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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 1200 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 5.30. 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

Today, we are living in a world of Internet controlling things where things or objects that are connected to the Internet than people. Since 1800s (the period of industrial revolution), mechanisation and automation started gaining its dominance in all the primary and secondary sectors to meet the increased demand of goods through more sophisticated tasks. According to UN, the world's population will reach 9.7 billion by 2050 and which demands 69% rise in global agricultural production between 2010 and 2050. IoT (Internet of Things) has gained immediate attention in agriculture due to the challenges which it faces today to meet the projected food demand of ever-increasing population. Agriculture should not only be sustainable but also be smart for efficient resource utilization and to attain greater production capabilities. Smart Agricultural Technology enables the farmers to have better control over process of growing crops and rearing livestock, post production practices etc. with a basket of highly promising family of technologies which is capable of contributing many solutions on the road to the modernisation of agriculture. The use of smart technologies will help to make farms more connected and intelligent by providing better decision-making real-time data. Artificial Intelligence (AI) of agriculture robots (Agribots) has made the agriculture smarter than ever. From drones to autonomous tractors to robotic arms, the technology is being deployed in creative and innovative applications. The application of IoT in agriculture has many forms like Precision Farming, Variable Rate Technology, Smart Irrigation, Smart Greenhouses, Machine Navigation, Harvesting Robotics, Ground Based Drones and Aerial Drones, Remote Sensing, Computer Imaging etc. Let's harness the virtual wold of Internet of Things (IoT) to make agriculture smarter and more intelligent.

We are privileged to announce that, this four-monthly journal (three issues in a year) has been given 5.30 rating by NAAS (ID-J154) for last two consecutive years and in the time of Internet of Things our journal could find a place in ICAR open access publication platform ***epubs*** too (accessible at http://epubs.icar.org.in/ejournal/index.php/JCMSD).

With enormous pleasure, I place before you the September-December, 2019 issue of the MOBILIZATION journal. I am sure that this issue will provide you a very mesmerizing intellectual experience as it is an assortment of strategic and action-oriented research outcome from diversified fields like Climate Change and Mitigation, Information and Communication Technologies (ICTs), Techno-economic Evaluation of Technologies, Women Empowerment, Adoption Research, Organic Agriculture etc.

I am grateful to the editorial team members Drs. Souvik Ghosh, S. K. Dubey, R. Roy Burman, Nishi Sharma, S.R.K. Singh, Reshma Gills, Sudipta Paul and Sujit Sarkar who are instrumental providing a swift and effectual editorial process and maintaining the quality and norms of our publications at high standards. I express my sincere thanks to Ms. Subhashree Sahu and Dr. Hema Baliwada for their commitment, efficient supervision and sensible support in shaping this issue of the journal as on-line editors. Finally, I would like to thank our amazing authors and readers. Your contributions, what makes the journal to reach its heights and be relevant. I encourage all of you to continue to send us your valuable research findings, thoughts and comments for further improvement of our journal.

J.P. Sharma
Chief Editor

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Initiatives of Krishi Vigyan Kendra (KVK) in Doubling of Farmers Income: A Case Study of Village Sagoon, Jammu

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ABSTRACT

The study was conducted in Jammu district of Jammu and Kashmir state to assess the impact of KVK interventions. Situation analysis revealed that majority of the farmers lacked knowledge about improved varieties and practices of cereals, pulses and oilseed crops which contributes for higher productivity. KVK conducted frontline demonstrations and capacity building programmes to built the confidence of the stakeholders in order to shift them from traditional Maize-wheat cropping system to pulses and oilseed based cropping system. The adoption of hybrid maize seed and line sowing helped the farmers to obtain 36 percent more grain yield and an additional income of Rs. 6446 per hectare. Cultivation of pulses and oilseeds helped the farmers to fetch an additional income of Rs. 40,800 and 6100 per ha, respectively. Moreover, demonstrations of proven technologies of wheat helped the farmers to fetch more yield per unit area. Overall, the KVK activities opens new horizons and helped farmers to think differently than the routine cultivation of traditional crops namely maize-wheat.

Keywords: KVK, Frontline demonstrations, Technologies

INTRODUCTION

The state of Jammu and Kashmir (J&K) is located in the North Western Himalayan Region having four distinct agro-climatic zones, namely sub-tropical, region, intermediate/ semi temperate mid hills, temperate region and cold arid region (Anonymous, 2011). J&K comprises of 22 districts. District Jammu is sub-tropical district of the Jammu region of J&K state located at 74°24' and 75° 18' East longitude and 32° 50' and 33° 30' North latitude. This sub-mountainous district spreads over an area of 3097 km^2. The District has a sub tropical climate with hot and dry climate in summer and cold climate in winter. Being in the foothills of the mountains, nights are generally cooler. Rainy season usually starts from the end of June or the beginning of July. Average rainfall in the district is about 1246 mm. The characteristic features of the district include an irrigated area of about 55% with an average landholding of farmers of less than 1 ha per person. The district has favorable agro-climatic conditions, fertile soils and subtropical climate ideally suited for cultivation of vegetables and/or rice crops in the irrigated area and maize in rain-fed areas.

MATERIALS AND METHODS

District Jammu comprises of 20 blocks and 20 teshils, 3 agricultural sub-divisions and four agro ecological situations. Sagoon Panchayat of Nagrota Block of District Jammu was selected purposely as it was selected the as operational village in the year 2016 by Krishi Viygan Kendra (KVK), Jammu. Panchayat Sagoon is situated towards east of Jammu district on Jammu-Mansar road. It is about 35 kms from district headquarter. In Sagoon Panchayat, there are 555 farm families and 8 villages. Majority (91%) of the farmers of the Panchayat possess less than one ha of cultivable land. Majority of the cultivable land is rain-fed and only few hectares of land being irrigated by local nullahs and bowlis. Maize-Wheat, Maize-Oilseeds, Pulses-Wheat, Maize-Pulses are the major farming systems/enterprises adopted by the farmers. Maize being prominent crop occupies 75% of area, followed by fodder crops namely oats/sorghum (10.6%), pulses (8.6%), oilseeds (4.2 %) and vegetables (1.6%) during *kharif* season and whereas *rabi* season, wheat is the prominent crop being cultivated on 78.6 percent of the area, followed by fodder (10%), oilseeds (7.1%) and pulses and vegetables on 1.6 percent

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of the area, respectively. The total geographical area of the Panchayat is 3293.4 ha, out of which nearly 10% area (337.3 ha) is cultivable. In 2015, the average productivity of maize was less than 20 q/ha, wheat productivity was 10-12 q/ha, gram less than 6 q/ha, oilseeds less than 4 q/ha and paddy being cultivated in less area having productivity of 26 q/ha in 2015. The reasons for lower productivity were non adoption of modern agricultural practices, lack of knowledge about newly released high yielding varieties (HYVs) and their availability, using seeds of third and fourth progeny onward by the farmers of the village. The farmers were not adopting scientific production technologies namely line sowing, balanced use of fertilizers, herbicide application and other management practices. In wheat, farmers were using grains of the preceding year crop as a seed. The farmers are using high seed rate per hectare which results in loss of precious seed and also increased cultivation cost. Moreover, they were not treating the seed with fungicide which invites various diseases resulting in low yield. Due to these faulty practices farmers are getting 30-40 percent lesser yield/ha. The scientists devised a compressive strategy to convince the farmers of the village to promote new technologies in the district.

The team of scientist of KVK collected the baseline information about the village through participatory rural appraisal (PRA) to get the first hand information about the village. On the basis of PRA, KVK Jammu chalked out the strategy to start the activities with capacity building programmes for the farmers and farm women, on farm testing (OFTs) of the technologies followed by the laying out of frontline demonstrations (FLDS) and for that KVK adopted the cluster approach and trained farmers were selected for demonstration of recommended technologies. KVK also worked on crop diversification to help the farmers to realize more returns from the same piece of land. Introduction of toria as third crop, cultivation of pulses crops namely mash (urd) and gram, perennial fodder grasses on waste and fragile lands, planting of multipurpose medicinal trees on the bunds and boundaries of their main field and cultivation of short duration high yielding varieties of paddy and mustard were the other areas on which KVK is working. In the year 2016-17, KVK organized seven (07) capacity building programs in which 289 farmers/farm women were trained, conducted OFTs on Wheat, Maize and Perennial grasses and laid out FLDS on Maize, Paddy, Wheat, Oilseeds and Pulses. The inventory of technologies demonstration along with detailed account on varietal/breed characters for each of the variety/breed selected for FLD are given in Table 1.

Seed treatment campaigns were conducted to educate farmers about the importance of healthy seed, impact of seed borne diseases and their management. Farmers' field days were conducted on Maize and Gram for horizontal spread of technology. The crop wise descriptions of frontline demonstrations are given in Table 2.

RESULTS AND DISCUSSION

The strategies adopted by KVK Jammu to transfer the proven technology among the farming community were: organizing capacity building programmes for the farmers/farm women to create awareness-knowledge, demonstrate newest technologies by laying front line demonstrations (FLDs) and conduct on farm trials (OFTs) on the farmer's

Table 1: Inventory of technologies demonstrated **along with varietal/breed characters for each of the variety/breed selected for FLD**

Crop	Name of the technology demonstrated	Characters
Maize	Hybrid Seed (Var. Double Dekalb *DKC* 7074)	Less water requirement, fast growth, better disease tolerance, attractive grain colour, higher yield
	Hybrid Seed (Var. Bioseed 9220)	Greatest stability, Highest yielding capability across environments, found promising for rainfed areas and for cultivation in stress-prone agroecologies
Wheat	HYV (VL 907)	Semi dwarf Grain - Amber, Plant height- 80-85cms (rain-fed) Maturity duration: 175-180 days (rain-fed) Others: Highly resistant to yellow and brown rust. Very good chapatti quality.
	HYV (VL 892)	Late sown, restricted irrigated with high yield potential & suited to low hills
Oilseeds	Demonstration of newly released variety RSPT-02	Productivity: 12q/ha, Maturity duration: 75-85 days, Oil content: 41 %, Fits well in paddy-toria-wheat rotation
Gram	GNG 1581 seed	Released in 2008; Yield potential: 23 q/ha: Maturity duration: 155-165 days

Table 2: Crop wise and Area wise description of FLDs laid by KVK

Crop	Area (ha)	Beneficiaries'
Maize	5.0	20
Wheat	2.0	20
Oilseeds	1.1	15
Gram	3.0	52

field. Moreover farmers' field days, kissan gosthis and extension literature were extensively distributed for the benefit of the farming community. In 2016-17, KVK organized seven (07) training programmes on different aspects of crop production and protection that resulted into increase in farmers' knowledge and adoption of scientific agricultural practices by the trained farmers. Other than this, KVK Jammu conducted on farm trials on farmers field namely, assessment of improved perennial grasses for herbage production under subtropical conditions and Assessment of paddy varieties for yield potential. One hundred and seven (107) frontline demonstrations were laid on 107 farmers' field covering an area of more than 11 hectares (Table 2). The results of the study revealed that farmers used to sow grains of the previous crops as seed in the ensuing season that resulted in fewer yields per unit area.

The data in Table 3 indicates that maize being the prominent crop during *kharif* season has been cultivated by every farmer. The average yield of the maize was nearly 22q/ha whereas on the demonstration plots, it comes to about 30 q/ha. Thus, there was additional production of maize from the same piece of land with similar efforts only with adoption of hybrid seeds and recommended dosages of chemical fertilizers. KVK demonstrated two varieties namely Double dekalb 7074 and Bioseed 9220 and both outperformed the farmers practice. The more yield helped the farmers to fetch an additional income of Rs. 6446 per hectare. If this income is extrapolated with the area under maize (253 ha), it comes to around Rs.16,30,838 per season. Thus, per capita income of every farmer of the Panchayat will increase by Rs 2983 per season. Similarly, in case of wheat, farmers are applying seed of varieties namely HD 2967 that is recommended for irrigated areas of Jammu district. Even farmers are applying previous year's grain as seed and getting lower yield. In *rabi* 2016-17, KVK demonstrated wheat varieties namely VL 907 and VL 892 and found that the results of wheat variety VL 907 was encouraging although it is recommended for midhills. There was significant increase in the yield of wheat as results indicate that demonstration plots have 53.6 percent more yield compared to farmers practice. The average yield of VL 907 wheat variety was 21.5q/ha compared to 14 q/ha in check plot. Thus, the per hectare net profit from demonstration plot was Rs. 21, 638 (Table 3). If we extrapolate this with wheat area of the panchayat (265 ha), it comes to around Rs 57,34,070. Therefore, it is concluded that replacing of farmers wheat seed with VL 907 variety will help them to earn better income from same piece of land. Similar types of results were obtained by the studies conducted by (Amithya et al. 2013; Ghosh et al. and Nagaraj et al 2017) that the yield and productivity of farmers field can be enhanced if old varieties are replaced by improved varieties that increases farmers annual income. Prajapati and Kumar Surendar (2012) also reported that frontline demonstrations play a vital role in increasing farmers income through supply of

KVK scientists examining farmers crops

Table 3: Comparative Economics' of KVK interventions with farmers practice

Crop	Name of the technology demonstrated	Yield (q/ha)	Yield (q/ha)	% Increase	Economics of demonstration (Rs./ha)				Economics of farmer practice (Rs./ha)			
		Demo	Check		Gross Cost	Gross Return	Net Return	BCR	Gross Cost	Gross Return	Net Return	BCR
Maize	Hybrid Seed Double Deklb	29.44	23.8	23.7	19500	44216	24716	2.26	18400	36320	17920	1.97:1
	Hybrid Seed Bioseed	28.94	23.8	21.6	19500	43516	24016	2.23	18400	36320	17920	1.97:1
Wheat	HYV(VL 907)	21.5	14.0	53.6	28450	52088	23638	1.83	28450	30450	2000	1.07
	HYV(VL 892)	15.1	14.0	7.9	28450	37298	8848	1.31	28450	30450	2000	1.07
Oilseed	RSPT-02 Variety	5.2	4.8	8.3	14700	20800	6100	1.41:1	14700	19200	4500	1.31:1
Gram	GNG 1581 Seed	5.9	5.1	15.7	30000	70800	40800	2.36	29400	61200	31800	2.08

critical inputs and trainings. Moreover educating farmers to adopt the scientific practices will help them enhance the farm production with the existing resources.

