	
Experience in chilli cultivation (years)	2-12	45	37.50	13.91±7.80
	12-21	58	48.33	
	21-31	17	14.17	
Training acquired in vegetable cultivation	Acquired	22	18.33	-
	Not acquired	98	81.67	

Kheti (mean score 1.54). As far as the use of social media is concerned, majority of the respondents had acquainted themselves about adoption of recommended technologies through use of WhatsApp (mean score 2.17), followed by You Tube (mean score 1.80) and Facebook (mean score 1.70), whereas in case of mobile services respondents appraised Kisan Call Centre with mean score of 1.50, edrmation. It can be observed from the Table 2 trainee. it weather related app (mean score 1.48) and PAU kisan App (mean score 1.37). Among farm broadcast, majority of the respondents had gathered information from television at Mera Pind Mera Khet (mean score 1.55) followed by radio (mean score 1.06). The advancement in information communication technology has led the farmers to use more of these social media platforms than printed media and other sources. By focusing more on these platforms, a larger audience of farmers can be reached. Radio is the least used platform for information among farmers due to the popularity of social media. Regarding overall mass media exposure, it was revealed that 70.00 per cent of respondents had medium level of mass media exposure for seeking information regarding chilli cultivation followed by 15.83 per cent of the respondents had high level of mass media exposure (Table 2).

Extension contacts referred to the frequency to which respondents made purposeful contacts with different extension agents for getting information

Table 2: Distribution of respondents according to their mass media exposure (n=120)

Source	Regularly		Sometimes		Never		Mean
	F	%	F	%	F	%	score
Print media							
Newspaper	48	40.00	29	24.17	43	35.83	2.04
PAU Khetisandesh	25	24.17	16	10.83	79	65	1.51
Changi Kheti/Progressive farming	24	20.00	17	14.17	79	65.83	1.54
PAU package of practices	34	28.33	32	26.66	54	45.00	1.83
Social media							
WhatsApp	61	50.83	19	15.83	40	33.33	2.17
Facebook	21	17.50	43	35.83	56	46.67	1.70
YouTube	39	32.50	27	22.25	54	45.00	1.80
PAU Website	3	2.50	5	4.17	112	93.35	1.10
PAU facebook live	7	5.83	11	9.17	102	85.00	1.20
Mobile services							
Weather Related app	16	13.33	27	22.50	77	64.17	1.48
Kisan Call Center	12	10.00	36	30.00	72	60.00	1.50
PAU Kisan app	11	9.17	23	19.17	86	71.67	1.37
Television (Farm broadcast)							
Mera Pind Mere Khet	9	7.50	44	36.66	67	55.83	1.55
Krishi Darshan	4	3.33	2	1.67	114	95.00	1.08
Radio							
Dehati programme	1	0.83	6	5.00	113	94.17	1.06
SMS Service							
PAU/KVK	3	2.50	5	4.17	112	93.33	1.09

regarding chilli cultivation. The data furnished in Table 3 illustrated that pesticide dealers had a maximum mean score of 2.54 and obtained first rank as majority of respondents had high extension contact for seeking advice about chilli cultivation. Whereas progressive farmers and HDO/ADO got second and third rank with mean score of 1.98 and 1.79 respectively as far the extension contacts were concerned. The data revealed that PAU scientists, KVK scientists and experts of private agencies were least contacted by respondents and obtained fourth, fifth and sixth rank with mean score of 1.38, 1.33 and 1.32 respectively. The reason for less contact with PAU/KVK scientist might be that seed of these varieties available with the pesticide/seed dealers. These finding are in concurrence with the finding of Kamboj (2022).

The information gathered from the farmers was divided into three categories: low (7.69-28.20), medium (28.21-48.72) and high (48.73-69.24) as shown in Table 4. According to table 4, the maximum 52.50 per cent of the farmers had a medium level of adoption regarding recommended chilli production technology. Whereas 30.00 per cent of respondents had a high level of adoption and 17.50 per cent of respondents had reported a low level of adoption. Similar findings were reported by Rohit *et al* (2023) who found a medium level of adoption among farmers in chilli production technology.

It is defined as hindrances or obstacles faced by the chilli growers in adoption of recommended practice in actual situations with respect to inputs, technology, picking and marketing etc. (Sharma 2002). Constraints in adoption of new technology never end. Awareness and knowledge of these constraints is required to take appropriate steps to enhance chilli productivity (Lal *et al.,* 2011). The constraints in the adoption of any

Table 3: Distribution of the respondents according to their seeking the agricultural advices from different sources (n=120)

Source	Regularly		Occasionally		Never		Mean	Rank
	f*	%	f*	%	f*	%	score	
HDO/ADO	24	20.0	47	39.1	49	40.8	1.79	III
KVK scientists	8	6.8	23	19.2	89	74.2	1.33	V
PAU scientists	11	9.2	24	20.0	85	70.8	1.38	IV
Private company representative	4	3.33	27	22.5	92	76.6	1.32	VI
Pesticides/seed dealers	69	57.5	47	39.1	4	3.33	2.54	I
Progressive farmers	42	35.0	33	27.5	45	37.5	1.98	II

*Multiple response

Table 4: Distribution of the respondents according to the overall extent of adoption of recommended chilli production practices (n=120)

Adoption index	Frequency	Percentage
Low (7.69-28.20)	21	17.50
Medium (28.21-48.72)	63	52.50
High (48.73-69.24)	36	30.00

agricultural innovation include the nature of the technology, the way in which it is conveyed to the farmer and the attitude and perception that the farmer has about the technology (Table 5). Constraints faced by chilli growers determine the success or failure of an innovation. To obtain better results, it is essential to minimize the constraints. The response of growers was sought for constraints faced by them in the adoption of the recommended package of practices for the chilli crop. Out of all the constraints identified by the respondents, the farmers were requested to give ranking to those which had a major bearing in adoption of chilli. Similar findings were recorded by Singh *et al.* (2022).

Data presented on input constraints the majority (70.00%) of chilli growers faced scarcity of labour at the time of picking, followed by erratic electric supply (42.50%) and unavailability of recommended pesticides in time (28.33%) (Table 5). Similar findings were reported by Shaker *et al.* (2019), Reddy *et al.* (2018) and Shende and Meshram (2015). The probable reasons for these constraints were that chilli needs labour at the time of picking and that labour shifts to paddy transplanting at that time and high power cuts in summer generally in the month of April-May.

In terms of technical constraints that 47.50 per cent of the chilli growers faced problems in identifying the problems of insects/pests or diseases. Results are in accordance with Kabir *et al.* (2011). About 44.16 per cent of chilli growers lacked knowledge about post-harvest practises and applications. Similar findings were reported by Naik *et al.* (2019).

Among the financial constraints, a major proportion (59.16%) of chilli growers perceived the problem of the high cost of hybrid seeds followed by 52.50 per cent of growers faced the problem of high expenditure on fertilizer and herbicides (Table 6). The plausible reason may be that most of the agricultural input dealers are profit-oriented and they sell various agricultural inputs at a higher price to the farmers. The results were in agreement with the findings of Roy and Gosh (2022) and Dangore *et al.* (2015).

In terms of marketing constraints, it was found that 81.66 per cent of the chilli growers faced marketing problems such as high price fluctuations. Similar results were reported by Panda *et al.* (2020). Sixty-five percent of respondents reported a lack of availability of the minimum support price in the chilli crop, while 53.33 per cent reported a lack of market information about prices. The reason could be that MSP on vegetable crops is not fixed by the government whereas 49.16 expressed as low price for their produce. The results are in line with Kumar (2008) as it revealed that the factors of marketing, constraints in production and marketing and thereby suggests suitable policy options for improvement of marketing. It was revealed that 59.16 per cent of the respondents faced sudden and unexpected/unseasonal rains spoiling the quality of fruit due to uncertainty in weather conditions in

Table 5: Distribution of respondents according to the input and technical constraints faced by chilli growers (n=120)

Constraints	Frequency*	Percentage	Rank
Input Constraints			
Lack of good quality seeds/nursery	21	17.50	IV
Scarcity of labour and intensive requirement of labour at picking time	84	70.00	I
Seed treatment is a complicated technique	15	12.50	VI
Unavailability of recommended pesticides timely	34	28.33	III
Erratic electricity supply	51	42.50	II
Unavailability of effective herbicides for weed management	18	15.00	V
Technical constraints			
Lack of knowledge about recommended variety	36	30.00	VI
Lack of knowledge about dose and method of application of fertilizers and herbicides application	42	35.00	IV
Difficult to identify micronutrient deficiencies	24	20.00	VII
Lack of training facilities/technical guidance	39	32.50	V
Problems in identifying the insects/pests or diseases	75	47.50	II
Lack of knowledge on post-harvest practices/applications	53	44.16	III
Lack of appropriate spraying equipments	16	13.33	VIII
Increase incidence of pests and diseases	58	48.33	I

*Multiple response

Table 6: Distribution of respondents according to the financial and marketing constraints faced by chilli growers (n=120)

Constraints	Frequency*	Percentage	Rank
Financial Constraints			
High cost/rent of land	39	32.50	V
High cost of labour	52	43.33	IV
Costly or high rate of hybrid seed	71	59.16	I
High expenditure on fertilizers and herbicides	63	52.50	II
Unavailability of credit facilities	56	46.66	III
Lack of incentives for setting up post-harvest plant	23	19.16	VI
Marketing Constraints			
Far away markets for sale of produce	32	26.66	VIII
High fluctuations in prices	98	81.66	I
Lack of transport facilities for marketing	21	17.50	IX
High transportation charges	53	44.16	VI
Didn't get appropriate price for good quality produce	59	49.16	V
Delay in payment by intermediaries	51	42.50	VII
Lack of market information and intelligence	64	53.33	IV
No support price for crop by govt.	78	65.00	II
Sudden and unexpected /unseasonal rains spoiling the quality of fruit	71	59.16	III

*Multiple response

Punjab. Hence, various private and govt. extension agencies need to step forward to disseminate improved chilli production technologies among the farmers in the particular study area.

CONCLUSION

Study concluded that majority of the respondents were matriculated, possessed medium operational land holding and medium level of extension contacts and mass media exposure. The major constraints expressed by chilli growers were the problem of scarcity of labour at time of picking, erratic electric supply as the major input constraints. While, in context of financial constraints, more than half of the growers faced problems like high cost of hybrid seed followed by high expenditure on fertilizers and herbicides. Technical constraints reported by the chilli growers were identifying the problems of insects/pests or diseases and some of them also reported lack of knowledge about post-harvest practices. Majority of the growers faced marketing problem as high fluctuation in price as the major marketing constraint in chilli as MSP on chilli crop is not fixed by the government. The farmers need to be educated and motivated to use the correct doses of fertilizers and pesticides so that they can get the higher returns, by reducing expenditure. Pesticide dealers and farmers should be imparted technical information through trainings, laying out results demonstrations, arranging visit to the progressive farmer's field and group discussions. Government should implement minimum support price of chilli to provide security to chilli growers due to adverse weather conditions. Extension agency should also increase the reach among chilli growers through different extension interventions such as compaigns, need based training and creating social media groups to impart knowledge regarding cultivation practices of chilli crop.

REFERENCES

Anonymous. 2021a. www.Indiastat.com Retrieved from:https://www.indiastat.com/table/dry-chillies/area-production-productivity-dry-chillies-india-19/29195 on 18.07.2022.

Anonymous. 2021b. *Package of practices for vegetable crops* pp 1-2. Punjab Agricultural University, Ludhiana.

Dangore. U.T.; A.K. Bahekar; S.B. Datarkar and A.S. Darekar. 2015. Constraints faced by dry chilli growers in production and marketing of dry chilli in Wardha district of Maharashtra. *Agriculture Update,* 10: 252-254.

Geetha, R. and K. Selvarani. 2017. A study of chilli production and export from India. *International Journal of Advance Research and Innovative Ideas in Education,* 3(2): 205-210.

Goudappa, S.B.; G.S. Biradar and R. Bairathi. 2012. Technological gap in chilli cultivation perceived by farmers. *Rajasthan Journal of Extension Education,* 20: 171-174.

Jha, K.K. and R. Das. 2019. Adoption of recommended production technology by chilli growers in Tripura. *Indian Journal of Extension Education,* 55: 117-122.

Kamboj, R.; D. Singh and L. Kaur. 2022 Adoption status of direct seed rice technology by the farmers of Punjab. *Indian Journal of Extension Education,* 58(1): 76-80.

Kumar, P. 2008. *Status of protected cultivation of vegetable by the farmers of Punjab*. M.Sc. thesis, Punjab Agricultural University, Ludhiana, India.

Lal, B.; T.K. Sinha; A. Kumar; A. Pandit and N.K. Pandey. 2011. Constraints perceived by the farmers in adoption of potato technology. *Potato Journal,* 38: 73-77.

Naik, V.; A.K. Singh; H. Roy and Padmaja. 2019. Assessment of constraints encountered by the chilli growers of Khamman district in adoption of recommended chilli production technologies along with suggestions. *International Journal of Current Microbiology and Applied Science,* 8: 2608-2613.

Panda, C.K.; R. Kumar and L.K. Meena. 2020. Lentil production economics and constraints: an empirical study in mokamataal of Bihar. *Journal of Community Mobilization and Sustainable Development,* 15(1): 254-258.

Reddy, Y.; P.K. Wakle; N.R. Koshti; R. Sardhar; N.P. Jangwad; A.M. Sonkamble and A.S. Tingare. 2018. Extent gap in adoption of recommended chilli cultivation by the farmers. *International Journal of Pure and Applied Bioscience,* 6: 102-107.

Rohit; P. Singh; H.C. Singh and K. Asha. 2023. Constraints faced by the farmers in the adoption of crop rotation in Ayodhya district. *Indian Research Journal of Extension Education,* 23(2): 120-124.

Roy, P. and S. Ghosh. 2022. Constraints Faced by Pineapple Growers in Tripura. *Indian Journal of Extension Education,* 58(2): 140-143.

Shaker, B.R.M.; J.H. Kumar; V. Chaintanya; P. Ranjitha; K.R. Kumar and J.M. Rao. 2019. Constraints faced by chilli farmers in production and marketing of dry chilli in Khamman district of Telangana state. *Journal of Pharmacognosy and Phytochemistry,* 8(3): 2143-2145.

Sharma, L.K. 2002. *Adoption of recommended practices for chilli cultivation and problems faced by the growers of selected districts of Punjab*. Ph.D. Dissertation, Punjab Agricultural University, Ludhiana, India.

Shende, N.V. and R. Meshram. 2015. Cost benefit analysis and marketing of tomato. *American International Journal of Research,* 13: 46-54.

Singh, L.; D. Singh and P.S. Sharma. 2020. An appraisal of potato seed production practices adopted by the farmers of Punjab. *Journal of Community Mobilization and Sustainable Development,* 15: 607-615.

Singh, N.; N.A. Bhardwaj; H.R. Meena and M. Latha. 2022. Constraints and opinions of farm women regarding vocational trainings conducted by Krishi Vigyan Kendra in Uttarakhand. *Indian Research Journal of Extension Education,* 22(5): 178-183.

Singh. 1979. An extension strategy for scientific storage of food grains at the farm level. *Agricultural Research Journal,* 2: 38-40.

Thakur, B.S.; R. Sharma and K. Chakrapani. 2020. A study on extent of adoption of recommended chilli (*Capsicum annum* L.) production technology among the farmers of Patharia in Madhya Pradesh. *International Journal of Agricultural Inventions,* 5: 225-226.

Verma, S.K.; D.P. Rai; B.P. Tripathi and K.K. Pandey. 2018. Chilli growers in Raipur district: study about socio-economic and psychological attributes. *International Journal of Current Microbiology and Applied Science,* 7: 1723-1730.

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Research Article

Varietal Diversity of Rice Crop in Sub-tropical Jammu Region of Jammu and Kashmir

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ABSTRACT

In the Jammu region, rice (*Oryza sativa*) is the main cereal crop cultivated on an area of 0.15 million hectare (mha) in *kharif* season under irrigated condition. A study was conducted in Jammu, Samba and Kathua districts of Jammu region to find out the varietal diversity of rice. A sample of 240 rice growers was selected by multistage sampling technique. Majority of farmers in the sub-tropics had cultivated basmati (70%) followed by semi-fine varieties (13%), coarse varieties (9%) and hybrids (8%) in the study area. Extent of adoption of basmati rice was 100, 92 and 84 per cent in the Samba, Jammu and Kathua districts. Extent of adoption with respect to area was basmati (72%) followed by semi-fine varieties (14%), coarse varieties (7%) and hybrids (7%). Basmati varieties cultivated were Basamti-370 and Pusa-1121. Semi-fine, coarse varieties and hybrids of rice were also cultivated by the rice growers in the study area. The semi- fine variety *Sharbati* was cultivated by 12.5 per cent of the farmers in Kathua and Samba districts each, whereas in Jammu district 21.25 per cent of the farmers cultivated *Sharbati* rice. The coarse varieties *Jaya* and *PR-113* were cultivated by 5 per cent and 33.8 per cent of the farmers respectively in Kathua district. None of the farmer in Samba and Jammu districts cultivated these coarse varieties. In hybrids, Dhanya 748 was cultivated by 11.25 per cent of the farmers of Kathua district and only 1.25 per cent of the farmers of Samba district cultivated this hybrid. Other hybrids like Dhanya 834 was cultivated by 2.5 per cent each was cultivated by Jammu and Samba districts. The other rice hybrid VNR 2355 was cultivated by 7.5 per cent of the rice growers in Jammu district. None of the farmers of Kathua district cultivated hybrid rice Dhanya 834 and VNR 2355.The mean varietal diversity of rice crop in the study area was 0.131±0.009 calculated by using Thiel's entropy index. The mean varietal diversity index of Jammu, Samba and Kathua was 0.103, 0.127 and 0.161, respectively. The difference in mean varietal diversity index of rice between Jammu and Kathua was 0.056 which was found to be statistically significant (p=0.011). The varietal diversity in rice crop is on the lower side, especially in Jammu district. This could be due to because of the farmers predominantly cultivating Pusa-1121 and Basmati-370.

Keywords: Varietal diversity, Sub-tropics of Jammu, Rice crop

INTRODUCTION

Rice (*Oryza sativa*) being a staple crop for millions worldwide, exhibits a rich varietal diversity that is crucial for food security, adaptation to environmental conditions, and cultural practices. According to the IFPRI from 1993 and 2020 A.D. the global demand for cereals is expected to increase by 41 per cent. Also, IRRI, 1998 projected that annual rice production must increase from 556 million tonnes in 2000 A.D. to 758 million tonnes by 2020 A.D. Thirty-six per cent increase (1.8% per year) (Prasad, 2005). In world, the major rice producing area is 165.49 mha with a production of 516.02 mmt and yield of 4.66 t/ha. Major rice-growing and rice-eating nations in south and South east Asia must achieve a higher production growth rate. These South east Asia include China 29.45 mha with a production of 145.95 mmt and yield of 7.08 t/ha,

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India 47.83 mha with a production of 135.76 mmt and yield of 4.26 t/ha, Bangladesh 11.60 mha with a production of 36.35 mmt and yield of 4.70 t/ha, Pakistan 2.98 mha with a production of 7.32 mmt and yield of 3.69 t/ha and Nepal 1.45 mha with a production of 3.65 mmt and yield of 3.79 t/ha (FAOSTAT, 2024).

The Eastern Himalaya and adjoining ranges, commonly referred as north-eastern India with over 100 distinct groups, harbours a huge crop/cultivar diversity with over 10,000 cultivars of rice alone (Hore 2005), and associated indigenous knowledge (Ramakrishnan, 1992). With the advent of the Green Revolution, genetic diversity within and between the crop species has reduced. Post Green Revolution, many traditional rice varieties consumed prior to the Green Revolution have become non-existent (Nelson *et al.,* 2019). High-yielding varieties of rice and wheat were introduced as part of the Green Revolution to increase agricultural productivity replacing many local varieties (Pingali and Rajaram, 1997). This resulted in reduced genetic diversity within a particular species (Keneni *et al.,* 2012). Genetic variation is crucial for maintaining biological potential of a species (Dhillon *et al.,* 2004; Rahman *et al.,* 2007; Rana *et al.,* 2009) and for food security (Desclaux, 2005; Dawson *et al.,* 2008). Agricultural diversity can promote environmental health, resilience, and food production (Wolfe, 2000).

Crop species diversity is frequently highlighted as contributing to both nutritional security and ecological resilience (Reiss and Drinkwater, 2018). It is more successful in pest management than single species or varietal stands because it contains colonies of natural enemies that protect crops (He *et al.,* 2019). Varietal diversity has been shown to have a positive influence on dealing with abiotic stresses (Condori *et al.,* 2014) while posing a threat to food security. In Bangladesh, more than four types of rice were grown by 7.84 per cent of farmers, 2-3 rice types were grown by 65.69 per cent of farmers, and only one variety of rice was cultivated by 26.47 per cent of farmers (Muttaleb *et al.,* 2008).

Virk and Witcombe (2007) reported that at All India level weighted average age of rice varieties was 11.5 years during 1993. They further reported that during 1993, there was breeder seed indent for 20 varieties of rice and most popular 3 varieties share in indent was 38 per cent during 1986-88 to 1990-93. Virk and Witcombe (2007) observed that during 1986-88 to 1990-93, share of top 10 rice varieties in breeder seed indent was 60.4 per cent. Virk and Witcombe (2007) argued that one of the major reasons for low adoption and replacement was lack of quick and wider dissemination of information about new rice varieties released and poor popularization. Nayak *et al.* (2022) reported in Odisha, four mega varieties of rice were grown by 63 per cent by the farmers and has a varietal diversity index 0.311. The varietal diversity index in Odisha varies from 0.25 (low land flood prone areas) to 0.35 (upland areas of rice cultivation).

Ankit *et al.* (2024) reported that in 1998-99 there were 12 rice varieties cultivated and the results of this study show that the number of varieties cultivated in 2020-21 were 21, thus overtime the varietal diversity of rice has increased by 75 per cent. In 1984-85 and 1990-91, 9 rice varieties were cultivated in which 2 major rice varieties namely PR 106 and Jaya. PR 106 was cultivated on 57 per cent area in 1984 85, which further decreased to 41 per cent (1987-88), again increased to 62 per cent (1990-91) and then decreased to 23 per cent (1998-99) (Ankit *et al.,* 2024).The other variety was Jaya, cultivated on an area of 20 per cent in 1984-85 which further increased to 25 per cent (1985-86) and then decreased to 9 per cent (1990-91) (Ankit *et al.,* 2024). Thereafter, 1990-91 and 1998-99, 12 rice varieties were cultivated in which there were two major rice varieties cultivated by farmers namely PR 111 and Pusa 44. PR 111 was cultivated on an area of 4 per cent in 1995-96 which further increased to 26 per cent (1998-99) and Pusa 44 was cultivated on an area of 6 per cent (1991-92) which increased to 27 per cent (1998-99) (Ankit *et al.,* 2024).

Ankit *et al.* (2024) reported that 18 rice varieties were cultivated in Punjab in 2016. There was 3 major rice varieties namely Pusa 44 which was grown under an area of 27.23 per cent, Basmati 1121 (23%) followed by PR 121 (20.71%), in Punjab (Ankit *et al.,* 2024). Singh *et al.* (2018) reported that compared to traditional basmati rice, Pusa Basmati-1121 was of shorter duration and with double yield. These attributes also led to wider adoption of variety with a share of 63 per cent of area under basmati rice in India in the

year 2015. However, Pusa Basmati-1121 became susceptible to pests and diseases and hence being used as a parent in developing biotic stress resistant basmati varieties.

MATERIALS AND METHODS

Profile of the study area: The study was conducted in rice wheat growing sub-tropical area of Jammu and Kashmir (J&K) and Punjab. Union Territory of J&K is in the northwestern Himalayan region. It has three distinct agro climatic zones namely sub-tropical Jammu region (up to 800 meters above mean sea level), intermediate/semi-temperate mid-hills (800-1500 meters above mean sea level), and temperate (1500-2500 meters above mean sea level). In J&K, only sub-tropical area of Jammu region was selected for the study.

Sampling plan: A multistage sampling technique was used to draw the sample of farmers. From the sub-tropical Jammu region, three representative districts namely Jammu, Samba and Kathua were selected purposively (Figure 1). In the subtropical Jammu region, four blocks each were selected from Jammu, Samba and Kathua districts. R.S. Pura, Bishnah, Marh and Jourian were selected from Jammu district; Ghaghwal, Vijaypur, Ramgarh and Rajpura from Samba district, and Barnoti, Nagri, Marheen and Hiranagar from Kathua district. Further, from the selected blocks, a list of villages practicing rice-wheat cropping systems was prepared. Simple random sampling without replacement technique was applied to select two villages from each block. A total number of 24 villages were chosen for the study. Lists of the farmers cultivating rice-wheat crops were prepared by meeting Sarpanches/ progressive farmers of each village. From the lists prepared, a sample of 10 farmers was drawn from each village by employing random sampling without replacement. Thus, a total sample size of 240 farmers was selected for the study (Table 1). The data were collected through the personal interview method with the help of two semi-structured interview schedules from the sampled farmers.

Figure 1: Location of surveyed villages in the sub tropical Jammu region

Descriptive statistics of farmers: The descriptive statistics of farmers include the average age of farmers from the three regions Jammu, Samba and Kathua was 51.34, 51.27 and 52.43 years respectively. And the average landholding from these three regions Jammu, Samba and Kathua was 1.55 ha, 2.78 ha and 1.59 ha respectively

Measurement of extent of adoption: The adoption of rice and wheat varieties/hybrids was measured by the percentage of farmers cultivating and the area under a crop variety.

Measurement of varietal diversity: For estimation of varietal diversity of rice and wheat varieties, Theil's entropy index (1972) was used.

$$E = \sum_{i=1}^{n} Pi \log(\frac{1}{Pi})$$

Where, E is the entropy index,

P_i is the proportion of area under i^{th} variety to total area under the crop (rice/wheat),

n is the number of varieties raised by the farmers

Statistical analysis: One way ANOVA- test was applied to compare the mean from the representative districts of subtropics of Jammu, Samba and Kathua.

Table 1: Sampling plan

State/Region	Districts	Blocks	Villages selected	Farmers from each villages	Total
Sub tropics of Jammu	3	12	24	10	240

RESULTS AND DISCUSSION

Majority of farmers in the sub-tropics had cultivated basmati (70%) followed by semi-fine varieties (13%), coarse varieties (9%) and hybrids (8%) in the study area (Table 2). Extent of adoption of basmati rice was 100, 92 and 84 per cent in the Samba, Jammu and Kathua districts. Extent of adoption with respect to area was basmati (72%) followed by semi-fine varieties (14%), coarse varieties (7%) and hybrids (7%) (Table 2). Basmati varieties cultivated were Basamti-370 and Pusa-1121. Semi-fine, coarse varieties and hybrids of rice were also cultivated by the rice growers in the study area (Table 2). The semi- fine variety *Sharbati* was cultivated by 12.5 per cent of the farmers in Kathua and Samba districts each, whereas in Jammu district 21.25 per cent of the farmers cultivated *Sharbati* rice (Table 2). The coarse varieties *Jaya* and *PR-113* were cultivated by 5 per cent and 33.8 per cent of the farmers respectively in Kathua district (Table 2). None of the farmer in Samba and Jammu districts cultivated these coarse varieties (Table 2). In hybrids, Dhanya 748 was cultivated by 11.25 per cent of the farmers of Kathua district and only 1.25 per cent of the farmers of Samba district cultivated this hybrid (Table 2). Other hybrids like Dhanya 834 was cultivated by 2.5 per cent each was cultivated by Jammu and Samba districts (Table 2). The other rice hybrid VNR 2355 was cultivated by 7.5 per cent of the rice growers in Jammu district (Table 2). None of the farmers of Kathua district cultivated hybrid rice Dhanya 834 and VNR 2355 (Table 2). The mean varietal diversity of rice crop in the study area was 0.131±0.009 calculated by using Thiel's entropy index (Table 3). The mean varietal diversity index of Jammu, Samba and Kathua was 0.103, 0.127 and 0.161, respectively (Table 3). The difference in mean varietal diversity index of rice between Jammu and Kathua was 0.056 which was found to be statistically significant (p=0.011) (Table 3). The varietal diversity in rice crop is on the lower side, especially in Jammu district. This could be due to because of the farmers predominantly cultivating Pusa-1121 and Basmati-370.

Varietal diversity of rice in sub tropics of Jammu: In Jammu subtropics the earlier studies reported that in 2016 about 7 rice varieties were cultivated by farmers out of these Basmati 370 was dominant varieties (58.49%) followed by PR 113 (16.13%) and followed

Table 2: Extent of adoption of rice varieties/hybrids with respect to percent farmers

Rice variety/ hybrid	(% farmers)	(% area)
Basmati variety		**32.00**
Pusa 1121#	45	5.77
Basmati 370#	48	11.22
Un-descript (Komo Basmati)	6	6.87
Pusa 1718	1	5.00
Pusa Basmati 1509 #	-	-
Pusa 1401/ Muchhal Basmati	-	-
CSR-30#	1	3.12
Semi-fine variety		**4.98**
Sharbati	15	2.48
Devgoda	4	2.5
Coarse variety		**8.97**
Jaya#	2	2.34
Pusa 44	-	-
PR 106	-	-
PR113#	11	6.63
PR 114#	-	-
PR 118#	-	-
PR 121#	-	-
PR 122#	-	-
PR 126#	-	-
PR 127#	-	-
PR 128#	-	-
PR 129#	-	-
PR 201	-	-
Hybrid		**54.04**
Arize 6444	1	5.62
BH 21	1	2.5
Dhanya 748	4	7.60
Dhanya 834	2	8.44
HKR 47	-	-
HK 100	1	7.50
Hybrid 28P67	-	-
Kaveri 468	-	-
Paddy 105	-	-
PHB 71#	1	3.75
Sawa 127	1	10.00
Super hybrid 901	-	-
Tata RIL 666	-	-
VNR 2355	3	8.62

Table 3: Varietal diversity index of different rice varieties/hybrids in sub tropics of Jammu (ANOVA)

	Jammu					
Crop	**Jammu**	**Kathua**	**Samba**	**|Mean Difference**		
Rice	**(1)**	**(2)**	**(3)**	**(1-2)**	**(1-3)**	**(2-3)**
Mean varietal diversity index	0.103	0.161	0.127	0.056* (0.011)	0.024 (0.268)	0.034 (0.148)

F-value=0.046*

by Pusa 1121 (12.42%) (Peshin *et al.,* 2017). However, Bano 2019 reported that in 2016 about 17 rice varieties were cultivated but the dominant varieties were Basmati 370 and Basmati 1121. The result of this study show that 16 rice varieties were cultivated (which include hybrids) and the dominant varieties cultivated were Basmati 370 (11.22%), Basmati 1121 (5.77%), PR 113 (6.63%) with varietal diversity of 0.131.