During *rabi* 2016-17, KVK demonstrated oilseed toria on farmers field to incorporate this short duration variety in the farmers cropping sequence. The results of toria variety RSPT-02 shows that farmers got an additional income of Rs 1600 per hectare without compromising the next crop. There is tremendous scope of this crop in the Panchayat as the fields have sufficient moisture after harvesting of maize crop. Chickpea crop was being cultivated in the past by the farmers of Sagoon Panchayat. But due to the non-availability of good quality seed, shortage of labour to do intercultural operations, lack of knowledge about chemical weed management and attack of gram pod borer and its subsequent effect on crop yield forced the farmers to discontinue sowing of this precious crop during *rabi* season. In *rabi* 2016-17, KVK laid demonstrations of chickpea on 52 farmers field and the results were encouraging. The average productivity of the chickpea crop was 5.9 q/ha. The impact of this intervention was very encouraging and all the farmers have kept the seed of GNG 1581 variety for sowing in the coming *rabi* season. The farmers of the Panchayat revealed that compared to wheat, the cultivation of gram will fetch double income from same piece of land. Thus, the Government of India's initiative to double the farmers' income by 2022 can be easily achieved if the farmers plan cropping system for whole year and include crops like chickpea that will fetch higher returns than the traditional crops. The results of the study further suggest that if the farmers out of his 0.4 ha farm size, replace chickpea with wheat on 0.15 ha area, he will be able to earn income same to 0.25 ha of area on which he will cultivate wheat. Moreover, farmers were also suggested to sow toria after the harvesting of maize crop to get an additional income @ Rs 6000-7000/ha. Thus, addition of oilseed and pulse crops in the existing cropping sequence not only helps the farmers to increase their farm income but also ensured the sustainability of environment as pulse crops enriches the soil fertility naturally. Further, the incorporation of oilseed and pulses ensured livelihood security of the farmers by producing necessary household items on his own farm and generating more employment during lean period after sowing of maize and wheat crops. It was evident that KVK played vital role in raising the socio-economic status of the farmers. Farming community welcomed new technologies of agriculture and allied

sciences which improved their production. Farmers trusted the KVK activities and maintained the regular relationship for upgrading their knowledge. KVK would put every effort to improve the farming situation of farmers by working in cluster villages and develop a model for line departments to further up-scale the technologies for doubling of the farmers' income.

CONCLUSION

The study revealed that KVK activities namely frontline demonstrations and capacity building programmes built farmers confidence to shift from traditional Maize-wheat cropping system to pulses and oilseed crops. Cultivation of pulses and oilseeds helped the farmers to fetch an additional income of Rs, 40,800 and 6100 per ha, respectively. The study revealed that compared to wheat, the cultivation of gram is more remunerative and can help farmer to double farm income from the same piece of land. Overall, the KVK activities opens new horizons and helped farmers to think differently than the routine cultivation of traditional crops namely maize-wheat. The results of the study recommends that if the farmers out of his 0.4 ha farm size, replace wheat with chickpea on 0.15 ha area, he will be able to earn income same to 0.25 ha of area on which he will cultivate wheat. Moreover, farmers are also suggested to sow toria after the harvesting of maize crop to get an addition income. The incorporation of oilseeds and pulses will be helpful for sustainability, livelihood security and will generate more employment as the farmers remained without work after sowing of maize and wheat crops. Thus, the Government of India's initiative to double the farmers' income by 2022 can be easily achieved if the farmers plan cropping system for whole year and include oilseed and pulse crops that can fetch higher returns than the traditional cereal based cropping system.

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Constraints Analysis of Dairy Farmers in Malwa Region of Punjab

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ABSTRACT

The present study aimed at identifying the constraints faced by the dairy farmers of Punjab. The study was conducted in three districts Muktsar, Mansa and Bathinda of Malwa belt of Punjab. An ex-post facto research design was chosen for the present study. The study was conducted on a sample of 120 dairy farmers comprising of 60 trained dairy farmers and 60 non trained dairy farmers randomly selected from these districts. The findings of the study revealed that lack of availability of veterinary literature in the village, heavy investment, competition from established and large units, and distant location of A.I. centers were the major constraints faced by the dairy farmers. Overall analysis of the constraints revealed that technical constraints (63.78%) and economic constraints (83.88%) were ranked first in case of both trained and untrained dairy farmers respectively. The farmers suggested that price of milk should be standardized and injections of good quality made available were the major two suggestions to order to make dairy farming more remunerative.

Keywords: Ex-post facto, Constraints, Trained, Untrained, Veterinary literature

INTRODUCTION

Dairying is a secure path and has become a commercial enterprise (Jagrati and Ilakal, 2014). Dairying is an instrument to bring about socio-economic transformation and symbiotic relationship that exists between agriculture and dairy farming (Reshma *et al.,* 2014). The social, economic, psychological and social factors are important to study the influence of the adoption for any technology. Despite having enormous bovine wealth, still per capita production is one of the lowest in the world due to the reason that the farmers do not adopt improved dairy management practices at the desired level (Patil *et al.,* 2009). One of the major reasons of low productivity could be due to traditional dairy farming practices by the farmers. It is known fact that for increasing productivity and production, it is essential to go for adoption of scientific dairy farming practices in the field of breeding, feeding, health care, management and fodder production to achieve better production leading to higher income for economic viability (Kumar *et al.,* 2011). Constraints are nothing but the problems that come in the way of adoption of technology. If these constraints are identified, it will be easy to bridge the gap between dairy technology and its adoption by dairy farmers (Rathod *et al.,* 2014). There is dire need to understand various impediments faced by the dairy farmers. Keeping in view, the present study was conducted with the specific objective of exploring the constraints faced by the dairy farmers of Punjab

MATERIALS AND METHODS

The research was conducted in Muktsar, Mansa and Bathinda districts of Malwa belt of Punjab. The ex-post-facto research design was selected for the present study. All the farmers who acquired specialized training on dairy farming from KVKs of three districts (Bathinda, Muktsar and Mansa) during the period of 2011-2013, and farmers who have not undergone training from these KVKs constituted the population. A list of dairy farmers who undergone training during the period of 2011-2013 from KVKs of these districts was procured. Out of the list, 20 trained farmers were selected randomly from each KVK and an equal matching sample of 20 untrained dairy farmers was also chosen randomly from these three districts. Thus, 60 trained and 60 untrained dairy farmers constituted the total sample of 120 farmers.

The research methodology involved survey technique which included pretesting and final data collection. In first phase, pretesting was done on a sample of 20 dairy farmers

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on a non sampled area and final data collection was done in the 2015. The data was personally collected by stating the objectives of the study and every effort was made to receive the unbiased response of the farmers. The dairy farmers who possessed minimum three dairy animals such as cows/buffaloes or both were considered for the study.

Constraints were operationalised as obstacles faced by the farmer in implementing the improved dairy management practices in actual situation. Their response regarding various dairy management practices was recorded in the always, sometimes and never by assigning scores of 3, 2 and 1 respectively. The responses were further converted into means and ranked to ascertain the severity of the constraints faced by the dairy farmers.

RESULTS AND DISCUSSION

Various constraints faced by the trained and untrained dairy farmers have been presented in Table 1.

Constraints faced by respondents in management of dairy enterprise: The various constraints faced by the dairy farmers were studied in four major areas such as economic, technical, marketing and general constraints. The data related to these constraints have been tabulated in Table 1.

Economic constraints: A perusal of Table 1 exhibits that the first and foremost constraint faced by the trained dairy farmers was in making the heavy investments in the dairy enterprise with mean score 2.53 ranked I followed by the less finance amount by the bank for purchasing the milch animals ranked II, high cost of veterinary medicines ranked III, high cost of concentrate ranked IV. High cost of crossbreed cow/improved buffalo was ranked V and delay of payments from the dairy cooperatives was ranked VI. Whereas, less finance amount from the banks was the major constraint expressed by the untrained dairy farmers and was ranked I followed by the high cost of crossbreed cow/improved buffalo (II), high cost of concentrate (III), high cost of veterinary medicines (IV), heavy investments (V) and delay of payments from the dairy cooperatives was ranked (VI). Low concentrate is must for dairy animals for animal diet; if its cost increases naturally it affects the income. The price of crossbred cow/improved buffalo is higher than local cow /buffalo due to difference in milk yield. During the discussion, it was found that loan advancing period was very cumbersome and involves considerable documentation and uncertainty. The actual amount of the loan lent by bank was less than the actual requirement of the dairy farmers for purchasing the cow/ buffalo.

Technical constraints: A glimpse of Table 2 reveals that lack of availability of veterinary literature in the village

Table 1: Ranking of the economic constraints expressed by the respondents based on their mean scores

S.No.	Economic constraints	Trainees (n=60)		Non trainees (n=60)	
		Mean Score	Rank	Mean score	Rank
1.	High cost of concentrate	1.53	IV	2.73	III
2	High cost of crossbreed cow/ improved buffalo	1.35	V	2.75	II
3.	High cost of veterinary medicines	1.85	III	2.72	IV
4.	Heavy Investment	2.53	I	2.70	V
5.	Less finance by bank for purchasing milch animals	2.00	II	2.80	I
6.	Delay payments from the dairy cooperative	1.17	VI	1.40	VI

Table 2: Ranking of the technical constraints expressed by the respondents based on their mean scores

S.No.	Technical constraints	Trainees (n=60)		Non trainees (n=60)	
		Mean Score	Rank	Mean score	Rank
1	Lack of veterinary facilities in the village	2.27	III	2.25	IV
2	Problem identification of Heat	1.25	V	1.68	VI
3	Highly expensive Consultancy service of private practitioners	1.50	IV	1.90	V
4	Lack of availability of veterinary literature in the village	2.80	I	2.97	I
5	Lack of technical knowledge to manage the dairy enterprise	1.23	VI	2.50	III
6	Lower conception rate in dairy animals	2.42	II	2.82	II

occupied rank I with mean score 2.80 followed by lower conception rate in dairy animals (II), lack of veterinary facilities in the village (III), highly expensive consultancy service of private practitioners (IV), identification of heat (V) while the lack of technical knowledge to manage the dairy enterprise was ranked VI with the mean score 1.23. In case of untrained farmers, lack of availability of veterinary literature in the village was most expressed constraint that occupied rank I with the mean score 2.97, followed by lower conception rate in dairy animals (II), lack of technical knowledge to manage the dairy enterprise (III), lack of veterinary facilities in the village (IV), highly expensive consultancy service of private practitioners (V) and problem in identification of heat was ranked VI with the mean score 1.68. It was found that there was no availability of literature in the village and farmers had to face problem in getting timely information whereas the services provided by the private practitioners were also expensive. The probable reasons of these constraints might be due to reason that veterinary hospitals are established in big village. There are limited veterinary health centres, this is main reason for the expensive consultancy service of private practitioners. Hence, it was difficult for the farmers to avail timely treatment to their animals.

Marketing constraints: It is clear from Table 3 that amongst the marketing constraints, the competition from the established and large units ranked first with mean score 2.15. Low price of milk, poor marketing outlet of milk and difficulty in storage of milk in summer season were ranked II, III and IV respectively. In case of untrained farmers, the established and large units ranked first with mean score 2.87 followed by low price of milk (II), difficulty in storage of milk in summer season (III) and poor marketing outlet of milk ranked IV with mean score 1.30. The possible reasons for low price of milk might be due to the high competition from major units and also common preference to quality milk. Poor marketing outlet of milk and lack of storage facilities might be due to lack of government support.