CONCLUSION

From the study, it is concluded that over time, in sub tropics of Jammu there is always more varieties of rice crop i.e. the varietal pool is large but only confined to two to three varieties *viz*. Basmati 370, Pusa Basmati 1121. And also having an acreage of more than five per cent of rice acreage under these varieties. thus, higher varietal diversity. Besides, there is diversity in different rice types cultivated by the farmers such as basmati, semi-fine and coarse rice.

REFERENCES

Ankit; R. Peshin; R. Sharma; U. Shankar and R. Kumar. 2024. Varietal Diversity of Rice and Wheat in Subtropical North India. *Indian Journal of Ecology,* 51(6): 1365-1371.

Condori, B.; R.J. Hijmans; J.F. Ledent and R. Quiroz. 2014: Managing potato biodiversity to cope with frost risk in the high Andes: A modeling perspective. e81510.

Dawson, J.C.; K.M. Murphy and S.S. Jones. 2008. Decentralized selection and participatory approaches in plant breeding for low-input systems. *Euphytica*, 160: 143–154.

Desclaux, D. 2005. Participatory plant breeding methods for organic cereals. In: Bueren, E.T., Ostergard, H. (eds.) Lammerts. Proceedings of the COST SUSVAR/ECO-PB workshop on organic plant breeding strategies and the use of molecular markers, Driebergen (NK), pp 17–23.

Dhillon, B.S.; M. Singh; R. Parsad; V.K. Gupta and B.B. Singh. 2004. Evaluation of plant genetic resources: issues, advances and opportunities. In: Dhillon, B.S., Tyagi, R.K., Lal, A., Saxena, S. (eds.) Plant Genetic Resource Management. Narosa Publishing House, New Delhi, pp 242–265.

Eliazer Nelson, A.R.L.; K. Ravichandran and U. Antony. 2019. The impact of the Green Revolution on indigenous crops of India. *Journal of Ethnic Foods,* 6(1): 1-10.

Keneni, G.; E. Bekele; M. Imtiaz and K. Dagne. 2012. Genetic vulnerability of modern crop cultivars: Causes, mechanism and remedies. *International Journal of Plant Research,* 2(3): 69-79

Muttaleb, M.A.; M.A. Jalil; A.K. Paul; S.M. Habib and M.M. Hossain. 2008. Diversity of rice varieties in some selected Haor areas of Sunamganj district. *International Journal of Sustainable Crop Production*, 3(5): 31-34.

Nayak, S.; K. Das; M.K. Bhowmick; S.M. Hossain; S. Singh; U.M. Singh and V.K. Singh. 2022. Flood Stress Prevalence and Assessment of Farmers' Preparedness with Resilient Rice Varieties: A Review in Context of Eastern India. *Response of Field Crops to Abiotic Stress,* pp 277-296.

Pingali, P.L. and S. Rajaram. 1997. The impact of the green revolution on crop diversity. *Journal of Development Economics*, 54(2): 407-426.

Prasad, R. 2005. Rice-wheat cropping systems. *Advances in Agronomy,* 86: 255-339.

Rahman, S.N.; M.S. Islam; M.S. Alam and K.M. Nasiruddin. 20070 Genetic polymorphism in rice (*Oryza sativa* L.) through RAPD analysis. *Indian Journal of Biotechnology,* 6: 224–229.

Ramakrishnan, P.S. 1992. Shifting agriculture and sustainable development - An inter-disciplinary approach from North-eastern Himalayas. UNESCO and Parthenon Publishing Group, London.

Rana, J.C.; K.S. Negi; S.A. Wani; S. Saxena; K. Pradheep; A. Kak; S.K. Pareek and P.A. Sofi. 2009. Genetic resources of rice in the Western Himalayan region of India: Current status. *Genetic Resource and Crop Evolution*, 56: 963–973.

Reiss, E.R. and L.E. Drinkwater. 2018. Cultivar mixtures: A meta analysis of the effect of intraspecific diversity on crop yield. *Ecological Applications,* 28: 62-77.

Singh, V.; A.K. Singh; T. Mohapatra; S, G.K. and R.K. Ellur. 2018. Pusa Basmati 1121–A rice variety with exceptional kernel elongation and volume expansion after cooking. *Rice*, 11: 1-10.

Virk, D.S. and J.R. Witcombe. 2007. Trade-off between on farm varietal diversity and highly client oriented breeding—A case study of upland rice in India. *Genetic Resource Crop Evolution*, 54: 823–835.

Wolfe, S.M. 2000. Crop strength through diversity. *Nature*, 406: 681-682.

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Research Article

Weathering the Risk: Investigating Farmer Withdrawals from PMFBY and Underlying Agricultural Challenges

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ABSTRACT

The Pradhan Mantri Fasal Bima Yojana (PMFBY) was launched to provide financial protection to Indian farmers against crop losses due to natural calamities, pests, and diseases. However, despite its intended benefits, several farmers have discontinued their participation in the scheme. This study investigates the underlying reasons for the withdrawal of PMFBY by beneficiary farmers in Samba district of Jammu and Kashmir. Data was collected from 225 farmers, including 150 PMFBY beneficiaries and 75 non-beneficiaries, binary logistic regression was used to analyze the data. The findings reveal that dissatisfaction with claim procedures, high premium rates, tedious processes and lack of transparency are the key drivers of discontinuance. Logistic regression analysis indicated that education level (p=0.02) and irrigated land holding (p=0.009) significantly influenced farmers' decisions to opt out. Farmers also suggested individual-level assessment (84.00%), greater awareness (75.00%) and improved claim settlement mechanisms (59.00%) to enhance the scheme's effectiveness. The study highlights the need for policy reform and targeted interventions to restore farmer confidence and ensure the sustainability of crop insurance in India.

Keywords: Agricultural, Challenges, Farmer, Investigating, PMFBY, Weathering, Withdrawals

INTRODUCTION

Agriculture continues to be a cornerstone of India's economy, contributing approximately 21 per cent to the nation's Gross Value Added (GVA) in 2022 (Anonymous 2022). The prosperity of agriculture is directly linked to the overall economic well-being of a nation. The growth of the agricultural sector is essential for India's overall development and plays a crucial role in alleviating poverty. But, Indian agriculture suffers from innumerable problems and one significant challenge faced by farmers is the high level of risk and uncertainty inherent in agriculture. Indian agriculture is inherently vulnerable due to its deep reliance on natural conditions and volatile markets. With nearly 50 per cent of the country's population dependent on agriculture for livelihood, even minor disruptions can have widespread socio-economic consequences (Bhaskar and Darekar, 2018).

Natural disasters embargo developmental progress as a consequence of economic losses incurred on humanity. Over the past decades, these losses are consistently escalating to a large scale. The intensity of these natural disasters is expected to further increase due to prevailing climate change (Scott-Smith, 2018). Natural disasters could be climate-induced and geophysical in nature. Climate induced natural disasters (CIND) include floods, droughts, extreme temperatures, storms and wildfires etc., while earthquakes, tsunamis and mass movements comprises geo-physically induced natural disasters. A significant portion of India's farmland is rain-fed, making it highly susceptible to monsoon variability, droughts, floods, and unseasonal weather events. Climate change has only intensified these risks, leading to increasingly unpredictable rainfall patterns, rising temperatures, and frequent extreme weather events such as hailstorms and cyclones.

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Apart from climatic uncertainties, Indian farmers also face market risks. Price volatility due to fluctuating demand, lack of storage infrastructure, middlemen exploitation, and limited access to real-time market information often leads to distress sales. Despite government procurement policies, many farmers remain disconnected from Minimum Support Price (MSP) systems, especially those growing non-cereal or perishable crops. The combination of low resilience, credit dependency, and inadequate risk-mitigation systems places small and marginal farmers-who make up over 85% of the farming community-at the greatest risk. These factors contribute not only to economic instability but also to a cycle of indebtedness, making mechanisms like crop insurance critical for sustainable agriculture.

In India, crop insurance has a long history that stretches back to the 1920s (Nair, 2010). After independence, India's crop insurance system saw numerous policy-level experiments and modifications [Vyas and Singh (2006); Banerjee and Bhattacharya (2011)]. Due to their high premiums, complex methods for calculating losses, and slow distribution of compensation, crop insurance plans have historically not been popular with Indian farmers [Singh and Nisha (2020)]. The new crop insurance scheme namely Pradhan Mantri Fasal Bima Yojana (PMFBY) scheme was launched by the Government of India on January 13, 2016 and was subsequently implemented in the Kharif season of 2016. The scheme is operational in 22 out of the 30 Indian states. It employs an area approach for the calculation of losses due to risk faced by the farmers and crop losses are assessed on the basis of a yield-based index. The scheme covers crops grown across Kharif, Rabi and summer seasons in India. The coverage includes cereals, millets and pulses, oil seeds and annual commercial and horticultural crops such as banana, turmeric, tapioca. Crop insurance serves as a vital safeguard for farmers, offering financial protection against anticipated losses and enabling them to stabilize their income and investments. By mitigating the adverse effects of natural hazards, such as droughts, floods, and pests, crop insurance helps maintain the sustainability of farming operations.

Farmers are always confronted with fluctuation of expected price and yield variability, natural calamities and other outcomes that affect their financial returns and overall family welfare. The consequences of decisions or events of the farmers are often not known with certainty until long after such decisions were made by them. Risk is believed to play an important role in the investment decisions of individual farmers. Risk is the act of providing financial protection for property and life against death, loss or damage, while insurance is the equitable transfer of a risk or loss from one entity to another in exchange for a premium or a guaranteed and quantifiable small loss to prevent a large and possibly devastating loss (Kumar *et al.,* 2021). Economic growth and agricultural growth are inextricably linked to each other, managing risks in agriculture is a big challenge to the policy makers and the researchers.

Farmer attitudes significantly influence their willingness to adopt riskier agricultural practices and technologies. Cultivating a positive outlook toward crop insurance is essential for encouraging such adoption. Key factors in fostering this positive attitude include farmers' awareness of the Pradhan Mantri Fasal Bima Yojana (PMFBY) and their understanding of how it can facilitate their farming activities. Additionally, farmers' perceptions of the procedures and benefits associated with the PMFBY scheme play a crucial role in its successful implementation. Famers faith in agricultural insurance is lost due to ineffective claim calculating process and farmers willingness to enrol in agriculture insurance is reduce.

Recognizing the importance of crop insurance, a study was conducted in Samba district, to find out reasons for discontinuance of the PMFBY by the beneficiary farmers.

MATERIALS AND METHODS

Static-group comparison research design research design was used in the present investigation. The study was carried out in Samba district of Jammu and Kashmir Union Territory. The proportionate sampling technique was used for the present study. Proportionate sampling is a sampling strategy used when the population is composed of several subgroups that are vastly different in number. The number of participants from each subgroup is determined by their number relative to the entire population.

All blocks of district Samba were taken for the present study. From all blocks, 150 PMFBY beneficiary farmers were selected by proportionate randomly sampling method with replacement. Out of the 12421 total beneficiaries in Samba district, 150 farmers were selected proportionately from all the blocks. For comparison, 75 non PMFBY beneficiaries as per half of the proportionate value of the block for selection of PMFBY beneficiaries were taken up conveniently from each block. Thus, the total sample size for the present study was 225 (150 beneficiary, 75 non-beneficiary). The primary data was collected with the help of well-structured and pre-tested interview schedule, designed especially in the light of objectives, whereas secondary data was collected from sources like thesis, journals, literature etc. The statistical measures like frequency, percentage, mean, standard deviation, were used to analyze the data to draw tangible inferences.

Discontinuance of the PMFBY is operationalized as the decision to withdraw adoption of PMFBY after having previously adopted it. Binary logistic regression model was applied to identify the independent variables influencing the discontinuance. The result of this type of regression can be expressed as follows

$$\text{Ln } [p/1\text{-}p] = b_0 + b_1x_1 + b_2x_2 + b_3x_{3\ldots\ldots} b_kx_k$$

Where, - p represents the probability of an event

b_0 is the y- intercept, and

x_1 to x_k represents the independent variables included in the model.

For the validation of model, chi square test was taken into account. The Nagelkerke's R^2 was used as measure of determination of variation caused by predictors.

RESULTS AND DISCUSSION

There are eighteen farmers who opted PMFBY previously have decided to discontinue the practice of crop insurance. Majority 72 per cent of the farmers reported bad experiences of previous incidents as the major reason for quieting the PMFBY. the other reasons of discontinuance of PMFBY reported by the beneficiary farmers include dissatisfaction with claim procedure (56%) claiming procedure is to tedious (44%), high premium rate (39%), no loss due to any natural calamities (22%) and claim not received for crop failure due to border firing (11%). The other reasons reported by the farmers include land dispute among the family members and respondents have 70 years of age and thus not entitled for kissan credit card (Table 1).

The reasons for discontinuance of the crop insurance schemes have been studied by the many scholars (Thapa and Noel, 2023). Although, there was increase in the enrolment of 31 per cent as reported by web portal but on the other side 12 per cent of the PMFBY farmers to earlier opted this scheme. The major issues raised by the respondents includes: not satisfied with claim procedure, farmers complaints that claims were not being deposited in their accounts in the event of losses and majority of farmers (72%) have bad experience of previous incidents followed

Table 1: Reasons of discontinuance of PMFBY by the beneficiaries

Particulars	PMFBY farmers (n=18)	
	Number	Percentage
High premium rate	07	39
Claiming procedure is too tedious	08	44
Bad experience of previous incidents	13	72
Not affected by any natural calamities therefore not interested in paying premium amount	04	22
Not satisfied with the claim procedure	10	56
Land dispute between family members	01	06
No claim was received in case of crop failure during the border firing	02	11
Completed 70 years of age, no KCC claimed	01	06

*Multiple response;
Figures corresponding to percentages have been rounded up to nearest whole number

by 56 per cent not satisfied with the claim procedure. The study conducted Lakshmanan and Ashoke (2019) concluded that the major reasons for not concluding the crop insurance is that farmers were not compensated even if they suffer loss from adverse natural event, high premium rate toward purchase of PMFBY and less compensation compared to actual loss. Mukherjee and Pal (2017), Nirmal and Babu (2021) also reported that delays in the claim settlement are major issue with the PMFBY. Rawat and Zechariah (2022) in their study they found that high premium rate delay in payment of insurance claim and premium rate not found. GOI (2014) also reported that farmers having poor understanding and lack of awareness regarding crop insurance process result in disaffection those among who join. Farmers having small land holding, insufficient irrigation facilities, late payment of compensation, lengthy claim settlement procedure were found main reasons for the discontinuance of PMFBY (Haque and Khan, 2017). The farmers also reported that PDS has led to drastic reduction in agriculture activities as the inducement for farming has reduced due to cheap availability of food grains. The farmers are losing interest in farming was also found reason for non-adoption of PMFBY.

To find the factors affecting discontinuance of the PMFBY by the beneficiary, out of eight independent variables selected for the analysis, two variables namely education (p=0.02) and irrigated land holding (p=0.00) significantly affected the continuance of the PMFBY by the beneficiary farmers (Table 2). The R^2 value was 0.158, which indicate that there is 16 per cent variation in discontinuance of the PMFBY by the beneficiaries was explained by the variable selected for the analysis. The positive sign with variable education and irrigated land holding indicates that as the education and irrigated facilities increases, the number of PMFBY farmers decreases. It was also observe that, one unit increase in education and irrigated land holding increase discontinuance of the PMFBY by 0.23 and 0.06 per cent, respectively (Table 2).

Majority (84%) of the farmers suggested that unit of assessment should be at individual level instead of village/village panchayat level and 75 per cent farmers suggested that awareness should be created about the benefits of PMFBY. The others suggestions were: quick settlement claims (59%), insurance service at your doorstep / at village level (46%), separate desk for crop insurance in banks / cooperatives (35%), Need for transparency in settlement of claims (31%), inform farmers before deducting premium (25%), reduce premium rate (22%), Public-grievance settlement mechanism at local level (17%) and make the website user friendly for online application (11%).

Suggestions were sought from the farmers to improve the effectiveness of PMFBY. Agriculture insurance is ineffective for individual farmers who have experienced specific crop losses that do not affect the entire region (Panda, 2017). Famers faith in agricultural insurance is lost due to ineffective claim calculating process and farmers willingness to enrol in agriculture insurance is reduce (Rajeev and Nagendran, 2019) (Panda, 2017). The farmers suggest that there should be quick settlement of claims, transparency in settlement of claims, grievance settlement mechanism at local level and creating awareness about the benefits available were the major suggestions.

Table 2: Factors affecting the discontinuance of the PMFBY by the beneficiary farmers

Variable	B	S.E.	Wald	p-value	Model summery
Constant	-43.914	1.366	0.000	0.997	-2 Log likelihood = 84.205
Age	0.56	0.39	2.091	0.148	Cox & Snell R square = 0.158
Education	0.231	0.105	4.886	0.027	Nagelkerke R square = 0.305
Mobile phone	17.936	10.037	0.000	0.999	
Family size	0.098	0.190	0.266	0.606	
Farming experience	-0.061	0.033	3.311	0.069	
Irrigated land holding	0.061	0.023	6.855	0.009	
Unirrigated land holding	0.008	0.032	0.063	0.802	
Extension agency	18.595	8.900	0.00	0.998	

Table 3: Suggestions for improving PMFBY

Particulars	PMFBY farmers (n=18)	
	Number	Percentage
Quick settlement of claims	89	59
Need for transparency in settlement of claims	46	31
Public-grievance settlement mechanism at local level	25	17
Create awareness about the benefits available	112	75
Individual farm as unit of assessment instead of village/village panchayat level	126	84
Separate desk for crop insurance in banks / cooperatives	53	35
Reduce premium rate	33	22
Make the website user friendly for online application	16	11
Inform farmers before deducting premium	37	25
Insurance service at your doorstep / at village level	69	46

*Multiple response;
Figures corresponding to percentages have been rounded up to nearest whole number

By looking into the suggestions given, it was clear that farmers were not completely aware about modalities of the scheme, the benefits available and how the indemnity was calculated and paid to them. This calls for a transparent claims settlement mechanism and a crop insurance information centre at Gram Panchayat level. The farmers also reported that major risk to crops is from wild animals, those animals cause most of the crop losses but this risk is not covered under PMFBY. So, these risks should be incorporated under the crop insurance. Further, making individual farm as unit of assessment than the existing Gram Panchayat level and a separate desk for crop insurance in banks were the felt suggestions given by the sample farmers. Similar suggestions were found in studies of Vyas and Singh (2006) and Raju and Chand (2008). The farmers were not acquainted with the process of crop cutting experiments (CCEs) as not one visited their fields and no information was provided to them. So, the farmers suggest that proper information or awareness should be created among farmers.

CONCLUSION

The study underscores the critical gaps in the implementation and perception of the Pradhan Mantri Fasal Bima Yojana (PMFBY) among farmers in Samba district, Jammu & Kashmir. Despite its potential to serve as a safety net against climatic and market-related risks, the scheme has witnessed discontinuance by several farmers due to dissatisfaction with claim procedures, high premium rates, lack of transparency and unawareness of the scheme's benefits. The findings reveal that education level and irrigated land holdings significantly influence farmers' decisions to opt out of the scheme. These insights point to a pressing need for systemic reforms in the delivery of PMFBY.

Improving awareness, ensuring quicker and transparent claim settlements, providing localized grievance redressal mechanisms and shifting the unit of assessment to the individual farm level are key to enhancing the scheme's credibility and reach. Moreover, risks like crop damage due to wild animals, currently excluded, should be integrated to make the coverage more comprehensive. Strengthening farmer trust through consistent policy execution and participatory approaches will be instrumental in bolstering the resilience of Indian agriculture and securing the livelihoods of millions dependent on it.

REFERENCES

Anonymous. 2022. Agricultural Statistics at a glance, *Department of Agriculture Cooperation & Farmers' Welfare.* Government of India.

Banerjee, D. and U. Bhattacharya. 2011. Innovations in agricultural insurance in India: Retrospect and prospect. *Indian Journal of Agricultural Economics,* 66(3): 458-470.

Bhaskar, G. and A. Darekar. 2018. Prime Minister's Fasal Bima Yojana (PMFBY): A Case of Its Implementation in Datia District of Madhya Pradesh. *International Journal of Management, Technology and Engineering*, 8: 1878 -1886.

GoI (Government of India) (2014). Report of the committee to review the implementation of crop insurance schemes in India, Ministry of Agriculture. New Delhi.

Haque, M.I. and M.R. Khan. 2017. Farmers' sensitivity to crop loss: evidence from India. *International Journal of Economic Research*, 14(8): 91-100.

Kakumanu, K.R.; K. Palanisami; U.S. Nagothu; S. Xenarios; K.G. Reddy; B. Ashok and T. Tirupataiah. 2012. An Insight on farmers' willingness to pay for insurance premium in South India: Hindrances and challenges. *Norwegian Institute for Agricultural and Environmental Research-Biforsk, working paper*.

Kumar, D.S.; B.C. Barah; C.R. Ranganathan; R. Venkatram; S. Gurunathan and S. Thirumoorthy. 2011. An analysis of farmers' perception and awareness towards crop insurance as a tool for risk management in Tamil Nadu. *Agricultural Economics Research Review*, 24(1): 37-46.

Lakshmanan, P. and K.R. Ashok. 2019. Assessment of farmer's perception towards Pradhan Mantri Fasal Bima Yojana (PMFBY) as a Risk management strategy in Tamil Nadu. *International Journal of Multidisciplinary Research and Development*, 6(2): 114-116.

Lakshmanan, P. and K.R. Ashok. 2019. Factors influencing adoption of Pradhan Mantiri Fasal Bima Yojana (PMFBY) in Tamil Nadu.

Mukherjee, S. and P. Pal. 2017. *Impediments to the Spread of Crop Insurance in India*, Shree publishers. p 312.

Nair, R. 2010. Crop insurance in India: changes and challenges. *Economic and Political Weekly*, 45(6): 19-22.

Nirmal, R. and S.C. Babu. 2021 When implementation goes wrong. In : *Lessons From Crop Insurance in India, IFPRI Discussion Paper*. pp 567.

Panda, A. 2021. Climate Change and Agricultural Insurance in the Asia and Pacific Region. *The Asian Development Bank: Mandaluyong, Philippines*.

Rajeev, M. and P. Nagendran. 2019. Where do we stand? Crop insurance in India. *Review of Rural Affairs,* 54: 26-27.

Raju, S.S. and R. Chand. 2008. Agricultural Insurance in India: Problems and Prospects. In: *National Centre for Agricultural Economics and Policy Research* (Indian Council of Agricultural Research), New Delhi.

Rawat, A. and J. Zechariah. 2022. Study on impact of Pradhan Mantri Fasal Bima Yojana (PMFBY) in Faridabad district of Haryana. *The Pharma Innovation Journal*, 11(4): 2012-2014.

Scott-Smith, T. (2018). Paradoxes of resilience: A review of the World Disasters Report 2016. *Development and Change*, 49(2).

Singh, P.J. and A. Nisha. 2020. Crop Insurance in India: Evolution, Issues and Way Forward. *Journal of Critical Reviews,* 11(7): 2851-2869.

Thapa, T. and A.S. Noel. 2023. Identifying the constraints faced by the farmers in the adoption of Pradhan Mantri Fasal Bima Yojana (PMFBY) in Prayagraj district, Uttar Pradesh. *The Pharma Innovation Journal*, 12(5): 306-308.

Vyas, V.S. and S. Singh. 2006. Crop insurance in India: Scope for improvement. *Economic Political Weekly*, 41(43/44): 4585-4594.

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Research Article

Socio-economic Constraints Faced by Fish Farmers in Hisar District

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ABSTRACT

The fisheries sector has been recognized as a powerful income and employment generator as it stimulates growth of a number of subsidiary industries and is a source a of low cost animal protein to the people particularly to the economically weaker sections of the society and thereby Sit is an advantageous position to ensure national food security. The study was conducted in rural areas of Hisar district of Haryana state and 25 fish farmers were the sample. Age distribution among farmers reveals a relatively balanced representation, with 55.00 per cent of respondents falling within the age group up to 35 years, and 45.00 per cent in the age range of 36-50 years. It's evident that there's a consensus regarding certain aspects, such as the suitability of loamy soil for fish culture, with 70.00 per cent of respondents affirming its efficacy. Additionally, 90.00 per cent of respondents recognize the detrimental effects of overfishing on ecosystems and fishermen's livelihoods, indicating a widespread awareness of the need for sustainable fishing practices. 25.00 per cent of farmers exhibited a low level of knowledge, while 45.00 per cent demonstrated a medium level and 30.00 per cent showed a high level of knowledge. 30.00 per cent of farmers exhibited a low level of adoption, while 50.00 per cent demonstrated a medium level and 20.00 per cent showed a high level of adoption. regarding technological constraints, respondents unanimously ranked the complexity of information highest with WMS: 3.00, followed closely by concerns about the high cost of technology (WMS: 2.55). Other significant concerns include technology not suited to the existing environment, lack of location-specific technologies, and issues with storage techniques, disease, pest management, hatching techniques, and fry/fingerling supply.

Keywords: Knowledge, Socio-economic , Fish, Adoption, Constraints

INTRODUCTION

India ranks as the third largest fish producing country globally, contributing 7.96 per cent to the world's total fish production. For the financial year 2022-23, India's fish production is estimated at 16.25 million metric tons (MMT), with 12.12 MMT from the inland sector and 4.13 MMT from the marine sector. With 11678 lakh fish seedings and 24765 hectares under fish culture, the Fisheries Department of Haryana hopes to produce 2.33 million tons of fish in 2024–2025. Haryana has seen a significant increase in fish production, going from 600 metric tonnes in 1966–1967 to 215173 metric tonnes in 2023–2024. Since its founding, the state's fish farming area has grown significantly, from 58 hectares to 20518 hectares. Simultaneously, the swift growth of the fish farming business has prompted various national, regional, and international entities to participate in development efforts to enhance the economic viability and environmental sustainability of aquaculture practices, including advances in fish pond designs and non-technical dimensions of fish farming development. Systems for raising aquatic animals vary greatly in terms of cultural practices and integration with other

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agricultural endeavors. The most popular kind of infrastructure for freshwater aquaculture is land ponds. But in the last few years rapid and substantial improvements in freshwater aquaculture farming techniques have been made which have improved resource efficiency and productivity while also having an impact on the environment. The water recirculation system in aquaculture is very important process in fish farming. Energy costs, associated with intensive fish production, are the main obstacles to expanding investments in this technology. Biological filtration, aeration, water circulation, and temperature control are necessary for obtaining good results and thus the use of motors, pumps, heaters, and ventilation devices make energy a fundamental element in the entire process. However, because this system primarily relies on striking a balance between the significant amount of capital that must be invested and running expenses, it is still impossible to verify its economic viability. Biswajit *et al.* (2011) also reported in their study that knowledge about scientific fish culture plays a very important role in the adoption of scientific technologies. They further said that Knowledge is a component of the behaviour of an individual and to improve the adoption of scientific fish culture under village conditions it is necessary to assess the knowledge of the fish farmers.

MATERIALS AND METHODS

The study was conducted in Hisar district of Haryana state. The selected villages were local Hisar, Paniharchek, Rawalwas, Kalan, Mattershyam, Chaudhariwas, Balsamand etc. Selection of respondents- Twenty fish farmers were selected from district Hisar. The data were collected through well-structured Interview schedule. The data were tabulated, classified and analyzed with application of suitable statistical tools to work out the association of the dependent and independent variables. Frequency, percentage, and weighted mean score were calculated.

Table 1- Socio–economic profile of the fish farmers: Age distribution among farmers reveals a relatively balanced representation, with 55.00 per cent of respondents falling within the age group up to 35 years, and 45.00 per cent in the age range of 36-50 years. Caste composition among farmers shows a significant presence from the backward class,

Table 1: Socio-economic profile of the fish farmers (n = 20)

Independent Variables	f (%)
Age	
Up to 35 years	11 (55.00)
36-50 years	09 (45.00)
Education	
Up to middle school	02(10.00)
Secondary and senior school	06(30.00)
Above senior. secondary	12(16.00)
Caste	
General	02 (10.00)
Backward class	12 (60.00)
Scheduled caste	06 (30.00)
Gender	
Male	20 (100.00)
Marital Status	
Unmarried	02 (10.00)
Married	18 (90.00)
Family type	
Nuclear	08 (40.00)
Joint	12 (60.00)
Family size	
Small (up to 4 members)	07 (35.00)
Medium (4 to 8 members)	09 (45.00)
Large (above 8 members)	04 (2.00)
Size of land holding	
Medium (Up to 2.5 acre)	06 (30.00)
Semi Medium (2.51-5 acre)	08 (40.00)
Large (5.1-10 acre)	06 (30.00)
Experience in farming	
Low (up to 3 years)	04 (20.00)
Medium (4-03)	14 (70.00)
High (above 10 years)	02 (10.00)
Mass media exposure	
Low (4-6)	04 (20.00)
Medium (7-9)	10 (50.00)
High (10-12)	06 (30.00)
Social participation	
Not member of any organization	02 (10.00)
Member of one organization	10 (50.00)
Member of more than one organization	08 (40.00)
Socio-economic status	
Low (5-8)	03 (15.00)
Medium (9-12)	11 (55.00)
High (13-16)	06(30.00)

constituting 60.00 per cent of respondents, followed by 30.00 per cent from the scheduled caste, and 10.00 per cent from the general caste. This highlights the socio-cultural diversity within the farming sector, with implications for social dynamics and access to resources.

Gender distribution among farmers is overwhelmingly male, with 100.00 per cent of respondents being male. Marital status data indicates that a majority of farmers, accounting for 90.00 per cent, are married, while 10.00 per cent are unmarried. Family type distribution shows a relatively balanced representation between nuclear (40.00%) and joint families (60.00%). Family size varies, with 35.00 per cent of farmers having small families (up to 4 members), 45.00 per cent having medium-sized families (4 to 8 members), and 2.00 per cent having large families (above 8 members). Size of landholding among farmers is distributed across medium, semi-medium, and large categories, with 30.00 per cent, 40.00 per cent, and 30.00 per cent of respondents respectively, indicating varied land ownership patterns and agricultural production capacities.

Experience in farming varies among farmers, with 20.00 per cent having low experience (up to 3 years), 70.00 per cent having medium experience (4-10 years), and 10.00 per cent having high experience (above 10 years). Mass media exposure among farmers ranges, with 20.00 per cent having low exposure, 50.00 per cent having medium exposure, and 30.00 per cent having high exposure. Social participation levels vary, with 10.00 per cent of farmers not being members of any organization, 50.00 per cent being members of one organization, and 40.00 per cent being members of more than one organization. Lastly, socio-economic status distribution among farmers shows a majority falling within the medium category (55.00%), followed by 30.00 per cent in the high category, and 15.00 per cent in the low category.