General constraints: Data furnished in Table 4 reveals that distant location of the A.I., centers was the most expressed constraint, ranked I with mean score 2.52 whereas, susceptibility of dairy animals and lack of availability of improved fodder seeds were ranked II and III while lack of knowledge about silage making was ranked IV with mean score 1.42. On the other side, lack of knowledge regarding silage making was ranked I followed by distant location of A.I., centers', susceptibility of dairy animals and lack of availability of improved fodder seeds were ranked II, III and IV. The poor irrigation facilities for growing fodder was least expressed constraint and was ranked V with mean scores 1.20 and 1.65 by the both trained and untrained dairy farmers respectively. The crossbreed cows/buffalo are more susceptible to disease due to unfavorable climate than health. Dairy farmers faced in difficulty to inseminate their animal at proper time due to limited number of A.I. centers'. The major constraints perceived by the respondents

Table 3: Ranking of the marketing constraints expressed by the respondents based on their mean scores

S.No.	Marketing constraints	Trainees (n=60)		Non trainees (n=60)	
		Mean Score	Rank	Mean score	Rank
1	Low Price for milk	1.92	II	2.85	II
2	Poor marketing outlet of milk	1.32	III	1.30	IV
3	Difficulty in store milk in summer season	1.25	IV	1.48	III
4	Competition from established and large units	2.15	I	2.87	I

Table 4: Ranking of the general constraints expressed by the respondents based on their mean scores

S.No.	General constraints	Trainees (n=60)		Non trainees (n=60)	
		Mean Score	Rank	Mean score	Rank
1	Distant location of A.I. Centers	2.52	I	2.72	II
2	Poor irrigation facilities for growing fodder crops	1.20	V	1.65	V
3	Lack of knowledge about silage preparation	1.42	IV	2.93	I
4	Lack of availability of improved fodder seeds	1.90	III	2.18	IV
5	Susceptibility of dairy animal to diseases	2.25	II	2.67	III

were lack of knowledge regarding ITK documentation, lack of interest of the young farmers in adoption of ITKs and lack of knowledge regarding the use of ITKs practices. Uday *et al.* (2013) found that the inadequate amount of loan supply, lack of availability of labour, lack of veterinarians and heavy cost for the shed construction were the constraints in dairy development as expressed by the village leaders.

Ranking of different constraints faced by the respondents: It is evident from the Table 5 that technical constraints were the most expressed constraints (63.78%) by the trained dairy farmers followed by general constraints (61.87%) and economic constraints (57.94%). Whereas, untrained dairy farmers mostly expressed economic constraints (83.88%) followed by general constraints (81.00%) and technical constraints (78.39%). Marketing constraints were the least expressed constraints i.e. 55.25 percent and 70.83 percent by the both trained and untrained dairy farmers respectively.

Suggestions of the respondents for improvement in dairy farming: Various suggestions offered by the dairy farmers have been presented in Table 6. It is apparent that majority of the respondents (91.67%) expressed the need for fixation of the milk price by government as it can be attributed to the fact that monetary returns by the sale of milk is the utmost desire of the dairy farmers. The standardization of milk price will bring uniformity in the market.

It was also suggested by nearly 75 per cent and of the respondents that there should be provision of the quality injections and regularly inspection of animal health by the vets. Around 62 per cent of the respondents suggested that training programmes should be provided at village level so that they can attend such programmes without suffering their routine work and cost of medicines should be affordable. The availability of concentrate and quality feed was suggested by 54.17 per cent and 45.83 per cent respectively, of the dairy farmers, they stated that it would be highly useful for them in managing their dairy enterprise. A total of 54.17 per cent and 37.50 per cent of the dairy farmers suggested that quality feed should be provided and loan sanctioning process should involve fast process and less documentation. One sixth (16.67%) of the respondents expressed that there should be provision of veterinary facilities at the village level for availing veterinary services. The provision of veterinary facilities would help the farmers in obtaining the first hand information from the veterinary staff which will play significant role in the successful management of the dairy enterprise.

Table 5: Ranking of overall constraints based on the mean percent score

S.No	Constraints	Trainees (n=60)		Non trainees (n=60)	
		MPS	Rank	MPS	Rank
1	Economic constraints	57.94	III	83.88	I
2	Technical constraints	63.78	I	78.39	III
3	Marketing constraints	55.25	IV	70.83	IV
4	General constraints	61.87	II	81.00	II

Table 6: Distribution of respondents according to suggestions given

S.No.	Suggestions	f	%	Ranks
1.	Price of milk to should be standardized	110	91.67	I
2.	Injections of good quality should be made available	90	75.00	II
3.	Dairy animals should be regularly inspected by the vets	88	73.33	III
6.	Training should be provided at village level	75	62.50	IV
7.	Cost of medicines should be reasonable	74	61.67	V
8.	Availability of concentrates at low cost	70	58.33	VI
9.	Loan procedure should be easy	65	54.17	VII
10.	Quality feed should be provided	55	45.83	VIII
11.	Paper work should be reduced	45	37.50	IX
12.	Easy availability of veterinary facilities	20	16.67	X

CONCLUSION

The findings shed light that major constraints expressed by the dairy farmers were heavy investment, less finance by bank for purchasing milch animals, lack of veterinary literature, competition from established firms, lack of silage making, distant location of A.I. centers. Farmers suggested that selling of milk at house level is not house level is not sufficient for supply to big farms and also not profitable. In this situation, they had to sell their milk at the lower rates. Fixing of milk price by the government can also be great step towards dairy development. It is suggested that more creation of awareness, access to loan facilities, timely extension services, training programs, provision of suitable literature can help to combat the problems faced by the dairy farmers in the study area.

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Women Empowerment through Self Help Groups: A Study in North Himalayan State of India

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ABSTRACT

Women empowerment is one of the critical issues in the development research and policy making in developing countries. It is a multidimensional concept and multifaceted process involving facilitation of women for action and involvement in social, economic and political spheres of life. Research evidence exists to suggest that SHGs contribute enormously to empower the women through providing access to knowledge and skills required to participate in the process of development. In this paper, an attempt is made to find out the contribution of SHGs in women empowerment. The study findings indicated that all SHG members reported that SHGs have contributed in their economic, social and political empowerment; and some socio-personal characteristics of women such as age, education, caste and income were found to be positively and significantly correlated. The study has underscored the understanding that SHGs can effectively contribute towards women empowerment.

Keywords: Women empowerment, Self help groups, Women entrepreneurship, Hill women, SHGs in Uttarakhand

INTRODUCTION

'Empowerment' as a concept was first introduced at the International Women's Conference at Nairobi Kenya (1985). The conference defined empowerment as "a redistribution of social power and control of resources in favour of women". However, empowerment in the context of women's development has been conceptualised as 'a way of defining, challenging and overcoming barriers in a woman's life through which she increases her ability to shape her life and environment'. It is an active, multidimensional process which should enable women to realize their full identity, potential and power in all spheres of life. It is unfortunate that because of centuries of inertia, ignorance and conservatism, the actual and potential role of women in society has been ignored, preventing them from making their rightful contribution to social progress. 'Empowerment of women and gender equality is globally recognized as a key element to achieve progress in all areas. Besides, it is one of the Millennium Development goals to which world leaders agreed at the Millennium Summit held at New York in 2001 (Bhagyalakshmi, 2002). World Bank (2001) has suggested that empowerment of women should be a key element of social development programmes.

Although the notion of women's empowerment has long been legitimized by International development agencies, but what actually comprises empowerment, and how it is measured, is still debated in the development literature. Malhotra *et al.* (2003) provides considerable review of this debate. They explained many ways in which empowerment can be measured with six dimensions: economic, socio-cultural, familial-interpersonal, legal, political and psychological. A number of studies have shown that women may be empowered in one area of life while not in others (Malhotra *et al.*, 2003; Kishore and Gupta, 2004; Hashemi *et al.,* 1996), while Williamson (1983) and Jejeebhoy and Sathar (2001) have studied women empowerment in different countries with special emphasis on demographic determinants.

SHGs s as a tool for Women Empowerment: Self Help Groups (SHGs) are considered as one of the most significant tools in participatory development approach for the economic empowerment of women. It is an important institution for improving life of women on various social components (Kondal, 2014). Globally, women empowerment through SHGs is aimed at systematically empowering marginalized grassroots level

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women by way of consentization, income generation and capacity building. Women participation in Self Help Groups have obviously created tremendous impact upon the lifestyle and livelihood pattern of rural women and have empowered them at various levels not only as individuals but also as members of the family, the community and the society as whole. It can further play a catalytic role in removing rural poverty and improve the women entrepreneurship and financial inclusion in India.

The concept of self help groups serves to underline the democratic principle "for the people, by the people and of the people", and the extension philosophy of 'helping people to help themselves'. The basic objective of SHG is to provide rural women a platform for psycho-social interaction and mutual support for asserting their identity and individuality. The empowerment of women through Self Help Groups (SHGs) would lead to benefits not only to the individual women, but also for the family and community as a whole through collective action for development.

The self help group is the brainchild of Grameen Bank of Bangladesh, which was founded by Nobel Laureate, Prof. Mohammed Yunus of Chittagong University in the year 1975. Association in Self Help Groups has enabled rural women to gain greater control over resources like material possession, intellectual resources like knowledge, information, ideas and decision making in home, community, society and nation. The SHGs have focused the attention on skill improvement, facilitating innovation and invention, gaining access to credit from financial institutions for micro enterprises / projects, inculcating of the spirit of frugality. Women can achieve power, if she has financially viable status, cultural and social status improves. Such type of overall improvement of the power is known as women empowerment.

In India, Self Help Groups are usually women oriented and most of their activities are concentrated towards savings and credit activities. There is a common perception in development scholarship and thinking that increased participation in savings and credit activities or economic attainments will empower the women. Thus, Self Help Groups are seen as an important tool for empowering the women. Besides, it is also believed that it will enhance women's status in the family and community, giving them more power to participate in decision making.

Theoretical Framework: Poverty and unemployment are the twin problems faced by most of the developing countries. According to the Planning Commission (Government of India) more than one-third of India's total population i.e. 320 million lives below the poverty line, and approximately half of them happen to be women. The concept of women's empowerment emerged from intellectual debates generated by the women's movement during the 1980s when feminists, particularly from Third World countries, displayed dissatisfaction with the prevailing development discourse that was largely apolitical and economistic in its orientation. However, empowerment is not essentially a socio-political phenomenon alone; it is a comprehensive process having personal, economic, social and political dimensions with personal empowerment being the core of the empowerment process. In fact political empowerment will not succeed in the absence of economic empowerment. National Policy for the Empowerment of Women (2000) states that the women's movement and a widespread network of NGOs, which have strong grassroots presence and deep insight into women's concerns, have contributed in inspiring initiatives for the empowerment of women. Empowerment of Women as Agents of Social Change and Development was included as sector specific 3-fold strategy in the tenth Plan. It included social empowerment, economic empowerment and gender justice as the three components of women empowerment.

Amin, Becker and Bayes (1998) split the concept of women's empowerment into three components, each measured separately: Inter-spouse consultation index, which seeks to represent the extent to which husbands consult their wives in household affairs; Individual autonomy indexes which represents women's self-reported autonomy of physical movement outside the house and in matters of spending money; and the Authority index, which reports on actual decision-making power (which is traditionally in the hands of the patriarch of the family). Comparable components of empowerment are included in the eight indicators by Hashemi (1996): mobility, economic security, ability to make a small purchase, ability to make larger purchases, involvement in major decisions, and relative freedom from domination by the family, political and legal awareness, and involvement in political campaigning and protests. Further, Stromquist (2002) observed that empowerment consists of four dimensions, each equally important but none sufficient by itself to enable women to act on their own behalf. These are the cognitive (critical understanding of one's reality), the psychological (feeling of self-esteem), the political (awareness of power

inequalities and the ability to organize and mobilize) and the economic (capacity to generate independent income).

Many studies have been undertaken for exploring the different dimensions as well as indicators of empowerment, and developed a number of tools which measure the degree of empowerment through SHGs. However, in the present study, women empowerment has been measured on three dimensions: Economic empowerment, Social empowerment and political empowerment. Following Meena and Puspha (2005) various indicators for measuring the dimensions of women empowerment through SHGs identified are:

1. **Economic indicators:** Income generation, Employment generation, Decision on how saving and income is spent;
2. **Political indicators:** Involvement in household decision-making, Ability to influence household decisions, Political awareness and interest, voting, decision about voting, etc., Relative participation and voice in public decision-making – community, state and nation; and
3. **Social indicators:** Freedom to participate in community organizations, Take membership in various organizations. Against the backdrop of the foregoing theoretical framework, the present study was undertaken with the following specific objectives.
    1. To study the socio-demographic and communication characteristics of the SHG members
    2. To determine the contribution of SHGs towards economic, social and political empowerment of SHG members
    3. To find out the relationship between socio-personal. Economic and communication characteristics of the SHG members and women empowerment.

MATERIALS AND METHODS

The study was carried in the Himalayan state of Uttarakhand which formed its universe. Multi-stage random sampling method was used to select the SHGs. Of the two divisions in Uttarakhand (Kumaon Division and Garhwal Division), one district from each division was selected; and then from each of the selected district, two blocks were selected. Thereafter, list of all the SHGs from the selected district headquarter was procured. Total number of SHGs in the selected districts was 328. Following simple random sampling (chit method), 16 SHGs were for the study from each district. Further, all women SHG members from each SHG were the target of the study; and the total sample size was 198. A pre-tested structured interview schedule was used for data collection. Analysis of data was done using simple inferential statistics and quantitative techniques.

RESULTS AND DISCUSSION

The findings of the study are presented under the following sub-heads.

Socio-demographic profile of SHG members: Table 1 gives the distribution of respondents according to socio-demographic characteristics of the respondents. Age-wise break-up of the respondents shows that majority of them (81%) were in the age group of 31-46 years, and the Mean age of the respondents was 35.6 Years (Min. 22, Max. 51) which indicate that the majority of them were relatively young. This indicates that most of the middle aged women were members of the SHG.

As regards education, 15 percent were illiterate and almost half of the respondents were education up to primary level, 25 percent up to middle level and only 8 percent up to high school. Education plays a very important role in women empowerment as it gives them a sense of self-confidence and support to participate actively in SHG activities. Education helps women to resist exploitation besides inspiring them to be self reliant. Caste plays an important role in social system of India, and social stratification in rural communities is generally based on caste. The caste-wise composition shows that 42 percent women in study sample belonged to SC/ST category followed by 39 percent belonging to Backward and only 18 per cent belonging to forward castes. Religion is a key factor that can affect an individual opting for her role and position in the group. The religion-wise distribution of respondents show that 45 percent were Hindus followed by 40 percent Sikhs and only 13 percent Muslims. This indicates the composition of study sample although in general population, it may be a little bit different. Further, pattern of living is different in rural areas as compared to urban areas. The common perception is that urban areas are charaterised by small family size and people living in rural areas has high family size. The results of the study reveals that 52.5 percent of the respondents hails from large family size (having more than 6 persons per family)

Table 1: Distribution of respondents according to socio-demographic profile characteristics

Categories	Frequency	Percentage
Age		
Young (<30 years)	28	14.14
Middle (31-46 years)	162	81.81
Old (>47 years)	08	4.04
Education		
Illiterate	30	15.15
Primary school	93	46.96
Middle school	51	25.75
High school	16	8.08
Intermediate	8	4.04
Caste		
Scheduled Caste/ Tribe	83	41.91
Backward	78	39.39
Forward	37	18.68
Religion		
Hindu	90	45.45
Muslim	27	13.63
Sikh	81	40.90
Family Size		
Small (1-4 members)	21	10.60
Medium (4-6 members)	73	36.86
Large (More than 6)	104	52.52
Woman's Occupation		
Housewife	170	85.86
Daily farm labour	28	14.14
Annual Income		
Low (Up to Rs. 25,588)	82	41.41
Medium (Rs. 25,589 to 43,641)	111	56.06
High (Rs. 43,642 and above)	05	2.52
Training Exposure		
Training not received	182	91.91
Training received	16	8.08

and 36.8 percent belonged to medium family size (4-6 persons per family), and only 10 percent were from small family (les than 4 persons per family).

The occupation of a person determines the life style and the class/ status of that person. As regards the occupation of respondents, the study revealed that a large majority (85.86%) were housewives and only 14.14 percent were engaged in some sort of occupation (daily farm labour). This reflects the working status of the women which is going to have a crucial role in their involvement with SHGs. The income of an individual /family is an indicator of their class/status in the society besides other attainments. SHG members position in society is influenced by factors such as their annual income and socio-economic status. In the study sample, most of the women (56%) belonged to medium category followed by 41 percent belonging to low income group and only 2 percent belonging to high income group. As regards training received, a large majority of the respondents (91.9%) didn't attend any training and only 8 percent had reported to have received some training before joining the SHG.

Women Empowerment: Contribution of SHGs: Women empowerment through SHG was studied on three dimensions, i.e. economic, social and political. While economic aspects of women empowerment through SHGs included increase in material possessions of the SHG member, the social dimensions focused on social benefits like recognition by family members, increased self confidence, participation in family decision making, etc. However, the political dimensions included increased participation in social and political organisations such as village panchayat, becoming member / office bearer of an organisation working for the welfare of the women, especially in rural areas. Indrani Sah *et al* (2018) in a study on empowerment of rural women through fishery based SHGs in Chhattisgarh reported that an overall gain in empowerment index value for all the five dimensions of empowerment viz. decision making ability, spending ability, social participation, cosmopoliteness, and access to assets and resources.

Economic Empowerment: An attempt was made to find out the economic benefits derived by the respondents as a result of their becoming the member of SHG. The respondents were asked about the major material possessions (household assets) before and after the joining of SHG, and the percentage increase in material possessions was taken as an indicator of their economic empowerment. The results obtained are presented in the Table 2.

A careful perusal of the results presented in Table 2 reveals that all the respondents (100%) had reported an income earning after joining as against the situation before joining the SHG. Further, almost all the respondents have seen an increase in their material possessions (household assets) although item-wise increase in different material

Table 2: Distribution of respondents according to economic benefits obtained through SHGs (N=198)

Activity	Before Joining SHG		After Joining SHG		Percentage
Economic	**Number**	**Percentage**	**Number**	**Percentage**	**Increase**
Income	00	00	198	100	100
Material Possession					
TV	176	84.00	198	100.00	100.00
Radio	178	89.89	188	94.94	5.05
Fan	35	17.67	120	60.60	42.93
Chula	198	100.00	198	100.00	100.00
Table / Chairs	68	34.34	167	84.34	50.00
Other household items (bicycle)	98	49.49	169	85.35	44.86
Livestock Possession					
Cow	189	95.45	196	98.98	3.53
Buffalo	140	70.70	180	90.90	20.20
Sheep	65	32.82	176	88.88	56.06
Goat	80	40.40	125	63.13	22.73
Poultry	36	18.18	90	45.45	27.27
Piggery	-	-	-	-	-
House Repair /Renovations					
Kachcha	160	80.80	58	29.29	-51.51
Pucca	80	40.40	186	93.93	53.53

possessions of the respondents varied. For example, before joining the SHG, only 84 percent member had television but after joining the SHG, all the members (100%) had televisions in their home. Further, there was also a substantial increase in the livestock kept by them. The members also spent money on the renovation of their houses as more than half of the respondents reported to have renovated their houses after joining the SHG. This is a reflection of their increased income and control of financial resources (including decision making on the expenditure pattern) after joining the SHG, indicating the economic empowerment of women by SHG.

Therefore, it can be included that SHGs have definitely made an impact on their life through increase in their economic status. Zaman (1998) found a strong link between socio-economic household conditions and improved women's status and married women who currently contribute to household income. It appears also that women capable of borrowing larger amounts can enhance their control over their assets. Sidhu, Kaur and Sharma (2018) in a study of 400 SHGs from nine districts of Punjab reported that only 277 SHGs were sustaining and the remaining had discontinued; only half of those who sustained were involved in income generating activities. Thus, economic empowerment is one of the critical indicators of women empowerment.

Social Empowerment: As discussed earlier, the social empowerment focuses on increased recognition of the SHG members in the society as well as in the family before and after their joining of SHG. The increased recognition was taken as an indicator of social empowerment of women through SHG. The results obtained are given in the following Table 3.

It is evident from the above table that all the respondents (100%) got the social benefits after joining the SHG. Before joining the SHG, none of the respondents reported recognition by family members and had low self confidence. But, after joining the SHG, all the respondents reported that they got the increased recognition by their family member as well as there was a perceptible change in their self confidence. Further, only 40 percent of the women reported participation in fairs/ festivals within and outside the village before joining the SHG. However after joining the SHG, All the respondents reported that they have participated in fairs/ festivals within and outside the

Table 3: Distribution of respondents according to their economic benefit through SHGs (N=198)

Activity	Before		After		Percentage
Social Benefits	**Number**	**Percentage**	**Number**	**Percentage**	**Increase**
Recognition by family members	35	17.67	198	100	100
Increase in self confidence	36	18.18	198	100	100
Participation in fair/ festival Within /outside the village	80	40.40	198	95.45	55.05

village. This is a reflection of their social empowerment through SHG. Therefore it can be conclude that SHGs have brought about social empowerment of women. Kumaran (1997) reported that most of the women member benefited from SHGs programmes and it also helped in improving their socio-economic status.

Political Empowerment: Political empowerment of women was conceptualised as the political benefits derived by the respondents before and after joining the SHG. The respondents were probed about the benefits (as given in the table below) derived by them after their joining of SHG. The results obtained are given in the Table 4.

As is evident from the above table, none of the respondent was member of any gram panchayat before joining the SHG. But, after joining the SHG, we see that 20 percent have become members of gram panchayat which indicate their political empowerment. Further, there is a substantial increase in the membership of club or cooperative society after joining the SHG. This is reflective of women empowerment through SHG. The findings are in line with the findings of Kaul and Sahni (2009) who reported that major reason of women leaders for not attending the training was patriarchal set up and the consequent non-cooperation of male members. As a reaction, the women got frustrated and choose to abstain from the further meetings.

Relationship between Socio-personal and Psychological Characteristics with Women Empowerment (after joining SHGs): The relationship between socio-personal characteristics (independent variables) and Women empowerment as perceived by the respondents (dependent variable) was determined by computing Pearson's Product Moment correlation coefficient was worked; and the partial regression coefficient (b) was also worked out which determines the degree of prediction of dependent variables from independent variables. The results obtained are given in the following Table 5.

The results presented in Table 5 gives the relationship between the women empowerment (after joining SHGs) with different socio-personal characteristics of the

Table 5: Relation between selected independent variables and dependent variable

Independent Variables	Correlation Coefficient (r)	Partial Regression Coefficient (b)	't' value
Age	0.153*	-.151	1.192
Education	0.059*	-.809	1.099
Caste	0.146*	.156	1.762
Religion	0.126	.484	0.707
Family size	0.144*	.453	0.427
Women occupation	0.119	-.133	0.774
Income	0.086	.132	1.323
Training exposure	0.065	-.876	0.423

R^2=0.238; a_{Y1}=6.66; 'f'_{Y1}= 1.351**

(* Significant at 1 % level of significance, ** Significant at 5% level of significance)

Table 4: Distribution of respondents according to political benefit through SHGs (N=198)

Activity	Before		After		Percentage
Political Benefits	**Number**	**Percentage**	**Number**	**Percentage**	**Increase**
Member of Gram Panchayat	00	00	40	20.20	20.20
Member of Zilla Panchayat	00	00	-	-	-
Member of club	28	14.14	98	49.49	35.35
Member of co-operative society	20	10.10	140	70.70	60.60
Others	-	-	-	-	-

respondents. The findings of the study showed that three variables, viz. age, education, caste and family size had a positive and significant relationship with the women empowerment after joining SHGs; and this was found to be significant at one per cent level of significance. So, in this case null hypothesis i.e. there was no relationship between the socio-personal characteristics of the women was rejected and alternative hypothesis, i.e. there was relationship between the socio-personal characteristics of respondents was accepted at one per cent level of significance. Further, other variables viz. Religion, Women occupation, income and training exposure had positive but non-significant relationship with women empowerment. The findings are in line with the findings of Renjitha (2003) who found that age, education, family size of the SHGs members had significantly associated with women empowerment.

Further, by using the multiple linear regression analysis, the prediction of dependent variables (Women empowerment) from independent variables (Selected socio-personal characteristics) was been studied, i.e. the increase in the dependent variable for a unit increase in the independent variable. From the results presented in Table 5, it is evident that coefficient of determination (R^2) was found to be 0.298 which means that about 30 percent of the variation in the dependent variable was contributed by the eight independent variables put together. The corresponding 'f' value was calculated to be as 1.351*, which was found to be significant at five per cent probability level. Therefore, it indicated that this particular regression model was found to be significant.

CONCLUSION

The present study has reinforced the understanding that SHGs can effectively contribute to empower the rural women. The finding of the present study has underscored the need to look at the contributory factors that increase women empowerment and crucially affect the relationship between women empowerment and their attributes. SHGs are now increasingly seen as a means for eradicating poverty and become instrumental in the empowerment of rural women. With commitment to Millennium Development Goals (MDGs) to eradicate extreme poverty by 2015, the central as well as State governments have designed specific schemes and strategies that promote the setting up of SHGs and in making the credit available to them through government as well as non-governmental institutions. Formation of women's collectives has been linked to income generation activities and sought to emphasise the fact that if these institutions are supported by way of extending credit facilities by financial institution, they can effectively transform the scenario in terms of women empowerment.

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Constraints in Adoption of Improved Dairy Husbandry Practices in Western Uttar Pradesh

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ABSTRACT

The present study was conducted to analyses the constraints faced by the dairy farmers in Saharanpur district of Western Uttar Pradesh. This study was conducted in five villages under five blocks of Saharanpur district by personally interviewing 200 respondents sampled randomly. It was observed from the study that the most important constraint faced by the farmers was long calving interval due to repeat breeding problems in dairy animals and non-adoption of good animal health practices was mainly due to High cost of veterinary medicine. Non remunerative price for milk was another important constraint in adoption of good feeding practices. High cost of feed and construction of housing facilities was the most important constraint found in adoption of good animal management practices. The study suggests that awareness programs and need based trainings may be organized, for capacity building of the farmers in the study area, for adoption of improved dairy husbandry practices.