Table 2- Knowledge level of fish farmers: It's evident that there's a consensus regarding certain aspects, such as the suitability of loamy soil for fish culture, with 70.00 per cent of respondents affirming its efficacy. Additionally, 90.00 per cent of respondents recognize the detrimental effects of overfishing on ecosystems and fishermen's livelihoods, indicating a widespread awareness of the need for sustainable fishing practices. The unanimity on recommended fish species, including Rahu, Catla, Grass-carp, and Mrigal,

Table 2: Knowledge level of fish farmers (n = 20)

S.No.	Knowledge statements	Yes	No
1	Loamy soil is good for fish culture	14 (70.00)	06 (30.00)
2	Overfishing can lead to declines in population disrupting ecosystems and threatening the livelihoods of fisherman	18 (90.00)	02 (10.00)
3	Rahu, catla, Grass -carp and Mrigal are the recommended species	20 (100.0)	-
4	July to September is suitable time for stocking of fish seed	17(85.00)	03(15.00)
5	7-8 months is proper harvesting time period	16 (80.00)	04(20.00)
6	Availability of good quality fish seed is a major problem in fish farming	20 (100.0)	-
7	Colour light green and temperature 25-30°C are required for appropriate water quality maintenance	12 (60.00)	08 (40.00)
8	To control predators or parasitic animals of pond the use of Tortoise, Frog-netting, mahuacake @ 2500 kg/ha)	14 (70.00)	06 (30.00)
9	To control aquatic weeds- Valenesia, hydrilla (250-300 ppm urea solution), mechanically uprooting or netting or chemical control measure (2,4-D)	11 (55.00)	09(45.00)
10	Recommended organic manure used – dung compost @ 15000-20000 kg/ha/annum in 7-11 instalment, 2-3 weeks for seed stocking	09 (45.00)	11 (55.00)
11	Liming can dramatically set the pH of fish ponds	17 (85.00)	03 (15.00)
12	Flakes, planktons, nektons and benthos are natural fish feed	20 (100.00)	–
13	Hand feeding is best method for feeding fish	14 (70.00)	06 (30.00)
14	Lime is most commonly used chemical to control acidic condition of fish culture	18 (90.00)	02 (10.00)

Table 2 contd...

S.No.	Knowledge statements	Yes	No
15	Advantages of using inorganic fertilizers -promote the development of plankton algae, which provide natural food for many fish species	14 (70.00)	06 (30.00)
16	It is necessary to remove excess aquatic weeds- because it will Stunt or interfere with a balanced fish population and can led to fish mortality because of depletion in dissolved oxygen	17 (85.00)	03 (15.00)
17	Indicators of oxygen depletion in fish pond- fish gasping at the surface of the pond, foul odours - decaying organic matter and algul, bloom	20 (100.00)	–
18	Measure to control of disease outbreak in fish are vaccination, providing water sources free of pathogens, protection from the transfer of pathogens	19 (95.00)	01 (05.00)
19	It is must to stop manuring and feeding when pond water turns greenish	20 (100.00)	–
20	Bleaching is also used as a disinfectant in fish pond before stocking of fish seeds	18 (90.00)	02 (10.00)

further underscores a shared knowledge base within the fishing community. An overwhelming majority 85.00 per cent of respondent agree on stocking of fish seed between July to September. Further with regard to 7-8 months harvesting time period (80.00) per cent of respondent agree. Availability of good quality fish seed emerges as a major concern, unanimously acknowledged by all respondents. Concerning water quality maintenance, knowledge vary on the requisite color and temperature, with 60.00 per cent agreeing on light green color and 25-30°C temperature. Measures to control predators or parasitic animals yield a response of 70.00per cent endorsing certain methods while the remaining 30.00 per cent disagree. Likewise, opinions diverge on strategies for aquatic weed control, with more than half 55.00per cent of farmer supporting specified measures. Organic manure recommendations see a split, with 45.00 per cent in agreement and 55.00 per cent dissenting. There's agreement that lime is commonly used to control acidic conditions (90.00%). Consensus exists on natural fish feed types, hand feeding as the preferred method, and the benefits of inorganic fertilizers in promoting algae development (100%, 70.00%, and 70.00% agreement, respectively). Moreover, with regard to knowledge of farmers removing excess aquatic weeds had 85.00% agreement and indicators of oxygen depletion in fish ponds had cent percent agreement. In the context of measures to control disease outbreaks had 95.00% agreement and the necessity of stopping manuring and feeding when pond water turns greenish had cent percent agreement. Finally, on the use of bleaching as a disinfectant in fish ponds pond before stocking of fish seeds an overwhelming majority 90.00 per cent of respondent agreed of its use.

Table 3- Knowledge levels of farmers: The knowledge levels of farmers, categorized as low, medium, and high. 25.00 per cent of farmers exhibited a low level of knowledge, while 45.00 per cent demonstrated a medium level and 30.00 per cent showed a high level of knowledge.

Table 3: Knowledge level of the farmers (n=20)

Knowledge level	Frequency	Percentage
Low (20-26)	05	25.00
Medium (27-33)	09	45.00
High (34-40)	06	30.00

Figures in parentheses denote percentage

Table 4- Adoption level of the farmers presents the adoption levels of farmers, categorized as low, medium, and high. 30.00 per cent of farmers exhibited a low level of adoption, while 50.00 per cent demonstrated a medium level and 20.00 per cent showed a high level of adoption.

The Table 5- Reasons for adoption of fish farming: Analysis reveals that, an overwhelming majority (85.00)

Table 4: Adoption level of the farmers (n=20)

Adoption level	Frequency	Percentage
Low (12 – 19)	06	30.00
Medium (20 – 27)	10	50.00
High (28 – 36)	04	20.00

Figures in parentheses denote percentage

Table 5: Reasons for adoption of fish farming (n=20)

S.No.	Aspects	Agree	Neutral	Disagree	WMS	MS	Rank
1.	Aware of fish farming practices	17 (85.00)	03 (15.00)	_	57	2.85	I
2	Good economic return	11 (55.00)	07 (35.00)	02 (10.00)	49	2.45	II
3.	Aquaculture is ecologically more sustainable	10 (50.00)	04 (20.00)	06 (30.00)	44	2.2	III
4.	Proper loamy soil and assured water supply	09 (45.00)	05 (25.00)	06 (30.00)	43	2.15	IV
5.	Suitable bio physical conditions	07 (35.00)	08 (40.00)	05 (25.00)	42	2.1	V
6.	Approachable road or pucca path	08 (40.00)	05 (25.00)	07 (35.00)	41	2.05	VI
7.	Growing demand of seafood	05 (25.00)	09 (45.00)	06 (30.00)	40	2	VII
8.	It was not possible to sustain household expenditure through traditional agriculture and moreover the government is promoting fisheries culture and different aspects of aquaculture through different kind of subsidies ranging from 50 to 70 per cent	05 (25.00)	08 (40.00)	07 (35.00)	38	1.9	VIII
9.	Shade trees at bank of pond	06 (30.00)	05 (25.00)	09 (45.00)	37	1.85	IX
10	Easy access to advisory services	06 (30.00)	04 (20.00)	10 (50.00)	36	1.8	X
11	Household consumption	02 (10.00)	08(40.00)	10 (50.00)	32	1.6	XI
12	Cheapest and balanced nutrition for lower strata of the society	03 (15.00)	05 (25.00)	12 (60.00)	31	1.55	XII

Figures in parentheses denote percentage

per cent of respondents were aware of the fish farming practices, earning it the topmost rank. This suggests that a significant portion of respondents recognizes the importance and benefits of fish farming practices, indicating a strong foundation of knowledge in the community. Following closely behind was the acknowledgment of good economic returns from fish farming, with 55.00 per cent agreement, securing it second rank.

Furthermore, respondents also perceive aquaculture as ecologically sustainable, with 50.00 per cent agreement, placing it at the third rank. This highlights the growing awareness and emphasis on sustainable agricultural practices, aligning with broader environmental conservation efforts. Additionally, respondents cite the presence of proper loamy soil and assured water supply (45.00%) and availability of suitable biophysical conditions (35.00% agreed), earning them the fourth and fifth ranks, respectively. These factors underscore the importance of favorable environmental conditions and resource availability in facilitating successful fish farming endeavours.

On the other hand, aspects such as growing demand of seafood (40.00% agreed) and the presence of approachable roads or pucca paths (45.00% neutral) receive more mixed responses, ranking them at sixth and seventh, respectively. Additionally, about the government subsidies and promotion (40.00%) of the respondents have neutral stance ranking it at eight positions. Moreover, respondents also consider factors like shade of trees at bank of pond and easy access to advisory services (30.00% agreed), as contributing factors, ranking them at ninth, and tenth positions, respectively. Finally with regard to household consumption (50.00%) and balanced nutrition for lower strata of the society (60.00%) of the respondent did not agree that they play a role in adoption, ranking them at XI and XII position. Shubham et al (2023) in their study reported that cultural norms and societal dynamics can influence fish farming practices, sometimes hindering the adoption of sustainable farming. Thus collaborative efforts among the government departments, institutes, banks, NGOs etc. are essential.

Table 6- Socio and economic constraints: As the analysis reveals regarding technological constraints, respondents unanimously ranked the complexity of information highest with WMS: 3.00, followed closely by concerns about the high cost of technology (WMS: 2.55). Other significant concerns include technology not suited to the existing environment, lack of location-

Table 6: The Socio and Economic Constraints (n=20)

S.No.	Statements	Agree	Neutral	Disagree	WMS	Rank
A	***Technological constraints***					
1	High cost	13	05	02	2.55	II
2	Complexity of the information	20	_	_	3.00	I
3	Technology not suited with existing environment	09	04	07	2.10	VI
4	Lack of location specific technologies	8	02	10	1.90	VII
5	Lack of storage technique	06	06	08	1.90	VII
6	Disease and pest	13	03	04	2.45	IV
7	Poor Hatching techniques	06	06	08	1.90	VII
8	lack of supply of fry/fingerlings	14	02	04	2.50	III
9	high cost of feeds	11	06	03	2.40	V
B	***Economic constraints***					
1	Lack of financial support	09	06	05	2.20	II
2	Non availability of credit	08	08	04	2.20	II
3	High wages &labour cost	07	05	08	1.95	III
4	High cost of inputs	10	04	6	2.20	II
5	Insufficient marketing facilities	14	03	03	2.55	I
C	***Administrative constraints***					
1	Lack of policy support	07	08	05	2.10	IV
2	Inadequate extension contacts	14	03	03	2.55	III
3	Lack of need based program for any organization	18	_	02	2.80	II
4	Lack of organized market	19	01	_	2.95	I
D	***Social constraints***					
1	Poaching & poisoning	14	03	03	2.55	III
2	Social norms and beliefs	12	02	06	2.30	IV
3	Lack of family encouragement	06	08	06	2.00	V
4	Inadequate family labour	06	08	06	2.00	V
5	Ignorance about technical knowledge	18	01	01	2.85	I
6	Insurgency	12	04	04	2.70	II
E	***Infrastructural constraints***					
1	Non-availability of seeds	14	02	04	2.50	II
2	Shortage of labour	08	04	08	2.00	IV
3	Lack of storage facilities	12	04	04	2.7	I
4	Poor transportation	18	02	_	2.30	III
F	***Extension constraints***					
1	Lack farm and home visit by the extension workers	08	05	07	2.05	IV
2	Lack of farm publication	16	01	03	2.65	II
3	Lack of mass media exposure	07	01	12	1.75	V
4	Ineffective communication	08	04	12	2.20	III
5	Lack of need based training program	18	02	_	2.90	I

specific technologies, and issues with storage techniques, disease, pest management, hatching techniques, and fry/fingerling supply.

In terms of economic constraints, respondents ranked insufficient marketing facilities highest (WMS: 2.55), emphasizing the need for improved marketing infrastructure. Lack of financial support and non-availability of credit were equally ranked second (WMS: 2.20), indicating challenges in accessing financial resources. High wages and labor costs ranked third (WMS: 1.95), highlighting concerns about labor affordability, while the high cost of inputs was ranked fourth (WMS: 2.20), reflecting financial strains in acquiring necessary resources for fish farming. Sanee *et al.* (2025) in their study reported that fish farmers ranked inadequate execution of fisheries development plans and strategies as their main concern, with a mean score of 58.95.

Under administrative constraints, lack of policy support (WMS: 2.10) emerges as the fourth-ranked issue, indicating challenges stemming from inadequate policy frameworks. Inadequate extension contacts (WMS: 2.55) ranks third, suggesting shortcomings in the outreach efforts of extension services. Lack of need-based programs for organizations (WMS: 2.80) ranks second, highlighting the importance of tailored support initiatives. Lack of an organized market (WMS: 2.95) ranks highest, indicating significant hurdles in accessing structured market channels.

Turning to social constraints, it is indicated that the concerns about illegal activities harming fish farming. Ignorance about technical knowledge (WMS: 2.85) ranks highest. Insurgency (WMS: 2.70) ranks second, suggesting disruptions caused by security challenges Respondents identified poaching and poisoning (WMS: 2.55) as the third-ranked challenge, underscoring the importance of enhancing technical awareness among farmers. Social norms and beliefs (WMS: 2.30) and inadequate family encouragement and labor (both with a WMS of 2.00) are ranked fourth and fifth, respectively, highlighting familial and cultural dynamics impacting fish farming endeavors. Kummari *et al.* (2018) their study stressed that quantitative as well as qualitative improvement in fish production requires standardization of breeding techniques and adoption of scientific technologies and innovative techniques, which must be eco-friendly. Moreover, Government support is also essential to reduce economic losses and risks involved in fish farming. Meanwhile, farmers require training regarding the scientific management of fish farm.

Regarding infrastructural constraints, challenges include non-availability of seeds (WMS: 2.50), shortage of labor (WMS: 2.00), lack of storage facilities (WMS: 2.70, ranked highest), and poor transportation (WMS: 2.30). Lastly extension constraints, respondents highlighted issues such as lack of farm and home visits by extension workers (WMS: 2.05), absence of farm publications (WMS: 2.65, ranked second), limited mass media exposure (WMS: 1.75), ineffective communication (WMS: 2.20), and the absence of need-based training programs (WMS: 2.90, ranked highest). Islam *et al.* (2016) in their study also revealed the challenges faced by fisheries sector which included food security, degradation of habitat, urbanization, and expansion of industry sector etc. They suggested a rationale to develop liable fisheries management and optimum usage of water bodies. Pandey *et al.* (2006) also supported this statement that seed is considered to be the most crucial input for fish farming and the development of fish farming is highly dependent on adequate, quality and timely availability of the desired seed. He also said that assured supply of quality fish seed at the time of stocking is the second most important problem.

CONCLUSION

It was concluded that 90.00 per cent of respondent recognize the detrimental effects of overfishing on ecosystems and fishermen's livelihoods, indicating a widespread awareness of the need for sustainable fishing practices. The data revealed that, an overwhelming majority (85.00) per cent of respondents were aware of the fish farming practices, earning it the topmost rank. This suggests that a significant portion of respondents recognizes the importance and benefits of fish farming practices, indicating a strong foundation of knowledge in the community. Following closely behind was the acknowledgment of good economic returns from fish farming, with 55.00 per cent agreement, securing it second rank. The increase of coastal aquaculture can contribute to the production of much-needed extra food for the world's rising

population. Glacio Souza Araujo *et al.* (2022) also reported in their study that increasing fish output, through the growth of coastal aquaculture, using ecologically friendly techniques and suitable adaption measures for the physical cultivation methods used nowadays, is important. During the study, it was observed that most of the farmers (80%) do not get any kind of scientific fish culture training.

REFERENCES

Araujo, G.S.; J.W.A.D. Silva; J. Cotas and L. Pereira. 2022. Fish farming techniques: current situation and trends. *Journal of Marine Science and Engineering*, 10(11): 1598.

Chauhan, S.; V. Geethalakshmi; K. Rejula; S. Salas and P. Dona. 2025. Fish Farmers' Perception and Challenges in Public and Private Extension Systems. *Indian Research Journal of Extension Education*, 25(1): January – March

Das, M.; M.R. Islam; T. Akter; A.Q.M.R. Kawser and M.N. Mondal. 2018. Present status, problems and prospect of fish farming at Gazipur Sadar upazila in Bangladesh. *Progressive Agriculture,* 29(1): 53-63.

Goswami, B. and T. Samajdar. 2011. Knowledge of Fish Growers about Fish Culture Practices. *Indian Research Journal of Extension Education,* 11(2): 2011.

Islam, M.S.; H. Jahan and A.K.M. Abdullah Al-Amin. 2016. Fisheries and aquaculture sectors in Bangladesh: an overview of the present status, challenges and future potential. *Journal of Fisheries and Aquaculture Research*, 1(1): 2-9.

Kummari, S.; B. Prakash; S.P. Mamidala; N. Daggula and G. Suresh. 2018. Opportunities and prospects of inland freshwater aquaculture in Telangana: a step towards blue revolution. *Journal of Entomology and Zoology Studies*, 6(3): 314-319.

Pandey, S.K. and R. Dewan. 2006. Constraints in fish farming practices in Uttar Pradesh, India: An analysis. *Journal Indian Fisheries Association,* 33: 183-189.

Rohila, A.K.; R. Mukteshawar; B. Arulmanikandan and R. Kumar. 2023. Constraints Perceived by Farmers in Fish Farming: A Review Analysis. *International Journal of Environment and Climate Change*, 13(11): 1546-1550.

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Research Article

Training Needs of Marigold Farmers on Production Technologies in Samba District

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ABSTRACT

The first and foremost important step for planning a good training programme is to assess its needs. In recent years farmers are gradually sensitized and oriented to cultivate the high value crops other than their traditional farming. The flower crops have the inherent advantage of providing higher productivity per unit of land resulting in higher income. Likewise marigold growers needs to trained according to their requirement so as to get higher production of their crop. Looking to these facts, the present study was carried the general objective of this research in Samba district. Results revealed that majority of the marigold growers have 64 per cent training needs. The farmers were expressed their aspects wise training on plant protection, nursery raising, fertilizer management, field management and marketing management as well as on the economic return of the marigold crop. Correlation analysis revealed that education, farm size, annual income, decision making behaviour, risk orientation, marketing orientation were found positively and significantly correlated with training needs, where as age, caste were found non significant with the training need of marigold growers.

Keywords: Training needs, Assessment, Marigold production, Growers

INTRODUCTION

Training is an important process of capacity building of individual as to improve the performance. It may be defined as the act of increasing the knowledge and skill of employee in doing a particular job. Training is mostly directed at improving the ability of individual to do his job better. Singh (1989) described training need as the gap between what is going on and what should go on. Training need should be expressed in term of gap in attitude, knowledge and skills. Needs of the training are diverse and vary from crop to crop (Farinda and Ajay, 2005). Training is essential to induce motivation, create confidence and inculcate efficiency in and individual. The training needs assessment is vital to the training process. The assessment of training need is first and foremost activity for planning a good training programme. Production of marigold mainly depend on the farming system of marigold growers. In order to make any training programme meaningful and effective, it is imperative on the part of training institution to identify the training needs of the marigold farmer based on which a suitable training module can be developed so that the appropriate training is given to the people, in right form at right time so that higher degree of productivity and profitability can be achieved. Need assessment help to identify present problem and future challenges to be met through training and development. They are to be trained properly according to their need so as to be fitted and proficient in performing their jobs which would help in increasing production.

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Floriculture is a fast emerging and highly competitive industry. Flower plants are no longer meant for only window garden but play an important role in decoration world for decorating houses, office establishment and cars also. With the introduction of new cultivars, important crops, their cultural practices are changing. Marigold, important and commercial crop among flowers.it is highly remunerative crop because this crop fetch maximum price from per unit area. The recommended marigold cultivation practices are complex and costly which require sufficient information on the part of farmers. Training to the farmers about recommended cultivation practices can serve this purpose and to design training module for the farmers, training need assessment is must.

Area and production of marigold under Samba district is less. Thus there is need to extend area and production of marigold in Samba district. Looking to these facts, the present study was carried out with the following objectives to ascertain the training need of marigold growers. Pertaining the marigold production technology and to find out the relationship of selected characteristics of marigold farmers with their level of training needs.

MATERIALS AND METHODS

The present study was undertaken in Samba district of J&K state. The district consists of nine blocks from which block Vijaypur, Ramgarh and Gaghwal were selected purposively, as they cover more area under marigold crop. From each block four villages were selected and from each village thirty farmers were selected randomly to serve as sample respondents. In this way list of 120 marigold growers was prepared by simple random method of sampling. The primary data was collected using a pre tested structured interview schedule by conducting personal interview from the selected marigold growers.

RESULTS AND DISCUSSION

Training needs data regarding distribution of respondents according to their training needs were collected and classified in three groups. The data in this regard presented in Table 1.

The study on training needs revealed that 64.16 per cent of the marigold respondents were under high training need category. 21 per cent had medium training need where as rest of 17 per cent had low training need. Majority of marigold growers had high level of training needs followed by medium level of training need. It means that farmers were not aware regarding the production technology of marigold and also about the programme conducted by extension and other agencies. The farmers should be inculcated the spirit of attending the training programmes for their benefits. So the training programmes may be organised according to the need base and interest of the farmers of that particular area. Similar results were studied by Suneetha (2003).

Table 1: Distribution of the marigold growers according to their training needs with regard to marigold production technology (n=120)

Training level	Frequency	Percentage
High	77	64.16
Medium	25	21
Low	21	17

Important training need area identified with respect to marigold cultivation practices: Data regarding distribution of respondents according to their training needs in different subject matters were presented in the Table 2.

Table 2 revealed that training needs of the farmers based on overall mean score obtained was found essential in in plant protection aspects. The respondents perceived the training need in plant protection ranked first with mean score 2.19 due to significant damage reported by aphids, caterpillar, red spider mite and diseases like bud rot and wilting. These factors may be motivated them to assign the top rank. Training was found to be essential in the area of subject relating to nursery raising and management with mean score of 2.10 having ranking II followed by fertilizer

Table 2: Distribution of the marigold growers according to their aspect wise training needs

Aspects	Mean score	Rank
Nursery raising	2.10	II
Field management	2.00	IV
Fertilizer management	2.04	III
Plant protection	2.19	I
Economics & Marketing	1.90	V

management with mean score of 2.04 having ranking III. Marigold farmers also expressed their training need regarding field management which include land preparation, care and maintenance of crop etc. having mean score of 2.00 and ranked IV. The least essential training need area was identified as marketing of produce having mean score of 1.90 and was ranked VI with respect to other training need area.

Correlation between different selected characteristics and these training needs: To examine this relationship between selected characteristics of marigold, correlation coefficient (r) value was computed. Social economical characteristics were studied for assuming the training need on marigold production technology. Keeping this in mind efforts were made to find the correlation, if any between the selected characteristics of marigold growers. And their training need. To examine this relation ship between different charactertics of marigold growers, correlation coefficient was computed and presented in the Table 3.

The data depicted in Table 3 indicate that among ten characteristics studied, farm size and decision making behaviour were found positively and significantly correlated with training need at 0.01% level of probability, where as education, annual income, extension contact, risk orientation, market orientation were correlated positively and significantly at 0.05% level of probability. Further it was noticed that age, experience in marigold production and caste did not show any relationship with training needs.

Table 3: Effect of Correlation Coefficient

Variables	Correlation Coefficient (r value)
Age	1.253NS
Education	0.275*
Experience in marigold production	0.023NS
Farm size	0.423**
Annual Income	0.184*
Caste	0.0816NS
Extension contact	0.272*
Decision making behave	0.288**
Risk orientation	0.716*
Market orientation	0.212*

NS- Non significant; * and ** indicate signification of value at P=0.05 and 0.01 respectively.

High Economic Return : An important factor for training need: Furthermore, the input and output prices were taken for calculating cost of cultivation, gross returns, net returns and benefit : cost ratio (Table 4). With the adoption of improved technology higher gross return (Rs. 700000/ha), net return (Rs. 615,000/ ha) and B:C ratio (1:7.2) can be obtained in Marigold farming. This may be attributed due to higher yields obtained under improved technologies. Moreover it will attract the farmer to go for marigold cultivation by getting the knowledge through training programmes. These results are in close conformity with the findings (Hiremath *et al.,* 2009 and Mokidue *et al.,* 2011).

The formal school education possessed by the farmers and the training need of the farmers on marigold production technology definitely enhances the training needs because education facilitate to synthesises comprehensively the external information into the given situation. Training need identification and providing training according to needs of the farmer sharpens the hidden skills and act as medium to imbibe any new knowledge or skill in a given profession. Hence these variables were positively and significantly related to the training needs of the marigold farmers. The variable annual income has direct contact with training needs. The raised income level of the farmer act as driving force to search for new information regarding new technology. Decision making behaviour of the farmers depends on the ability to forming clear opinion and acting on them. This could be the reason of positive and significant relationship with the training needs of marigold growers on production technology and

Table 4: Cost of cultivation (Rs/ha), gross return (Rs/ha), net return (Rs/ha) and B:C ratio by adopting improved technology

Yield (q/ha)	Cost of cultivation (Rs/ha)	Gross Return (Rs/ha)	Net Return (Rs/ha)	B:C ratio
200	85000	700000	615,000	7.2

(Selling price of Marigold –Rs. 35/kg)

decision making behaviour. Verma (2018) also conducted an investigation on training need assessment of marigold growers.

CONCLUSION

It can be concluded from the investigation that majority of marigold growers expressed their need for training on marigold production technology. The analysis of selected characteristics like education, farm size, annual income, decision making behaviour, market orientation, risk orientation were found positively and significantly correlated with their training needs. It was also concluded that after coming to know its economic return, majority of marigold farmers gave emphasis of training need on marigold production technology as this information can help them to great extent while adopting in their field. They also required training especially on nursery management, field management, plant protection measures, nutrient management and marketing management respectively. So while preparing farmer training programmes for the area of training required by marigold growers should be given due importance to support them to take decision regarding adoption of marigold technology. The extension personnel's, policy makers and scientists shall keep the results of this study in view, while taking decision as regard to what contents of the technological information regarding marigold production technology should be taken to which type of the framers. Further they should concentrate on major areas, identified by this study for deciding the content of the message to be prepared for the marigold growers.

REFERENCES

Farinde, A.J. and A.O. Ajayi. 2005 Training need of women farmers in live stock production : Implication for rural development in Oyostate of Nigeria. *Journal of Social Sciences,* 10(3): 159-164.

Hiremath, S.M. and M.V. Nagaraj. 2010. Evaluation of front line demonstration trails on onion in Haveri district of Karnataka. *Karnataka Journal of Agricultural Sciences,* 22(2): 1092-1093.

Singh, R.P. 1989. A study on management of training programme of selected organisations in Karnal district. M.Sc. Thesis, National Dairy Research Institute, Karnal, Haryana.

Suneetha, S.R. 2003. A study on entrepreneurial behaviour of sericulture farmers in Chittor district of Andra Pradesh. M.Sc. (Ag) Thesis T.N. Agricultural University, Coimbatore, T.N.

Verma H.K. *et. al.* 2018. Training need assessment of marigold growers. Agriculture Update. 8(1&2): 257-259.

Verma, H.K. 2012. Training need assessment of marigold growers. M.Sc. Thesis, Anand Agricultural University, Anand Campus Gujrat.

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Research Article

Knowledge Level of Farmers About the Rice IPM Practices

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ABSTRACT

Rice (*Oryza sativa* L.) is one of the most important staple crops globally, serving as the primary food source for over half of the world's population. The present study was conducted in Punjab state to assess the knowledge level of farmers about the recommended rice IPM practices A total of 200 farmers were randomly selected from five district i.e. Ropar, Ludhiana, Gurdaspur, Shri Muktsar sahib, Ferozpur representing different agro-climatic zones of Punjab. Majority of the farmers had medium level of mass media exposure and extension contacts. Most of the farmers had medium level of overall knowledge regarding the cultural, mechanical and chemical practices of IPM however they lacked knowledge on ETL of insect-pest. The overall knowledge about the biological practices were found low.

Keywords: Knowledge level, Integrated pest management (IPM), Rice, Pest

INTRODUCTION

Rice (*Oryza sativa* L.) occupies a pivotal place in Indian agriculture and is the staple food of an estimated 3.5 billion people globally, and its cultivation is done on only 11 per cent of the worlds cultivable land (Dhakal and Poudel, 2020). In India, the major rice producing states with respect to area are Utter Pradesh (6.0 million ha), West Bengal (4.33 million ha), Chhattisgarh (3.78 million ha), Odisha (3.70 million ha), Bihar (3.31 million ha) and Punjab (3.15 million ha) (MoAFW, 2021). Since the Green Revolution began in 1965–1966 the yield of rice per hectare has increased by a factor of four. The agriculture sector in India made significant advancements as a result of the Green Revolution's success. India went from having a food shortage to having a surplus of food. Punjab is the top-ranking rice-producing state in the central pool of food grains. Rice farming not only sustains the livelihoods of millions of farmers but also plays a crucial role in ensuring food security for the growing population of India.

However, this intensive agricultural practice has brought with it a host of challenges, particularly related to pest management. In order to boost agriculture productivity and profitability, there has been a huge increase in the level of crop protection, as evidenced by a 15 to 20-fold increase in the number of pesticides used globally (Nayak and Solanki, 2021). Excessive use of chemical pesticides for crop protection is connected to long-lasting negative impacts on human health and the environment (Barzman *et al.,* 2015). This resulted in a decline in soil fertility and a deterioration in ground water quality, which in turn caused numerous health issues in humans, livestock, and the environment. Agro-chemicals are also used unscrupulous and extensively in paddy production, which resulted in a number of issues including environmental contamination, health risks, pesticide resistance in insects, and unsustainable farming practices' majority of pesticide residues are fundamentally hazardous to human life.

In response to these challenges, the concept of Integrated Pest Management (IPM) has gained traction as a sustainable alternative. IPM focuses on managing many pests simultaneously, regular pest monitoring and their natural enemies, employing treatment and economic limits when using pesticides, and the

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coordinated application of numerous suppressive techniques (Duke and Powles, 2008). The integration of Cultural, Mechanical, Biological and Chemical practices make the pest management practice a stronger approach rather than sole application of chemical pesticides.

MATERIALS AND METHODS

The present study was conducted in Punjab state focusing on five districts i.e., Ropar, Ludhiana, Gurdaspur, Ferozpur and Sri Muktsar Sahib each representing different agro-climatic zones respectively. Two blocks were selected randomly from each districts, from each block two villages and from each village ten respondents were selected randomly, thus making a total sample of 200 respondents. A knowledge test was developed to evaluate the knowledge level of farmers. This test included questions about IPM practices for rice crop. The test featured multiple-choice, yes/no and fill-in-the-blank questions related to these practices. The items related to the IPM practices used in rice crop were developed by consulting experts and farm literature.

The purpose of item analysis is to identify poorly performing items, revise them for clarity or difficulty, and improve the overall validity and reliability of the test. Item analysis typically includes evaluating two main metrics: item difficulty and item discrimination. To analyze the items, 45 questions were posed to the 20 farmers. Each question have two possible outcomes, either correct or incorrect. Each correct answer by the respondent was given 1 score while each wrong/ no response was allotted 0 score. The knowledge score of each respondent was determined by the total number of correct answers. Items having a discrimination index greater than 0.3 and a difficulty index between 0.30 and 0.80 were chosen. While these criteria were the primary factors for the final selection of items, some items with very low or high difficulty and discrimination indices were modified and moulded based on feedback from experts. As a result, 40 items were retained in the knowledge test.