Keywords: Constraints, Dairy husbandry, Scientific management and Adoption

INTERODUCTION

Livestock plays an important role in Indian economy. About 20.5 million people depend upon livestock for their livelihood. Livestock contributed 16 percent to the income of small farm households as against an average of 14 percent for all rural households. Livestock provides livelihood to two-third of rural community. It also provides employment to about 8.8 per cent of the population in India. India has vast livestock resources. Livestock sector contributes 4.11 percent GDP and 25.6 percent of total Agriculture GDP (Annual Report, BAHFS, 2017).

As per the figures of 19th livestock census 2017, India has about 190.09 million cattle, which contribute to around 19.07 percent of the world cattle population. The current buffalo population of India is 108.7 million which accounts for 57.83 percent of the world buffalo population. Milk production during 2014-15 and 2015-16 is 146.3 million tonnes and 155.5 million tonnes respectively showing an annual growth of 6.27 percent. The per capita availability of milk is around 337 grams per day in 2015-16. The production of milk and corresponding growth rate (%) per year from 1985-86 to 2015-16 (Annual Report, BAHFS, 2017). But the milk production per animal is too less as compared to the developed and dairy primed countries. However, dairying as a subsidiary enterprise has great importance, since it helps in improving the socio-economic status of rural population. In dairy farming, about 70 percent of the expenditure is on animal nutrition which forms the basis of production (Verma *et al.,* 2011).

Uttar Pradesh has around 10.24 percent of cattle and 28.17 percent of buffalo population of the country (BAH&FS, 2017). Uttar Pradesh is an important state in milk production and marketing in India on co-operative dairy system. It contributed around 27.55 million tonnes (16.80%) of milk to the total milk pool of India with per capita milk availability of 345 g/day during 2016-17 (Annual Report, BAHFS, 2017). It has got the second highest cattle population and highest buffalo population in the country. Majority of the rural population of the state is engaged either in the livestock breeding or dairying in one way or the other. In this state, dairying is an important source of subsidiary income to the farmers. There is need to increase the production of market safe quality milk and milk product, to meet the demand of growing population. Even though Uttar Pradesh stands first in milk production, majority of the farmers are practicing unhygienic and

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unhealthy milk production practices, thus the produced milk is of poor standards. Dairy Farming Practices are used world-wide, which support the farmers to produce and market, safe quality milk to satisfy the quality standards. Dairy Farming Practices is an important practical tool used world-wide in supporting farmers, to produce and market, safe quality milk and milk products, to satisfy the expectations of the food industry and consumers (FAO, 2011).

METHODS AND MATERIALS

The present study was undertaken in Uttar Pradesh state, since it ranks first in milk production, and also is rich in bovine population. The study was purposively conducted in Saharanpur district of Western Uttar Pradesh. Out of the eleven blocks under Saharanpur district of Uttar Pradesh, Baliakhedi, Puwarka Nanauta, Gangoa and Rampur Maniharan block were selected randomly for the present investigation. From each block, five villages were selected randomly, and from each village 8 respondents were selected, making a total of 200 respondents. The farmers were personally interviewed with the help of semi-structured interview schedule, to enlist the constraints faced by them in each type of the activities, viz. Health care practices, breeding practices, milking practices, feeding practices and housing practices, and ranked them in terms of importance/ severity. Constraints for the present study, was operationalzed as obstacles or hurdles experienced by the dairy farmers in adoption of good dairy husbandry practices. The respondents were asked to rank, all the constraint relevant to them, according to the degree of importance as perceived by them. The ranks given to constraints, were analyzed by Snedecor and Cochran (1989).

RESULT AND DISCUSSION

Various management practices are important for the health and production of dairy animals. There are some constraints in adoption varying from area to area and farmer to farmer. Hence an attempt was made to study the management constraints of dairy animal owners. The respondents were asked about the nature and type of constraints faced by them in adoption of various management practices. The results are presented in Table 1-5.

High cost of veterinary medicine was top most constraint faced by the farmers (Table 1). The reason may be that the veterinary hospitals were far away from the villages, high cost of veterinary medicine is a world-wide phenomenon and also the veterinary doctor were not available when needed. Problem of mastitis in dairy animals, were perceived as second constraint by the farmers, which prevent them from adopting animal health care practices. The reason behind it may be, because they were less educated, unaware and also animals remain fairly healthy except for mastitis, which is a real problem. The constraints in clean milk production are suggestive of their fairly high level of knowledge in this aspect. This means that they know the practice but could not follow it properly. Thus, there is a need of training in this sphere of management to bring down the incidences of mastitis. All other constraints are of lower magnitude and are not really troubling them to any great extent. These findings were in accordance with that of, Kumar *et al.* (2012). 'Inadequate supply of vaccines' was perceived as third major constraint, faced by farmers. Similar finding were reported by Patel *et al.* (2013); Das *et al.* (2014); Kumawat *et al.* (2014); Kumar *et al.* (2014); Singh *et al.* (2015) and Jadhavar (2017). Non-availability of medicine and vaccines in time was encountered by majority of the farmers, in Chittoor District of Andhra Pradesh (Varaprasad *et al.,* 2013).

The results in Table 2 shows that, 'repeat breeding problems in dairy animals' was expressed as a major constraint in the study area because, they lacked knowledge on maintaining breeding records. Second constraint faced

Table 1: Constraints in Adoption of Animal Health care Practices as Perceived by the Farmers

Constraints on Health care	Frequency	Percentage	Rank
High cost of veterinary medicine	154	77.00	I
Problem of mastitis in dairy animals	120	60.00	II
Inadequate knowledge of diseases and their control	98	49.00	III
High incidence of diseases	98	49.00	IV
Distant location of veterinary hospital	94	47.00	V
Non availability of vaccine in time	68	34.00	VI

Table 2: Constraints in Adoption of Animal Breeding Practices as Perceived by the Farmers

Constraints on Breeding	Frequency	Percentage	Rank
Repeat breeding problems in dairy animals	161	80.50	I
Low conception rate through A.I.	119	59.50	II
Low genetic potential of local animals	115	57.50	III
Lack of availability of insemination in time	85	42.50	IV
Belief that PD through rectal palpation is harmful for pregnant animals	83	41.50	V
Lack of knowledge of heat detection	71	35.50	VI
Lack of improved bulls for breeding in villages	67	33.50	VII
Preference of natural service in buffalo	60	30.00	VIII

by the farmers was, 'low conception rate through A.I.'. Since, most of the farmers were poor in their financial status, so they could not afford to superior breed of animal so local animal conception rate vary low. Breeding is one of the important pillars of production. Regular calving results in economical maintenance of dairy animals. These results are in agreement with the results of Kant *et al.* (2015) the major constraints were repeat breeding. The most important suggestions received from the respondents to overcome these constraints, were organization of awareness campaign about climatic problems, provision of good quality bull and provision of animal health services at nominal rate. Khandi *et al.* (2011); Rathod *et al.* (2011); Patel *et al.* (2013); Kumar *et al.* (2014); Jadhavar (2017) and Kushram *et al.* (2018). Repeat breeding, poor conception rate, high charges for AI and lack of exotic breeding bulls were perceived as most serious by the farmers (Kumar *et al.,* 2014).

Table 4 indicates, the Inadequate knowledge for cultivation of fodder crops round the year was perceived as the most important constraint in the study area because, most of the farmers were not provided with appropriate knowledge about fodder cultivation from any related institutions. Farmers needed a good knowledge of crop rotation and short duration fodder crops. The second major constraint perceived by farmers was, 'high cost of feed', for the reason that, they did not follow a particular ratio in feeding their animal because every year land area will be short and not provide proper feeding of the feed like, concentrates, green and dry fodder availability is poor on the basis of their requirement of the dairy animals. The other constraints were 'non- availability of green fodder round the year, 'lack of knowledge of balanced ration', and 'irrigation facilities'. Singh *et al.* (2012) and Dhindsa *et al.* (2014), also observed similar constraints in dairy farming in Punjab, they reported high cost of feed and fodder, inadequate knowledge about balanced feeding, low availability of quality green fodder and dry fodder, as some of the important constraints. Varaprasad *et al.* (2013); Trailor *et al.* (2012) and Kumar *et al.* (2014) reported that, non availability of pasture, high cost of cakes/ concentrate and inadequate area for fodder cultivation, due to small size of operational holding as major constraints perceived by the farmers in their study area (which is in accordance

Table 3: Constraints in Adoption of Animal Feeding Practices as Perceived by the Farmers

Constraints on Feeding	Frequency	Percentage	Rank
High cost of feed	141	70.50	I
Non availability of green fodder round the year	127	63.50	II
Lack of awareness about treatment of poor quality straw to improve its nutritive value	111	55.50	III
Lack of knowledge about silage preparation	101	50.50	IV
Lack of knowledge of balance ration	88	44.00	V
Lack of availability of fodder crop seeds	71	35.50	VI
Lack of irrigation facilities	57	28.50	VII
Inadequate knowledge for cultivation of fodder crops round the year	54	27.00	VIII

Table 4: Constraints in Adoption of Animal Milking and Housing Practices as Perceived by the Farmers

Constraints on Housing	Frequency	Percentage	Rank
Non remunerative price for milk	139	69.50	I
High construction cost	129	64.50	II
Lack of knowledge in clean milk production	120	60.00	III
High production cost of milk	108	54.00	IV
High interest rate	90	45.00	V
Lack of own capital	79	39.50	VI

with the findings received). Trailor *et al.* (2012) found that, beside high cost of green fodder, dry fodder and concentrates, non availability of green fodder throughout the year and lack of sufficient pasture land for grazing, were the major constraints faced by the dairy farmers. Lack of availability of green fodder, low availability and high cost of concentrates, low availability of dry fodder and non availability of land for fodder production were ranked first, second, third and forth constraints respectively, by dairy farmers (Rathod *et al*., 2011; Patel *et al*., 2013; Das *et al.,* 2014; Kumar *et al*., 2014; Prajapati *et al*., 2015; Nagrale *et al.,* 2015; Kumar and Shukla, 2017 and Jadhavar, 2017).

The results in Table 4 depicts, the ranks given to the constraints faced by the farmers, related to good hygienic milking practices. The most important constraint faced by the farmers was, 'non-remunerative price for milk', for that reason, they did not know about the basic rules of remunerative price for milk', not direct contact of the milking society (dairy like PCDF, PARAG etc.) of the dairy farmers. So mediators direct contact of the dairy society and full credit tack of the milk in their society. Therefore no provide good rate of milk for the dairy farmers. Second constraint was 'high construction cost', was cited as a major constraint in the study area because, the farmers were poor in their financial status, so they could not afford to build houses scientifically, to keep their animals. Singh *et al.* (2012) and Surkar *et al.* (2014). third constraint was 'lack of knowledge in clean milk production', for that reason, they did not know about the basic rules of producing hygienic milk and more importantly, the benefits obtained by producing hygienic milk. 'high production cost of milk', was ranked fourth by most of the farmers, as they were unaware about low cost of milk production/kg because high cost of feeding and management of the dairy animal. Mohapatra *et al.* (2012) that, non remunerative price for milk was the most important constraint, followed by poor marketing. 'Lack of capital' was ranked six because, majority of the farmers followed, subsistence type of farming in which, most of the product was consumed by the farmers themselves, so no capital was gained. Similar finding was reported by Kaur *et al.* (2011); Rathod *et al.* (2011); Kumar and Shukla (2017); Singh, *et al.* (2017) and Jadhavar (2017). Lack of knowledge about clean milk production was one of the major constraint in Manipur (Singh *et al.,* 2012), and similar result was reported from Rajasthan, by Tailor *et al.* (2012) and Kushram *et al.* (2018). The study data revealed that 55.65 per cent of the farmers faced High level of constraint followed by medium (30.43%) and low (13.91%) in all five major areas of scientific cattle farming practices. Whereas item-wise constraint analysis revealed that the major constraints faced

Table 5: Constraints in Adoption of overall Animal Practices as Perceived by the Farmers

Constraints on Housing	Frequency	Percentage	Rank
Repeat breeding problems in dairy animals	161	80.50	I
High cost of veterinary medicine	154	77.00	II
High cost of feed	141	70.50	III
Non remunerative price for milk	139	69.50	IV
High construction cost	129	64.50	V
Non availability of green fodder round the year	127	63.50	VI
Lack of knowledge in clean milk production	120	60.00	VII
Low conception rate through A.I.	119	59.50	VIII

by the farmers were high illiteracy rate (87.82%) in selected villages, and high cost of construction of animal shed (84.34%), respectively.

The results in Table 5 is overall shows that, 'repeat breeding problems in dairy animals' was cited as a major constraint in the study area because, they lacked knowledge on maintaining breeding records. Second constraint faced by the farmers was, 'high cost of veterinary medicine', was top most constraint faced by the farmers (Table 5). The reason may be that, the veterinary hospitals were far away from the villages, High cost of veterinary medicine is a world-wide phenomenon and also the veterinary doctor were not available when needed. The third major constraint perceived by farmers was, 'high cost of feed', for the reason that, they did not follow a particular ratio in feeding their animal because every year land area will be short and not provide proper feeding of the feed like, concentrates, green and dry fodder availability is poor on the basis of their requirement of the dairy animals. The fourth most important constraint faced by the farmers was, 'non-remunerative price for milk', for that reason, they did not know about the basic rules of remunerative price for milk', not direct contact of the milking society (dairy like PCDF, PARAG etc.) of the dairy farmers. So mediators direct contact of the dairy society and full credit tack of the milk in their society. Therefore, no provide good rate of milk for the dairy farmers. The fifth constraint faced by the farmers was, 'high construction cost', was cited as a major constraint in the study area because, the farmers were poor in their financial status, so they could not afford to build houses scientifically, to keep their animals. Singh *et al.* (2012) and Surkar *et al.* (2014) reported other constraints were 'non- availability of green fodder round the year'. Singh *et al.* (2012) and Dhindsa *et al.* (2014), also observed similar constraints in dairy farming in Punjab, they reported high cost of feed and fodder, inadequate knowledge about balanced feeding, low availability of quality green fodder and dry fodder, as some of the important constraints. Seventh constraint was 'lack of knowledge in clean milk production', for that reason, they did not know about the basic rules of producing hygienic milk and more importantly, the benefits obtained by producing hygienic milk. The least important constraint faced by the farmers was, 'low conception rate through A.I.'. Since, most of the farmers were poor in their financial status, so they could not afford to superior breed of animal so local animal conception rate vary low. Breeding is one of the important pillars of production. Regular calving results in economical maintenance of dairy animals. These results are in agreement with the results of Kant *et al.* (2015) the major constraints were repeat breeding. The most important suggestions received from the respondents to overcome these constraints, were organization of awareness programme about scientific rearing and management of livestock and provision of animal health services at nominal rate. Repeat breeding, poor conception rate, and high charges for AI and lack of exotic breeding bulls were perceived as most serious by the farmers of both the districts (Kushram *et al.,* 2018; Kumar *et al.,* 2014).

CONCLUSION

Dairy husbandry practices play a significant role, in the production of good quality milk and milk product in the rural areas, so, we can say that, it is important to every small and marginal farmer, to increase their farm income. it can be concluded that, the important constraints faced by the farmers in western Uttar Pradesh, in adoption of dairy husbandry practices were repeat breeding problems in dairy animals, high cost of veterinary medicine, high cost of concentrate, non remunerative price for milk, high construction cost of housing, non availability of green fodder round the year, lack of knowledge in clean milk production and low conception rate through A.I.. Taking these constraints in consideration, the government should take initiatives, to broaden the knowledge base of the farmers related to dairy husbandry practices along with providing resources and facilities related to veterinary aids, easy finance options, which can help the farmers to deal with the constraints and thereby, open a path towards adoption of improved dairy husbandry practices .

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Adoption Status of Vegetable Cultivation: A Case Study of Sangrur district of Punjab

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ABSTRACT

The present study was conducted to find out the adoption status of vegetable cultivation in Sangrur district of Punjab. Four vegetable crops i.e. cauliflower, cucumber, okra and capsicum were selected for the study. A sample of 120 vegetable growers was taken randomly from the total number of vegetable growers in the area, keeping in view that at least 50 farmers of the sample should be cultivating each of the selected vegetable crops. The data was collected personally visiting and interacting the vegetable growers with the help of structured interview schedule. The analysis of the results revealed that majority of the respondents belonged to age group of 37-48 year and possessed the operational land holding of 2.5-5.0 acres. Most of the respondents (87.50%) had purchased the vegetable seeds from private seed shops in the market. In cucumber crop, more than half of the respondents (54.54%) have sown the un-recommended varieties and majority (85.72%) of them had used lesser seed rate per acre than the recommended by Punjab Agricultural University, Ludhiana. It was also investigated that majority the farmers has planted the capsicum and okra crops at closer plant to plant and more row to row spacing than recommended by PAU, Ludhiana. The respondents preferably planted cauliflower in the months of the August-September and applied higher than recommended doses of phosphatic fertilizer. Study also revealed that more number of pesticides sprays was applied to manage insect-pests and diseases in these vegetable crops. However, the farmers had obtained higher per acre yield than the average production of these vegetable crops. Almost all the respondents i.e. 99.16 per cent had marketed their vegetable produce to/ through the commission agents in local markets and very less (3.33%) of the respondents adopted direct marketing channels to sell their produce.

Keywords: Adoption, Vegetable cultivation, Status, Marketing, Cucumber, Capsicum, Okra, Cauliflower, Punjab

INTRODUCTION

Production of vegetables in India has been increasing continuously since the past two decades. India has been known to be the second largest producer of vegetables in the world, next to China (Nair and Barche, 2014). Area under vegetable cultivation in India is 10,290 thousand hectare with production of 175 million tones and productivity of 17.01 tones per hectare (Anonymous, 2017). Vegetable crops are vital for ensuring nutritional and food security for growing population of India. The per capita availability of vegetables in India is 230 gm per day as against 300 g recommended dietary allowance recommended by Indian Council of Medical Research (Vanitha *et al.*, 2013). Hence, there is need to enhance the production and productivity of vegetable crops through the modified technologies to meet the appropriate quality of vegetables in diet. However, vegetable growers are confronting different problems like high labour requirement in vegetable cultivation, no minimum support price on vegetables, poor quality of produce, glut in main season, excessive incidence of pests and higher cost of hybrid vegetable seeds. Olericulturists and extension specialist will have to develop suitable strategies to achieve the desired level of production potential (George and Singh, 2006).

Punjab state has observed a phenomenal change on cropping pattern in the post green revolution era with main focus on wheat-paddy crop rotation and the area under pulses, maize, oilseeds, fruits and vegetable etc. has decreased. This has led to exploitation of natural resources of state especially water and soil with loss of biodiversity. Dr. S.S. Johl in his report has also advocated reducing the

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area of one million hectare of land from paddy-wheat rotation to other less water consuming crops (Anonymous, 2002). Vegetable cultivation has emerged as an important enterprise for the farming community and many farmers have adopted it as a main source of the family income. These crops have also maintain the soil fertility because these are not exhaustive in nature. The vegetables are being used in processing industry as they can be processed to form commercial products like sauces, pickles etc. Cultivation of certain vegetables like leguminous vegetables increases the fertility of the soil through their symbiotic relationship with certain nitrogen-fixing bacteria. Moreover, diversification with the vegetable farming can help in generating higher income of farming community. During the year 2017-2018, the area under vegetable crops in Punjab was 24.3 thousand hectares with production of 4.91 million tons (Anonymous, 2018). In Punjab, Sangrur district has an important place in the production of vegetables and Malerkotla block of this district is an important vegetable cultivation hub of the state (Anonymous, 2019a). The present study was conducted to investigate the existing situation of vegetable growing practices in this vegetable hub of Sangrur district of Punjab,

MATERIALS AND METHODS

The study was conducted in Sangrur district of Punjab during the year 2017-18, using ex-post facto research design. Malerkotla block of this district has maximum area under vegetable cultivation in the district known as the vegetable hub of the state (Anonymous, 2019b). Therefore, the Malerkotla block of Sangrur district was selected for this study purpose. Based on the experts opinion, considering area under cultivation and economic value of the crops in the block, four vegetable crops i.e. cauliflower, cucumber, okra and capsicum was selected for the present study. A list of vegetable growers of all the villages having at least one acre of land under vegetable cultivation was obtained from Department of Horticulture of Punjab, Sangrur. A sample of 120 vegetable growers was selected randomly from these vegetables growers, keeping in view that at least 50 farmers should be cultivating each selected vegetable crop. A structured interview schedule was prepared to collect the data on adoption status of vegetable cultivation. The interview schedule was pre-tested by selecting 20 non-sampled vegetable growers from Ludhiana district. Content validity of instrument was ensured by taking the opinion of scientists from Department of Vegetable Science, PAU. The data were collected personally interviewing the vegetable growers with the help of structured interview schedule, by explaining them purpose of the investigation. Proper precautions were taken to ensure unbiased response of the respondents by providing them necessary instructions. The responses were transferred on an excel sheet and then tabulated and analysed with the help of appropriate statistical tools such as frequencies, percentage, mean score and range method.

RESULTS AND DISCUSSION

Socio personal characteristics of the respondents: The data presented in the Table 1 revealed that majority (57.50%) of the respondents belonged to age group of 37 to 48 years. It was found that 22.50 per cent of the respondents belonged to category 24 to 36 years of age and 20 per cent of the respondents belonged to category 49-60 years of age. Kaur (2004) and Singh (2011) also reported that majority vegetable growers belonged to middle age group in their studies. It has been concluded that maximum number of the respondents belonged to middle age group i.e. 37-48 years. The average age of all the respondents was 41.85 years. In this study, all the respondents were male. It was also reported that majority (28.34%) of the respondents were educated up to matric level followed by 25.83 per cent of the respondents who were illiterate. It was found that only 18.33 per cent of the respondents were educated up to senior secondary level. Thus, it can be concluded that on an average the respondents has completed 6.78 years of formal schooling. Similar results were also reported by Sharma (2002). Family size refers to total members in the family i.e., male, female and children. The findings also revealed that more than half of the respondents (69.16%) belonged to family of five or less than five members whereas 30.84 per cent of the respondents belonged to a family of larger size having more than five members. The average size of these families was 4.87.

Findings reveal that majority of the farmers (60.84%) had started the vegetable cultivation in the beginning on 0.5-1.0-acre area. Majority (80.82%) of these vegetable growers owned less than five acres of land and average land owned by all the respondents was 3.68 acres. To further enhance their income, these farmers took land on lease. It is revealed from the data in the Table 1 that little less than half (42.50%) of the respondents took 1-5 acres of land on lease followed by 6.66 per cent of the

Table 1: Distribution of respondents according to their socio personal characteristics (n=120)

Socio personal Characteristics	Category	Frequency	Percentage	Mean±S.D.
Age (years)	24-36	27	22.50	41.85±7.38 years
	37-48	69	57.50	
	49-60	24	20.00	
Gender	Male	120	100.00	6.78±4.54 years
Educational level (Years of formal schooling)	Illiterate	31	25.83	
	Primary	18	15.00	
	Middle	15	12.50	
	Matric	34	28.34	
	Senior secondary	22	18.33	
Family size	Upto 5 members	83	69.16	4.87±1.66
	More than 5 members	37	30.84	
Area at the beginning of vegetable cultivation (acre)	0.5-1.0	73	60.84	1.64±1.06 acre
	1-2	26	21.66	
	>2	21	17.50	
Land owned (acre)	<2.5	53	44.16	3.68±2.64 acres
	2.5-5	33	36.66	
	5-10	16	13.33	
	>10	4	3.33	
Land leased in (acre)	<2.5	51	42.50	1.06±1.73 acres
	2.5-5	19	15.83	
	5-10	8	6.66	
	>10	2	1.66	
Operational land holding (acres)	Marginal (<2.5)	33	27.50	4.72±3.26 acres
	Small (2.5-5.0)	55	45.83	
	Semi-Medium (5-10)	25	20.83	
	Medium (10.0-25.0)	7	5.84	
Total land under vegetable cultivation (acre)	<2.5	48	40.00	3.65±1.91 acres
	2.5-5	51	42.50	
	5-10	21	17.50	
Vegetable farming experience years)	5-10	26	21.66	17.20±6.14 years
	11-15	39	32.50	
	16-20	36	30.00	
	>20	19	15.84	
Subsidiary occupation	Dairy	19	15.83	-
	Goat rearing	80	66.66	
	Poultry	5	4.16	
Gross total income (lakh/annum)	3-6	69	57.50	7.02±0.92 lakh
	7-10	29	24.16	
	11-14	22	18.34	
Source of credit	Commission agent	98	81.68	-
	Fellow farmers	6	5.00	
	Relatives	5	4.16	
	Banks	11	9.16	

respondents leased 6-10 acres of land. Operational land holding represents the total cultivated land of respondents. Most of the respondents were either small (27.50%) or marginal (45.83%) farmers cultivating land less than five acres. About 20.83 per cent of respondents were semi-medium cultivating 5-10 acres of land and only 5.84 per cent of respondents were medium farmers with more than 10 acres of land. The average operational land holding was 4.72 acres for all the respondents. Josan (2002) also found that vegetable cultivation was mainly adopted by small and marginal farmers. It is also evident from the data presented in the table 1 that 40 per cent of the respondents had cultivated vegetable crops on area of less than 2.5 acres while 42.5 percent of them cultivated on an area of 2.5-5.0 acres and 17.50 per cent of the respondents covered an area of 5-10 acres under vegetable cultivation with average of 3.65 acres. Thus, it can be inferred that vegetable cultivation was main farming enterprise adopted by the respondents on their operational land holding. Similar findings were also reported by Anonymous (2019a).