RESULTS AND DISCUSSION

The data in Table 1 reveal that the 54 per cent of respondents were in age group of 39-54, followed by 25 per cent which were between the ages of 55-70 and the remaining 21 per cent were in young age category between the ages of 23-38. The data further revealed that 41 per cent of the farmers had completed their education up to senior secondary school while 31.50 per cent of the farmers were matriculate. About 12 per cent farmers have education level of primary school. Only 8.50 per cent of the farmers were illiterates and only a small per cent of the farmers, i.e. 7 per cent were graduates and above. A significant proportion 57 per cent of the respondents belonged to joint families, while 43 per cent were from nuclear families.

Table 1: Distribution of the respondents according to their socio-personal Characteristics (n=200)

Category	Frequency	Percentage
Age (years)		
23-38	42	21.00
39-54	108	54.00
55-70	50	25.00
Educational level		
Illiterate	12	6.00
Primary	37	18.50
Matriculation	61	30.50
Senior secondary	76	38.00
Graduate and above	14	7.00
Family type		
Nuclear	86	43.00
Joint	114	57.00
Occupation		
Agriculture	27	13.50
Agriculture + subsidiary occupation	123	61.50
Agriculture + govt Job	32	16.00
Agriculture + govt job + subsidiary occupation	6	3.00
Agriculture + Business	12	6.00
Operational land holding		
Marginal (less than 1 ha)	31	15.50
Small (1-2 ha)	39	19.50
Semi-medium (2-4 ha)	68	34.00
Medium (4-10 ha)	49	24.50
Large (10 ha or above)	13	6.50

The study further revealed that 61.50 per cent of respondents were engaged in agriculture combined with

subsidiary occupations. A smaller proportion i.e. 16 per cent was involved in agriculture along with government jobs. Meanwhile, 13.50 per cent of respondents depended solely on agriculture, and 6 per cent were involved in agriculture and business. Very few i.e. 3 per cent of the respondent depends solely on agriculture, government job and subsidiary occupations. According to the data in table 1, operational land holding, the farmers were divided into five categories, marginal (less than 1 ha), small (1-2 ha), semi-medium (2-4 ha), medium (4-10 ha) and large (more than 10 ha). More than one-third 34.00 per cent of the respondents had semi-medium landholdings (2–4 hectares), followed by 24.50 per cent who had medium-sized holdings (4–10 hectares). Small landholders (1–2 hectares) constituted 19.5 per cent and marginal farmers with less than 1 hectare of land had 15.50 percent. Only 6.50 per cent owned large landholdings of 10 hectares or more.

The data in Table 2 outlines the respondents' knowledge regarding various cultural practices of Integrated Pest Management (IPM) in rice crops. All the respondents had good knowledge of the practice of crop rotation. A significant proportion of the respondents 93 per cent were knowledgeable about the recommended varieties of rice. Similarly, 91 per cent of respondents knew about the recommended date of transplanting rice, reflecting their understanding of optimal sowing times for achieving better crop yields. The knowledge regarding summer deep ploughing was also notable, with 83 per cent of respondents acknowledging its importance. Additionally, 79.50 per cent of the respondents knew about the age of seedlings at the time of transplanting, which is critical for ensuring proper establishment of the rice crop. Knowledge regarding the removal of previous crop residue and the recommended seed rate of rice was reported by 75.50 per cent of the respondents. However, the knowledge levels declined for practices such as spacing 69.00 per cent and the depth of standing water 53.50 percent.

The research findings highlight that farmers exhibited considerable knowledge of major cultural practices related to IPM in rice, particularly crop rotation, recommended varieties, and transplanting times, probably due to influence of extension services, peer learning, and practical experience. A significant proportion of respondents were knowledgeable about the recommended varieties of rice, indicating that farmers actively utilized high-yielding and pest-resistant varieties to enhance productivity. Results reported by Singh *et al* (2011) are in accordance with the present study.

The data in Table 3 presents the respondents' knowledge regarding the recommended dosage of chemical fertilizers for rice cultivation. The data revealed that a majority of respondents 73.50 per cent knew about of the recommended dosage of urea (90 kg/acre). Similarly, 57.50 per cent of the respondents had knowledge of the recommended dosage of DAP (27 kg/acre). In contrast, the knowledge about MOP (20 kg/acre) was relatively lower, with 38.00 per cent. The lowest knowledge was observed for zinc (25 kg/acre), where only 32.00 per cent of the respondents had knowledge about the recommended dosage.

Table 2: Distribution of the respondents according to their knowledge regarding various cultural practices of IPM in rice crop (n=200)

Statement	Frequency	Percentage
Recommended date of transplanting of rice (20 June to 10 July)	182	91.00
Age of seedling at the time of transplanting rice (30-35 days)	159	79.50
Summer deep ploughing	166	83.00
Recommended varieties of rice	186	93.00
Removal of previous crop residue	151	75.50
Crop rotation	200	100
Recommended seed rate of rice (8 kg/acre)	151	75.50
Spacing (33 hill/ sq m)	138	69.00
Depth of standing water (10 cm)	107	53.50

Table 3: Distribution of the respondents according to their knowledge regarding recommended dosage of chemical fertilizer in rice on the basis of soil test basis (n=200)

Statement	Frequency	Percentage
Urea (90 kg/acre)	147	73.50
DAP (27kg/acre)	115	57.50
MOP (20 kg/acre)	76	38.00
Zinc (21%) (25 kg/acre)	64	32.00

Table 4: Distribution of the respondents according to their knowledge regarding various mechanical practices of IPM in rice crop (n=200)

Statement	Frequency	Percentage
Hand picking of the insect and their destruction	92	46.00
Use of hand nets	112	56.00
Clipping of rice seedling tips before planting	137	68.50
Light and pheromone traps	64	32.00
Rope method	154	77.00
Roughing practices	143	71.50

The Table 4 outlines the respondents' knowledge regarding various mechanical practices of Integrated Pest Management (IPM) in rice cultivation. The data revealed that 77.00 per cent of the respondents had knowledge about the rope method while 71.50 per cent of the respondents were familiar with roughing practices, a technique involving the removal of diseased or pest-infested plants. Clipping of rice seedling tips before planting was another practice known by 68.50 per cent of respondents. The use of hand nets was known by 56.00 per cent of respondents, highlighting a moderate awareness of this technique used for trapping flying insects. The knowledge about the hand picking of the insect was reported by 46 percent of the respondent. However, the knowledge of light and pheromone traps was lower, with only 32 per cent of respondents.

The relatively lower knowledge about light and pheromone traps compared to other mechanical practices is due to the complexity of these methods and lack of familiarity with the specific pests they target. Despite this, it is clear that farmers generally have a good understanding of mechanical IPM practices like rope methods, roughing, and clipping, which are simple, cost-effective, and commonly practiced techniques. Similar results were reported by Kumar (2023).

Table 5 presents the knowledge of respondents regarding various chemical practices of Integrated Pest Management (IPM) in rice cultivation. The data revealed that a large proportion of the respondents had knowledge of certain chemical practices, with 87.00 per cent of the farmers had knowledge that high doses of urea increase the incidence of pests. Furthermore, 83.50 per cent of the respondents had knowledge about the tank mixing of pesticides. About 66.00 per cent of the respondent knew about site-specific pesticide spraying. Only 43.50 per cent know about the recommended dose of chemicals for seed treatment and the recommended pesticide for stem borer/leaf folder. Additionally, 38.00 per cent of farmers were familiar with the name of the recommended chemical for seed treatment and the recommended pesticide for plant hopper. The lowest knowledge was observed for the recommended

Table 5: Distribution of the respondents according to their knowledge regarding various chemical practices of IPM in rice crop (n=200)

Statement	Frequency	Percentage
Recommended dose of chemical for seed treatment	87	43.50
Name of recommended chemical for seed treatment	76	38.00
Site specific pesticide spray	132	66.00
Name of recommended pesticide for stem borer/ leaf folder	87	43.50
Name of recommended pesticide for plant hopper	76	38.00
Name of recommended pesticide for rice hispa	42	21.00
Tank mixing of pesticides	167	83.50
High dose of urea increases the incidence of pests	174	87.00

Table 6: Distribution of the respondents according to their knowledge regarding Economic threshold level (ETL) (n=200)

Statement	Frequency	Percentage
Knowledge about the ETL of stem borer (5% dead heart)	89	44.50
Knowledge about ETL of leaf folder (10% leaf damage)	86	43.00
Knowledge about the ETL of plant hopper (minimum 5 per hill)	74	37.00
Insecticides spray to be done according to ETL level	78	39.00

pesticide for rice hispa, with only 21.00 per cent of the respondent.

The majority had knowledge to apply pesticides based on the site-specific condition promoted more sustainable and targeted pest management methods. The overall findings suggest that promoting knowledge about more advanced chemical practices, such as pheromone traps, through extension services and farmer training programs could further enhance pest management strategies in rice cultivation.

Table 6 provides data about the respondents' knowledge regarding the Economic Threshold Level (ETL) for various pests in rice cultivation. The data revealed that a significant proportion of respondents had knowledge about the ETL of stem borer and leaf folder, with 44.50 per cent and 43.00 percent respectively. However, the knowledge levels were lower when it came to the ETL of plant hopper, with 37.00 per cent of the respondent. Similarly, 39.00 per cent of the farmers had knowledge that insecticide sprays should be done according to the ETL, which indicates some understanding of pest management based on economic thresholds.

Table 7 presents data on the respondents' knowledge regarding various biological practices of Integrated Pest Management (IPM) in rice cultivation. The results revealed that 28.00 per cent of the respondents had knowledge about bio-pesticides. More than one-third of the respondent had knowledge about bio-fertilizer with 35.50 per cent and natural enemies with 34 per cent. About 43 per cent of the respondents had knowledge about pest defender ratio (2:1). Only 17.00 per cent of respondents had knowledge about release of trichogramma practice.

Table 7: Distribution of the respondents according to their knowledge regarding various biological practices of IPM in rice crop (n=200)

Statement	Frequency	Percentage
Bio-pesticide	56	28.00
Bio-fertilizer	71	35.50
Natural enemies	68	34.00
Pest defender ratio (2:1)	86	43.00
Release of trichogramma	34	17.00

Some biological practices of IPM are relatively well-known among the respondents, there is still a significant gap in knowledge, particularly with respect to advanced methods like trichogramma releases. The lower knowledge of trichogramma require more in-depth training or awareness campaigns to be understood and adopted by a larger group of farmers. The farmers will benefit from further education and method demonstrations on how to use these biological practices effectively, helping them to reduce reliance on chemical pesticides and improve sustainability in rice cultivation.

Table 8: Distribution of the respondents according to their knowledge regarding major insect pest of rice (n=200)

Statement	Frequency	Percentage
Rice stem borer	200	100
Leaf folder	200	100
Rice hispa	107	53.50
Rice root weevil	136	68.00
Plant hopper	200	100

The data in Table 8 presents the knowledge of respondents regarding the major insect pests of rice. The data indicated that all respondents 100 per cent were aware of rice stem borer, leaf folder, and plant hopper, as these are some of the most common and destructive pests in rice cultivation. However, the knowledge of rice hispa was lower, with only 53.50 per cent of respondents acknowledging it as a major

Table 9: Overall knowledge level of the respondents regarding biological practice of IPM in rice (n=200)

Category	Range	Frequency	Percentage
Low	12-15	47	23.50
Medium	16-19	108	54.00
High	20-23	45	22.50

pest. Similarly, rice root weevil was known to 68.00 per cent of farmers. While farmers have good knowledge of some of the major rice pests due to their significant impact on rice production, there is still a gap in awareness regarding other pests, which is due to regional variations in pest prevalence, limited access to information about less common pests.

Table 9 presents the overall knowledge level of respondents regarding biological practices of IPM (Integrated Pest Management) in rice. The data revealed that a majority of farmers 54 per cent had medium knowledge about the biological practices of IPM, as reflected by the category with a range of 16-19. Approximately 23.50 per cent of the respondents were in the low knowledge category range of 12-15. On the other hand, 22.50 per cent of respondents demonstrated a high knowledge level range of 20-23, suggesting that these farmers were more familiar with the advanced biological practices of IPM.

CONCLUSSION

Knowledge level of IPM practices among rice farmers plays a crucial role in the successful implementation of sustainable pest management strategies. The study indicated that the higher number of farmers had medium knowledge about the various cultural practices like recommended date of transplanting rice, recommended varieties of rice, crop rotation, summer deep ploughing etc. The finding also suggest that farmers had medium level of overall knowledge regarding the machinal and chemical practices of IPM however the overall knowledge about the biological practices were found low. More number of training programs should be conducted to reach out the farmers from all corners and introduce them to new and improved IPM practices which are locally feasible available, compatible. By focusing on increasing the knowledge of those in the low and medium categories, it is possible to enhance the overall effectiveness and sustainability of rice IPM practices.

REFERENCES

Barzman, M. 2015. Eight principles of integrated pest management. *Agronomy for Sustainable Development,* 35: 1199-215.

Damalas, C.A. and I.G. Eleftherohorinos. 2011. Pesticide exposure, safety issues and risk assessment indicators. *International Journal of Environmental Research and Public Health,* 8: 1402-1419.

Dhakal, A. and S. Poudel. 2020. Integrated pest management (IPM) and its application in rice-A review. *Reviews in Food & Agriculture,* 1: 54-58.

Duke, S. and S. Powles. 2008. Perspective Integrated pest management (IPM): definition, historical development and implementation, and the other IPM Lester. *Pest Management Science,* 63: 1100–06.

DWR. 2015. Vision 2050, Directorate of Weed Research, ICAR, New Delhi. p 1-2.

Flint, M.L.; S. Daar and R. Molinar. 2003. Establishing integrated pest management policies and programs: A Guide for public agencies. ANR Publication 8093. University of California, State Wide Integrated Pest Management Program UC Davis. Available at: http://anrcatalog.ucdavis.edu. Accessed on 19 May, 2022.

Horgan, F.G. 2017. Integrated pest management for sustainable rice cultivation: a holistic approach.

MoAFW. 2021. Agriculture Statistics at a Glance. Directorate of Economics & Statistics, Ministry of Agriculture & Farmers Welfare, Government of India. pp 21-21.

Nayak, P. and H. Solanki. 2021. Pesticides and Indian agriculture- A review. *International Journal of Research - GRANTHAALAYAH,* 9: 250-263.

Patel, R.M. and S. Sanwal. 2015. Knowledge of IPM practices among cotton growers of Sabarkantha district, Gujarat, India. *International Journal on Recent and Innovation Trends in Computing and Communication,* 3(2): 444-446.

Rao, A.N.; S.P. Wani; M.S. Ramesha and J.K. Ladha. 2017. Rice Production Systems. In: Chauhan, B.S., Jabran, K. and Mahajan, G. (Eds.). Rice Production Worldwide, Springer International Publishing AG. pp. 185–205.

Singh, A.; A.K. Vasishta; R. Kumar and D.K. Das. 2008. Adoption of Integrated Pest Management practices in paddy and cotton: A case study in Haryana and Punjab. *Agricultural Economics Research Review,* 21: 221–226.

Singh, S. and S. Narain. 2017. Knowledge and adoption level of IPM practices among tomato growers in Indore district (M.P.). *Indian Research Journal of Extension Education,* 14(3): 125-127.