Data in Table 1 indicate that 32.50 per cent of the respondents had 11-15 years of experience in vegetable cultivation whereas 30 per cent of respondents had 16-20 years of experience in vegetable cultivation while 21.66 per cent of respondents had 5-10 years of experience and the remaining15.84 per cent of respondents had 20 and more years of experience in vegetable cultivation. Sonkar and Mishra (2015) also reported that majority of vegetable growers had 21-32 years of experience. It can be concluded that maximum number of vegetable growers started vegetable cultivation about 15-20 years ago. Majority of the respondents (66.66%) had adopted subsidiary occupation of goat farming. It might be due to the fact that majority of surrounding population of selected Malerkotla block belongs to Muslim community and goat meat is preferred by them. So goat rearing is also a profitable occupation in study area. While 15.83 per cent of the respondents had dairy farming as a subsidiary occupation and only 4.16 percent of the respondents adopted poultry farming. The data in the table 1 indicate that little more than half i.e. 57.50 per cent of the respondents had gross annual family income varied from 3-6 lakh and 24.16 per cent of the respondents had gross annual income from 7-10 lakh. Remaining 18.34 per cent of the respondents had gross annual income from 11-14 lakh. The average gross annual income was found to be 7.02 Lakh for all the respondents. The findings are in line with Singh (1998). The data reveal in the table 1 that majority of the respondents i.e. (81.68%) had taken loan from commission agents as commission agent provide loan with very less interest for one year with pre-requisite condition of selling their vegetables produce through them, while 9.16 per cent of the respondents took loan from banks. About five per cent of respondents had taken loan from fellow farmers and the rest 4.16 per cent from relatives.

Source of seed and adoption of vegetable cultivation techniques: The data presented in Table 2 reveal that majority of the respondents i.e., 87.50 per cent had purchased the seed from private seed sources/ shops. About 55.83 per cent of the respondents used own seed/ nursery. Only 16.66 and 12.50 per cent of the respondents had purchased seed from PAU Ludhiana and state department of horticulture, Punjab, respectively. It might be due to the profuse availability of vegetables seeds as the private seed companies have developed strong extension network in this area. Moreover, many of these farmers have availed the loan from these shopkeepers cum commission agents and are liable to purchase farm inputs from them. The data in Table 3 shows that majority of the respondents i.e., 79.16 per cent adopted low tunnel technology for early protected cultivation and 66.66 per cent of the total respondents had used bed and ridge method of planting in depending upon the kind of

Table 2: Distribution of respondents according to source of seed and nursery for vegetable cultivation (n=120)

Source	Frequency*	Percentage
PAU, Ludhiana	20	16.66
State Department of Horticulture, Punjab	15	12.50
Private seed sources	105	87.50
Use own seed/nursery	67	55.83

**Multiple response*

Table 3: Distribution of respondents according to adoption of latest vegetable cultivation techniques at their field (n=120)

Source	Frequency*	Percentage
Low tunnel	95	79.16
Poly house	12	10.00
Bed/Ridge planting	80	66.66
Inter-cropping	40	33.33
Relay-cropping	50	41.66

**Multiple response*

vegetables. It was also found that 41.66 per cent of the respondents had used relay-cropping system for intensive cultivation. About 33.33 per cent of the respondents had adopted relay cropping system like cucumber in capsicum. In this relay cropping, cucumber crop is harvested in April and the residue is to be left in the field. The residual materials help as a mulching material in capsicum crop. This helps to reduce the temperature during fruiting phase of capsicum. Examples of intercropping were cauliflower-coriander and capsicum-onion.

Cultivation practices in cucumber crops: The data given in Table 4 reveal that all the respondents were cultivating un-recommended varieties of cucumber. It was found that more than half of the respondents i.e. 54.54 per cent had cultivated Rajani variety of cucumber followed by Laxami (29.87%), whereas Padmini variety was cultivated by 15.59 per cent of the respondents. All these varieties are not recommended by Punjab Agricultural University, Ludhiana (PAU, 2018). According to farmers, they are adopting these un-recommended hybrids mainly due to their high yield as compared to recommended variety. However, farmers also reported higher incidence of insect-pests and diseases on these varieties. Majority of the respondents i.e., 77.92 per cent cultivated cucumber crop on 1-2 acres of land and 19.49 per cent of the respondents cultivated cucumber crop on 3-4 acres of land. It was also found that majority of the respondents i.e., 81.81 per cent sown their cucumber crop during the months of November- December followed by 10.38 percent of the respondents sown the cucumber crop before November and only 7.81 per cent of the respondents sown the cucumber crop after December. All the respondents planted cucumber on beds and majority of the respondents (85.72%) used less than recommended seed rate (Dwivedi *et al.*, 2011). Only 14.28 per cent of the respondents used recommended seed rate. The average seed rate of cucumber used by the respondents was 432.85 g. It is also revealed that majority of the farmers cultivated their cucumber crop at wider row-row spacing and lesser than recommended plant-plant spacing.

The data in Table 4 also reveal that majority of the respondents i.e., 54.55 per cent applied 10-12 irrigations and more than one third (35.06%) of the respondents applied more than 12 irrigations to cucumber crop. It was also found that only 27.27 per cent of the respondents adopted recommended dose of urea fertilizer (90 kg/ acre) whereas 46.75 per cent used more than recommended dose of urea fertilizer for meeting nitrogen requirement of the crop. The average dose of urea fertilizer applied in cucumber crop was 87.01kg/acre which is less than the recommended dose of 90 kg/acre. It might be due to the reason that these varieties are not recommended by PAU, hence these farmers also apply fertilizer dose as per advice of private companies representatives. During discussion, the farmers also clarified that if they apply more nitrogen (Urea) then the occurrence of blight/ downy mildew will be more. So, they tend to use lesser amount of nitrogen fertilizer in cucumber crop. It was also found that only 11.68 per cent of the respondents adopted recommended dose of DAP and as high as 80.51 per cent of the respondents applied more than recommended dose of DAP fertilizer i.e. 45kg/acre. The average dose of DAP fertilizer used by the respondents was 84.02 kg/acre which is nearly double of the recommended dose (45 kg/acre) for meeting phosphorus requirement of the crop. Use of higher doses of DAP might be due to their perception that hybrids are high yielding and require more productive growth which can be achieved only by applying excess doses of phosphate fertilizers. Findings also reveal that more than half (55.84%) of the respondents adopted recommended dose of potash fertilizer (MOP). In case of pesttcide applications on cucumber crop, 37.66 per cent had applied 11-17 pesticides sprays on their crop and 36.37 per cent of the respondents sprayed their crop as high as 18-24 times. The average number of pesticide applications practiced by the farmers on cucumber crop was 14.97, whereas the PAU has recommended 10-11 sprays on an average throughout the season. Mahantesh and Singh (2009) also observed high pesticide use in vegetables. The average yield of cucumber obtained by the respondents was 177.59 q/acre and majority of the respondents (64.93 %) were able to obtain yield higher than the average yield. However, nearly one third (35.07%) of the respondents had obtained the yield lower than average.

Cultivation practices in capsicum crop: The data in Table 5 reveal that Indra was the most popular variety of capsicum and was adopted by 57.34 per cent of the respondents while 42.66 per cent of respondents cultivated Aisha variety. These varieties are not recommended by PAU (PAU, 2018). Majority of the respondents i.e., 74.66 per cent cultivated capsicum crop on 1-2 acres of land and 22.68 per cent of the respondents cultivated capsicum crop on 3-4 acres of land, while 1.66 per cent of the respondents cultivated capsicum crop on more than four

Table 4: Distribution of respondents according to various cultivation practices in cucumber crop (n=77)

Aspects	Categories	Frequency	Percentage	Mean±S.D.
Varieties	Laxami*	23	29.87	-
	Rajani*	42	54.54	
	Padmini*	12	15.59	
Area (acres)	1-2	60	77.92	2.4±0.89 acres
	3-4	15	19.49	
	>4	2	2.59	
Time of sowing	Before Nov	8	10.38	-
	November – December	63	81.81	
	After December	6	7.81	
Method of sowing	Bed planting	77	100	-
Seed rate	Less than recommended	66	85.72	432.85±122.12 g
	Recommended (1000g/acre)	11	14.28	
Spacing (Row-Row)	Less than recommended	6	7.79	-
	Recommended	5	6.49	
	More than recommended	66	85.72	
Spacing (Plant -Plant)	Less than recommended	64	83.12	-
	Recommended	7	9.09	
	More than recommended	6	7.79	
Number of Irrigations (10-12)	<10	8	10.39	11.7±2.97
	10-12	42	54.55	
	>12	27	35.06	
Urea	Less than recommended	20	25.97	87.01±17.80 kg/acre
	Recommended (90 kg/acre)	21	27.27	
	More than Recommended	36	46.75	
DAP	Less than recommended	6	7.79	84.02 ± 22.76 kg/acre
	Recommended (45 kg/acre)	9	11.68	
	More than recommended	62	80.51	
MOP	Less than recommended	10	12.98	37.00±4.41 kg/acre
	Recommended (35 kg/acre)	43	55.84	
	More than Recommended	24	31.17	
Number of pesticide applications	4-10	20	25.97	14.97±8.40
	11-17	29	37.66	
	18-24	28	36.37	
Yield (q/acre)	More than average yield	50	64.93	177.59±25.06 q/acre
	Less than average yield	27	35.07	

**Not recommended by PAU*

acres of land. It was also found that majority of the respondents i.e., 66.66 per cent were sown their capsicum crop during mid-November- mid December followed by 20 percent of the respondents sown the capsicum crop during January- February and only 13.34 per cent of the respondents sown the capsicum crop after February. All the respondents cultivated capsicum crop on bed planting. Majority of the respondents (80%) used lesser seed than recommended. Only 20 per cent of the respondents used recommended seed rate. The average seed rate adopted by the respondents was 111.8g against the recommended seed rate of 200g. Similar results were also reported by

Table 5: Distribution of respondents according to various cultivation practices in Capsicum crop (n=75)

Aspects	Categories	Frequency	Percentage	Mean
Varieties	Indra*	43	57.34	-
	Aisha*	32	42.66	
Area (acres)	1-2	56	74.66	2.33±0.87 acre
	3-4	17	22.68	
	>4	2	1.66	
Time of sowing	November – December	50	66.66	-
	January - February	15	20.00	
	After February	10	13.34	
Method of sowing	Bed planting	75	100	-
Seed rate	Less than recommended	60	80.00	111.8±15.23 g
	Recommended (200 g/acre)	15	20.00	
Spacing (Row- Row)	Less than recommended	4	5.34	-
	Recommended	11	14.66	
	More than recommended	60	80.00	
Spacing (Plant- Plant)	Less than recommended	67	89.33	-
	Recommended	4	5.34	
	More than recommended	4	5.33	
Number of Irrigations	<12	13	17.33	13.5±2.95
	12-15	47	66.66	
	>15	15	33.34	
Urea	Less than recommended	23	30.66	108.14±12.58 kg/acre
	Recommended (110 kg/acre)	32	42.66	
	More than recommended	20	26.66	
DAP	Less than recommended	6	8.00	80.18±19.93 kg/acre
	Recommended (55 kg/acre)	21	28.00	
	More than recommended	48	64.00	
MOP	Less than recommended	10	13.33	49.13±21.93 kg/acre
	Recommended (20 kg/acre)	16	21.33	
	More than recommended	49	65.33	
Number of pesticide applications	5-11	24	32.00	16.05±9.39
	12-18	32	42.66	
	19-25	19	25.34	
Yield (quintals)	More than average yield	46	61.34	118.33 ±17.23 q/acre
	Less than average yield	29	38.66	

**Not-recommended by PAU*

Kaur *et al.* (2017) that majority of capsicum and tomato growers had not adopted recommended seed rate and sowing time practices. More than 80 per cent of the farmers had adopted wider row-row and lesser plant-plant spacing. The data given in Table 5 also reveal that majority of the respondents i.e., 66.66 per cent applied 12-15 irrigations and more than one third (33.34%) of the respondents had applied more than 15 irrigations to capsicum crop. The average number of irrigations applied was 13.5. It was also found that 42.66 per cent of the respondents adopted recommended dose of nitrogen fertilizer (Urea), while 30.66 per cent of them applied less

than recommended dose of urea. Remaining i.e., 26.66 per cent of the respondents had used more than recommended dose of Urea. The average dose of urea applied by the respondents was 108.14 kg, which nearly at par with recommended dose. It is clear from Table 5 that majority of the respondents (64%) used higher than recommended doses of DAP fertilizer (55kg/acre). However 28.00 per cent of the respondents adopted recommended doses of DAP fertilizer. The average dose of DAP fertilizer applied was 80.18 kg /acre, which is much higher than recommended dose. Use of un-recommended practices may be due to the fact that as hybrids are high yielding and they require more productive growth which can be achieved by applying more DAP. Similarly use of higher doses of potash fertilizer (MOP) in capsicum crop was also reported in the study and it was found that 65.33 per cent of the respondents used more than recommended doses of muriate of potash (MOP) fertilizer. The data also reveal that majority of the respondents i.e., 42.66 per cent sprayed their crop 12-18 times whereas more than one third i.e., 32 per cent of the respondents sprayed their capsicum crop 5-11 times. It was also observed that 25.34 per cent of the respondents sprayed their crop 19-25 times. The average number of pesticide applications practiced by the farmers on capsicum crop was 16.05 while the recommended applications are 7-8 on an average during the cropping season. The average yield obtained by the respondents was 118.33 q/acre and 61.34 percent of the respondents had obtained yield higher than the average yield.