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Research Article

Knowledge and Advantages Regarding Adoption of Straw Baler Among Farmers in Haryana - A Sociological Study

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ABSTRACT

This study explores the adoption of straw baler technology among farmers in Haryana, focusing on their knowledge, socio-economic factors, and the perceived advantages. It was found that 58.75 per cent had a medium level of knowledge while 21.25 per cent of the respondents had a low level of knowledge and rest (20%) of the respondents exhibited a high level of knowledge. Results revealed that a significant majority (93.75%) of respondents were awarded about the role of balers in compacting agricultural residues like paddy and wheat straw. Knowledge of farmers about baler was found significantly associated with socio-economic variables like age, education, and income influencing the level of knowledge. The study also highlighted the key benefits of baler adoption, including convenience in handling straw (82.50%), time savings for sowing (62.50%), and enhanced transportation efficiency (78.75%). Other benefits include space efficiency, environmental benefits, and potential for secondary income through the use of straw residue. In this way adoption of baler technology offers numerous advantages and it's a beneficial proposal.

Keywords: Straw baler technology, Socio-economic factors, Knowledge, Advantages and Adoption

INTRODUCTION

After the rice crop is harvested, a significant amount of the residue is burned in the field, to remove stubble and straw. However, one of the causes of the pollution in the environment was the release of toxic gasses when paddy straw was burned in the fields. Burning crop residue in-situ releases greenhouse gases and particulate matter, but it also reduces the amount of nutrients needed for plant growth (Lohan *et al.*, 2018). Effective field residue management can improve irrigation effectiveness and erosion control. (Krishnappa, 2015). The adoption of advanced agricultural technologies plays a pivotal role in enhancing farming practices and improving productivity. Among these technologies, the use of straw balers has gained significant attention in rural areas, particularly in regions like Haryana, where straw residue from paddy and wheat crops is abundant. Therefore, it is imperative that balers be used for crop residue management. Straw balers are mechanized devices designed to compress and bundle agricultural materials such as paddy and wheat straw, making them easier to handle, store, and transport (Rehman *et al.,* 2016). The widespread adoption of this technology offers numerous advantages, including time and labor savings, improved storage efficiency, and potential for secondary income generation through alternative uses of straw residue (Bhattacharyya *et al.,* 2021). Uunderstanding about the knowledge, practices and benefits of agricultural technology adoption in rural area helps to provide recommendations for policymakers and agricultural practitioners to promote the effective use of such technologies (Yokamo, 2020).

Burning paddy straw has been a problem for the environment in recent years. Paddy straw can be managed in a number of ways in an environmentally favorable way, however farmers are not entirely aware

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of these technology (Kaur *et al.,* 2021). The level of awareness and adoption regarding baler were influenced with socio-economic factors in rural Haryana. The knowledge of farmers regarding the functionality, components, and benefits of balers, as well as the socio-economic variables that influence their decisions in adoption (Kathpalia *et al.,* 2024). So, keeping in mind the socio-economic benefits of straw baler for crop residue management, the study was planned with the following objectives:

Objectives

1) To know the knowledge regarding baler among farmers.
2) To delineate the factors associated with knowledge.
3) To find out the advantages in adoption of Baler.

MATERIALS AND METHODS

The study was carried out in the Fatehabad block of the Fatehabd district of Haryana state. Bhirdana, Dhani Masitanwali, Hizrawan, Bighar, Salamkhera, Bhutankalan, and hamlet Hasanga villages from Ratia block were chosen for the study because they had the highest number of farmers using straw baler. A total of eighty Baler adopter farmers were chosen. An interview schedule was developed in accordance with the study's objectives in order to gather the necessary data. Finally, a schedule of interviews was used to survey the chosen farmers. Depending on the type of data, statistical methods such as rank order, frequency, percentage, and chi-square were applied.

RESULTS AND DISCUSSION

The Table 1 presents the distribution of knowledge levels among Baler adopters. It was found that 58.75 per cent had a medium level of knowledge while 21.25 per cent of the respondents had a low level of knowledge and rest (20%) of the respondents exhibited a high level of knowledge.

The Table 2 illustrates the respondents' knowledge level regarding straw balers is illustrated in Table, an overwhelming majority (93.75%) of the respondents were aware that baler technology is utilized to compact and bundle various agricultural materials, such as paddy

Table 1: Knowledge level of respondents regarding Baler (n=80)

Knowledge level	Frequency	Percentage
Low (10-12)	17	21.25
Medium (13-16)	47	58.75
High (17-20)	16	(20.00)

Table 2: Knowledge Statements Regarding Adoption of Baler (n=80)

Knowledge statements	Yes (2)		No (1)	
	Frequency	Percentage	Frequency	Percentage
Baler technology is used for compacting and baler various agricultural materials, such as paddy straw, wheat straw or sugarcane trash	75	93.75	5	6.25
It is used to compress straw into bails for easy transport and storage	71	88.75	9	11.25
Rectangle baler led to improved storage efficiency and reduced transportation costs	65	81.25	15	18.75
It begins by picking up crop residue with pick up units and then compact it in rectangle or round shape	63	78.75	17	21.25
A bale indicator mounted on the bailer gives signal to operator for making of proper size of bail	56	70.00	24	30.00
Tractor power requirement is 30KW or more for baler	53	66.25	27	33.75
Rectangle balers are easy to handle	51	63.75	29	36.25
The basic components of a bailer include a pick-up or gathering system, a compression chamber and a bailing unit	47	58.75	33	41.25
According to density of bale, they could be high (200-350kg/m^3), medium (100-200kg/m^3) or low density (<100kg/m^3) balers	42	52.50	38	47.50
It is a powered take off powered machine	35	43.75	45	56.25

Figures in Parentheses indicate percentage

and wheat straw, among others. A significant majority of 88.75 per cent of the participants acknowledged that balers are employed to compress straw into bales, making transportation and storage more convenient. Additionally, 70 per cent of the respondent's demonstrated awareness that a bale indicator, mounted on the baler, provides signals to the operator for creating properly sized bales. Regarding tractor power requirements, three fourth of the respondents (66.25%) knew that a minimum of 30KW is necessary for baler. Furthermore, 63.75 per cent of the participants recognized that rectangular balers are easier to handle. Similarly, 58.75 per cent of the respondents correctly identified the essential components of a baler, including a pick-up or gathering system, a compression chamber, and a baler unit. Lastly, 52.50 per cent and 43.75 per cent the respondents displayed knowledge about bale density and powered take off machine.

The Table 3 presents the socio-economic variables and the level of knowledge regarding the baler adopters. Analysis revealed that age, caste, education, subsidiary occupation, size of landholdings, annual income, social organization participation, mass media exposure and socio-economic status were significantly associated with level of knowledge among respondents. Age was found to be significant at chi-value of 10.16*, indicating that knowledge regarding the technology increased with age. Family type and its size were found to be non- significant, indicating that it did not play a role in determining the level of knowledge. In contrast,

Table 3: Association between socio-economic variables and knowledge level of Baler (n=80)

Socio-economic variables	Knowledge level			
	Low	Medium	High	Total
Age				
up to 35 yrs.	10 (34.48)	13 (44.83)	6 (20.69)	29 (36.25)
35-50 yrs.	6 (15.38)	23 (58.97)	10 (25.64)	39 (48.75)
above 50 yrs.	1 (8.33)	11 (91.67)	0 (0)	12 (15.00)
Total	17 (21.25)	47 (58.75)	16 (20.00)	80 (100)
χ^2 ***Cal*** = 10.16*				
Caste				
General Castes	7 (14.00)	31 (62.00)	12 (24.00)	50 (62.5)
Backward Class	8 (42.11)	7 (36.84)	4 (21.05)	19 (23.75)
Scheduled Castes	2 (18.18)	9 (81.82)	0 (0)	11 (13.75)
χ^2 ***Cal*** = 10.42*				
Education				
Up to primary	15(31.25)	28(58.33)	5(10.42)	48(60.00)
Secondary & Senior secondary	0(0.00)	13(59.09)	9(40.91)	22(27.50)
Graduation and above	2(20.00)	6(60.00)	2(20.00)	10(12.50)
χ^2 ***Cal*** = 13.95*				
Family type				
Nuclear	12(21.43)	33(58.93)	11(19.64)	56(70.00)
Joint	5(20.83)	14(58.34)	5(20.83)	24(30.00)
χ^2 ***Cal*** = 0.01				
Family size				
Up to 4 members	10(20.83)	28(58.33)	10(20.83)	48(60.00)
5 to 8 members	4(23.53)	10(58.82)	3(17.65)	17(21.25)
Above 8 members	3(20.00)	9(60.00)	3(20.00)	15(18.75)
χ^2 ***Cal*** = 0.12				

Table 3 contd...

Socio-economic variables	Knowledge level			
	Low	**Medium**	**High**	**Total**
Subsidiary occupation of the family				
Nil	8 (21.05)	26 (68.42)	4 (10.53)	38 (47.5)
Business and services	6 (50.00)	2 (16.67)	4 (33.33)	12 (15.00)
Custom hiring	3 (10.00)	19 (63.33)	8 (26.67)	30 (37.5)
χ^2 ***Cal*** = 14.22*				
Size of land holdings				
Marginal (up to 2.5 acre)	0 (0)	6 (54.55)	5 (45.45)	11 (13.75)
Small (2.51 to 5 acre)	6 (37.5)	9 (56.25)	1 (6.25)	16 (20.00)
Semi-medium (5.1 to 10 acre)	3 (10.71)	20 (71.43)	5 (17.86)	28 (35.00)
Medium (Above 10.1 to 25 acre)	8 (32.00)	12 (48.00)	5 (20.00)	25 (31.25)
χ^2 ***Cal*** = 13.59*				
Annual family income				
Between Rs.200000 – 3,00,000/-	2 (8.00)	19 (76.00)	4 (16.00)	25 (31.25)
Between Rs.3,00,001 - 4,00,000/-	9 (36.00)	14 (56.00)	2 (8.00)	25 (31.25)
Above Rs. 4,00,000/-	6 (20.00)	14 (46.67)	10 (33.33)	30 (37.50)
χ^2 ***Cal*** = 11.35*				
Mass media exposure				
Low (4-6)	7 (30.43)	13 (56.52)	3 (13.04)	23 (28.75)
Medium (7-9)	6 (16.67)	26 (72.22)	4 (11.11)	36 (45.00)
High (10- 12)	4 (19.05)	8 (38.1)	9 (42.86)	21 (26.25)
χ^2 ***Cal*** = 11.43*				
Extension contacts				
Low (4-6)	10(50.00)	8(40.00)	2(10.00)	20 (25.00)
Medium (7-9)	2(5.88)	25 (73.53)	7 (20.59)	34 (42.50)
High (10-12)	4(15.38)	15 (57.69)	7 (26.92)	26 (32.50)
χ^2 ***Cal*** = 16.68*				
Social organization participation				
Nil	8 (22.22)	21 (58.33)	7 (19.44)	36 (45.00)
One organization participation	6 (20.69)	21 (72.41)	2 (6.90)	29 (36.25)
More than one organization participation	3 (20.00)	5 (33.33)	7 (46.67)	15 (18.75)
χ^2 ***Cal*** = 10.43*				
Socio-economic Status				
Low (5-8)	3 (13.64)	18 (81.82)	1 (4.55)	22 (27.50)
Medium (9-12)	8 (23.53)	20 (58.82)	6 (17.65)	34 (42.50)
High (13-16)	6 (25.00)	9 (37.50)	9 (37.5)	24 (30.00)
χ^2 ***Cal*** = 11.07*				

*Significant at 5% level of significance; Figures in parentheses indicate percentage

Table 4: Advantages for the Adoption of Baler (n=80)

Aspects	Reasons/Advantages			WMS	MS	Rank
	Agree (3)	Neutral (2)	Disagree (1)			
It has become more convenient to handle hay/straw	66(82.50)	6(7.50)	8(10.00)	218	2.72	I
It saves time & money due to more manageable transportation which includes process like collecting, loading and unloading	63(78.75)	8(10.00)	9(11.25)	214	2.67	II
Lesser storage space is required to store bales	58(72.50)	9(11.25)	13(16.25)	205	2.56	III
There is higher net return by adoption of baler	55(68.75)	11(13.75)	14(17.50)	201	2.51	IV
Saves time for next crop sowing	50(62.50)	12(15.00)	18(22.50)	192	2.40	V
Provides secondary income to the farmers by utilizing the residue for alternate purposes	48(60.00)	14(17.50)	18(22.50)	190	2.37	VI
It is environment friendly technology as with the burning of crop residue produced gases and create a very harmful situation for our environment but it can reduce air pollution	45(56.25)	15(18.75)	20(25.00)	185	2.31	VII
Baler improves the quality of straw for storing and transportation	36(45.00)	20(25.00)	24(30.00)	172	2.15	VIII
Baler is the least expensive method packing straw	30(37.50)	20(25.00)	30(37.50)	160	2.00	IX

Figures in parentheses indicate percentage

level of education was significant at chi-value of 13.95*, representing that higher level of education was positively associated with increased knowledge, 37.50 per cent of the respondents who earned above 4 lakhs had a high level of knowledge and 30 per cent of the respondents with high socio-economic status had high level of knowledge.

The Table 4 exhibits the reasons for adopting a baler technology. An overwhelming majority of respondents (82.50%) agreed that using a baler makes handling hay/straw more convenient. Farmers reported that using a baler saves time for sowing the next crop (62.50%) and mentioned that a baler saves time by facilitating easier transportation (78.75%), got rank II in the same way, 72.50 per cent of respondents stated that baler requires less storage space for the bales. likewise, farmers reported that adopting a baler leads to a higher net return (68.75%) which got rank V. besides, 56.25 per cent of participants reported that using a baler is environmentally friendly. other benefits mentioned by 60 per cent of respondents were that it provides farmers with secondary income by utilizing residue for alternative purposes and 45 per cent of respondents stated that baler improves the quality of straw for storage and transportation rank (IX).

CONCLUSION

The data reveals a high overall awareness of baler technology among respondents, particularly regarding its basic functions and utility. However, knowledge declines when it comes to technical components and operational specifics. This indicates a need for targeted training to enhance farmers' technical understanding for effective use and maintenance of balers. The study found significant associations between various socio-economic factors–such as age, education, income, landholding size, and socio-economic status–and the level of knowledge about baler technology. Education and income emerged as strong predictors of higher knowledge levels. In contrast, family type and size showed no significant influence on knowledge acquisition. The adoption of baler technology offers numerous advantages, including increased convenience in handling straw (82.50%) and time-saving benefits for sowing and transportation (62.50% and 78.75%, respectively). Farmers also report higher net returns (68.75%) and environmental benefits (56.25%). Additionally, balers provide secondary income opportunities and improve the quality of straw for storage and transport.

REFERENCES

Bhattacharyya, P.; J. Bisen; D. Bhaduri; S. Priyadarsini; S. Munda; M. Chakraborti and P. Nimbrayan. 2021. Turn the wheel from waste to wealth: economic and environmental gain of sustainable rice straw management practices over field burning in reference to India. *Science of the Total Environment*, 775: 145896.

Bielykh, A. 2025. Development of Agricultural Machinery for Sustainable Farming: A Comprehensive Review.

Kathpalia, J.; R. Tyagi; A.K. Saroha and R. Sihag. 2024. Knowledge and Advantages of Adoption of Straw Baler among Farmers in Haryana. *International Journal of Education and Management Studies*, 14(2): 189-193.

Kathpalia, J.; R. Tyagi; A.K. Saroha and R. Sihag. 2025. Adoption and Socio-economic Benefits of Baler for Agricultural Crop Residue Management. *IAHRW International Journal of Social Sciences Review*, 13(1).

Rehman, A.; L. Jingdong; R. Khatoon; I. Hussain and M.S. Iqbal. 2016. Modern agricultural technology adoption its importance, role and usage for the improvement of agriculture. *Life Science Journal*, 14(2): 70-74.

Yokamo, S. 2020. Adoption of improved agricultural technologies in developing countries: Literature review. *International Journal of Food Science and Agriculture*, 4(2).

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