Cultivation practices in okra crop: The data given in Table 6 reveal that more than half of the respondents (59.52%) cultivated VNR999 variety of okra followed by SV8999 (29.77%) whereas Jyoti was cultivated by remaining 10.71 per cent of the respondents. These varieties are not recommended by PAU, Ludhiana (PAU,2018). According to farmers, they are adopting these non-recommended varieties mainly due to their high yield (Upadhyay *et al.,* 2014). Majority of the respondents (63.09%) cultivated okra crop on 1-2 acres of land and (33.33%) of the respondents cultivated okra crop on 3-4 acres of land while 3.57 per cent of the respondents cultivated okra crop on more than 4 acres of land. It was also found that most of the respondents i.e., 54.76 per cent were sown their okra crop during the months of February-March followed by 28.57 per cent of the respondents sown the okra crop before February and only 16.67 per cent of the respondents sown the okra crop after March. All the respondents cultivated okra crop on bed and ridge planting. Majority of the respondents (53.57%) used seed less than recommended. Only (35.71%) of the respondents used recommended seed rate whereas 10.72 per cent of the respondents used more than recommended seed rate. Results are in line with the study of Kaur *et al.* (2017). Only one-fourth of the respondents have adopted the recommended row-row and plant-plant spacing.

The data also revealed that majority of the respondents i.e., 63.09 per cent applied more than 12 irrigations and 28.58 per cent of the respondents applied 10-12 irrigations to okra crop. The average dose of urea fertilizer applied by the respondents was found to be 108.03 kg/acre, which is higher than the recommended dose of 80 kg/acre. Only 17.85 per cent of the respondents adopted recommended dose of urea while 71.42 per cent respondents applied more than recommended doses of Urea. PAU has not recommended the use of DAP and potash fertilizer in okra crop. However, it is evident from Table 6 that respondents were applying these both fertilizers in okra crop. Majority (67.85%) of the respondents applied more than 50 kg of DAP fertilizer in an acre, whereas on contrary MOP was used less than 50 kg/acre by most (57.14%) of the respondents. The mean doses of DAP and MOP fertilizers used by the respondents were 83.26 and 47.43 kg/acre, respectively. The data reveal that more than half of the respondents i.e., 59.52 per cent sprayed their crop 12-18 times whereas 23.82 per cent of the respondents sprayed their crop 5-11 times. As many as 16.66 per cent of the respondents sprayed their okra crop as high as 19-25 times. The average number of pesticide applications practiced by the farmers on okra crop was 15.57 whereas the PAU has recommended 8-9 sprays on an average throughout the season. The average yield obtained by the respondents was 177.02 q/acre and 73.81 per cent of the respondents had obtained yield higher than the average yield.

Cultivation practices in cauliflower crop: The data in Table 7 reveal that more than half of the respondents (58.06%) cultivated Kavita variety of cauliflower followed by Katki (38.70%) whereas Maghari was cultivated by remaining 3.24 per cent of the respondents. These all varieties are not recommended by PAU (PAU,2018). However, they have also realized that there was higher incidence of insect-pests and diseases on the early grown varieties during June-August. Majority of the respondents (61.29%) cultivated cauliflower crop on 1-2 acres of land

Table 6: Distribution of respondents according to various cultivation practices in Okra crop (n=84)

Aspects	Categories	Frequency	Percentage	Mean
Varieties	SV8999*	25	29.77	-
	VNR999*	50	59.52	
	Jyoti*	9	10.71	
Area (acres)	1-2	53	63.09	2.42±0.92
	3-4	28	33.33	
	>4	3	3.58	
Time of sowing	Before Feb	24	28.57	-
	February - March	46	54.76	
	After March	14	16.67	
Method of sowing	Bed panting	84	100	-
Seed rate	Less than recommended	45	53.57	9.45±1.76
	Recommended (10 kg/acre)	30	35.71	
	More than recommended	9	10.72	
Spacing (Row- Row)	Less than recommended	5	5.95	-
	Recommended (45 cm)	28	33.33	
	More than recommended	51	60.72	
Spacing (Plant- Plant)	Less than recommended	57	67.85	-
	Recommended (15 cm)	22	26.19	
	More than recommended	5	5.96	
Number of Irrigations	<10	7	8.33	13.80±3.50
	10-12	24	28.58	
	>12	53	63.09	
Urea	Less than recommended	9	10.71	108.03±19.07 kg/acre
	Recommended (80 kg/acre)	15	17.85	
	More than recommended	60	71.42	
DAP*	<50	7	8.33	83.26±24.54 kg/acre
	50	20	23.80	
	>50	57	67.85	
MOP*	<50	48	57.14	47.43±5.48 kg/acre
	50	21	25.00	
	>50	15	17.86	
Number of pesticide applications	5-11	20	23.82	15.57±8.37
	12-18	50	59.52	
	19-25	14	16.66	
Yield (q/acre)	More than average yield	62	73.81	177.02±18.58 q/acre
	Less than average yield	22	26.19	

**Not recommended by PAU*

and 34.40 per cent of the respondents cultivated cauliflower crop on 3-4 acres of land while 4.31 per cent of the respondents cultivated cauliflower crop on more than four acres of land. Majority of the respondents (63.44%) were sown their cauliflower crop at the time of August-September followed by 20.43 per cent of the respondents sown the cauliflower crop before August and only 16.13 per cent of the respondents sown the cauliflower crop after September. All the respondents cultivated cauliflower crop on bed and ridge planting. Majority of the

Table 7: Distribution of respondents according to various cultivation practices in Cauliflower crop (n=93)

Aspects	Categories	Frequency	Percentage	Mean
Varieties	Kavita*	54	58.06	-
	Katki*	36	38.70	
	Maghari*	3	3.24	
Area (acres)	1-2	57	61.29	2.55± 0.97acre
	3-4	32	34.40	
	>4	4	4.31	
Time of sowing	Before Aug	19	20.43	-
	August-September	59	63.44	
	After September	15	16.13	
Method of sowing	Bed panting	93	100	-
Seed rate	Less than recommended	80	86.02	199.13±21.45 g/acre
	Recommended (250 g/acre)	13	13.98	
Spacing (Row- Row)	Recommended	13	13.98	-
	More than recommended	80	86.02	
Spacing (Plant- Plant)	Less than recommended	80	86.02	-
	Recommended	13	13.97	
Number of Irrigations	8-12	53	56.99	10.98±3.08
	>12	40	43.01	
Urea	Less than recommended	42	45.16	104.30±8.98 kg/acre
	Recommended (110 kg/acre)	41	44.08	
	More than recommended	10	10.75	
DAP	Less than recommended	14	15.05	71.21±19.88 kg/acre
	Recommended (55 kg/acre)	25	26.88	
	More than recommended	54	58.07	
MOP	Less than recommended	31	33.33	41.21±4.41 kg/acre
	Recommended (40 kg/acre)	25	26.89	
	More than recommended	37	39.78	
Number of pesticide applications	3-8	66	70.96	8.14±9.39
	9-14	17	18.28	
	15-20	10	10.76	
Yield(q/acre)	More than average yield	72	77.42	160.69±18.27q/acre
	Less than average yield	21	22.58	

**Not recommended by PAU*

respondents (86.02%) used lesser seed than recommended. Only 13.97 per cent of the respondents used recommended seed. Nearly half of the respondents have cultivated cauliflower at wider row-row and narrower plant to plant spacing than recommended.

The findings reveal that more than half of the respondents i.e., 56.99 per cent applied more than 12 irrigations and 43.01 per cent of the respondents applied 8-12 irrigations. It was also found that 44.08 per cent of the respondents adopted recommended dose of urea fertilizer (110 kg/acre) and nearly equal number (45.16%) of respondents applied less than recommended dose of Urea. The average dose of urea used by respondents on cauliflower crop was 104.30kg/acre which is at par with recommended dose. Use of lesser dose urea might be due to the reason that majority of these farmers also has

used farm yard manure and poultry manure on their fields. On contrary, DAP fertilizer was used by the farmers in much higher quantity (71.21 kg/acre) than recommended (55 kg/acre) as 58.07 per cent of the respondents applied more than recommended dosages. It might be due to the perception of the farmers that local varieties demand more DAP. It was found that 26.89 per cent used recommended dose of muriate of potash followed by 39.78 per cent of the respondents had used more than recommended dose of muriate of potash (MOP). It can also seen that majority of the respondents i.e., 70.96 per cent sprayed their cauliflower crop 3-8 times whereas 18.28 per cent of the respondents sprayed their crop 9-14 times. About 10.76 per cent of the respondents sprayed the cauliflower as high as 15-20 times. The average number of pesticide applications practiced by the farmers on cauliflower crop was 8.14. The average yield obtained by the respondents was 160.69 q/acre and majority of the respondents (77.42%) were able to obtain yield higher than the average yield. However, 22.58 per cent of the respondents had obtained the yield lower than average.

Marketing practices of vegetable crops: Data on various marketing aspects of vegetables viz. marketing channels, place of marketing, distance and market fee is presented in Table 8. It is evident that that almost all the respondents i.e., 99.16 per cent sold their agricultural produce to commission agent and only 3.33 per cent of the respondents sold their produce through direct marketing channel. Similarly, almost all the respondents i.e., 92.50 per cent sold their produce in the local market at 10-20 km of distance. During discussion, it was investigated that these vegetable farmers had availed loan from commission agents on marginal interest with the condition to sell their vegetable produce through them in the local market (Sidhu *et al.,* 2010). Remaining 7.50 per cent of the respondents preferred to market their produce at more than 20 km of distance. It was shown that more than half (52.50%) of the respondents has paid 3-5 percent of market fee whereas 41.66 per cent of the respondents has paid less than three percent of market fee.

Table 8: Distribution of respondents according to marketing aspects of vegetable crops (n=120)

Aspects	Categories	Frequency*	Percentage
Marketing channels	Commission agent	119	99.16
	Direct	4	3.33
Place	Local	111	92.50
	Distance	9	7.50
Distance (km)	10-20	111	92.50
	>20	9	7.50
Market fee (%)	<3	50	41.66
	3-5	63	52.50
	>5	7	5.83

**Multiple Response*

CONCLUSION

Vegetable crops are vital for ensuring nutritional and food security for growing population of India. Cultivation of vegetable crops can play a significant role in realizing crop diversification in Punjab. Malerkotla block in Sangrur district of Punjab is an important vegetable cultivation hub in the state. This study has presented the adoption status of various cultivation practices in important vegetable crops i.e. cauliflower, capsicum, cucumber and okra in this block. It was concluded that majority of respondents were found to have using private seeds or their own seeds or nursery for vegetable cultivation at their farm. Among the different vegetable cultivation techniques, low tunnel cultivation of vegetables crops was found to be most popular. Cucumber crop was mostly cultivated on 1-2 acres of land and planted at the recommended time during November and December. In case of capsicum, Indra was the most popular variety among the respondents however this crop was planted earlier than recommended time using lesser seed rate than the recommended. Okra farmers were using lesser seed rate and with wider spacing. Study infer that this vegetable hub is characterized by small land holding, deviating from recommended production technology and intensive farming using higher farm inputs to realize higher yields. Undoubtedly, the farmers have less extension contacts and most of them are illiterate. Farmers' education and training by organizing camps and training courses are advocated for scientific cultivation of vegetable crops. These findings would be of immense importance for researchers and policymakers in further strengthening research work and promoting vegetable production in country.

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Impact of Crime on Women and their Families in Rural Haryana- A Sociological Appraisal

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ABSTRACT

Crime against women and children in form of domestic violence is a major concern in India and impacts severely on their health, self-confidence and social prestige. Especially children experience family violence as a witness and /or a victim. The communities' native to the state of Haryana in India is primarily patriarchal, burdened with age old regressive mindset under the socio-cultural and religious structures which discriminate against women. Therefore, it was important to bring to light the issues affecting women in this region. So this study focused on studying the consequences of crime on victim women and their families. Two hundred women were randomly selected and out of these, one hundred and twenty, who were affected with some kind of violence, were interviewed. Data were collected and statistically analyzed for physical, psychological, inter-family and societal consequences of violence on these women. 58.83 per cent women felt gynecological problem regarding physical consequences. In case of psychological problems 66.66 percent of respondents who felt anxiety. At family levels, 40.0 per cent respondents felt that atmosphere was unsuitable for children, while 39.16per cent respondents reported denial of human rights/basic needs by husband. The societal consequences reported were affected your relationship with friends and neighbours (44.16%) and resulting humiliation and demeaning remarks from others (38.3%). The impact of violence on women had an adverse effect on children. 36.7% children felt responsible for abuse and powerless to stop it, 29.16 per cent reported living with fear. Concerted efforts are required to curb violence against women in Haryana.

Keywords: Impact of violence on family, Psychological and societal consequences, Patriarchal

INTRODUCTION

Violence against women is an international phenomenon cutting across boundaries of culture, class, education, income, ethnicity and age. The United Nations defines violence against women as any act of gender based violence that results in, or is likely to result any, physical, sexual or mental harm or suffering to women including threats of such acts, coercion or arbitrary deprivation of liberty, whether occurring in public or private life.

Global estimates published by WHO indicate that about 1 in 3 (35%) women worldwide have experienced either physical or sexual violence by their intimate partner or non partner in their life time. The statistics presented in the National Crime Records Bureau report 2012 reaffirm the rising trend of crime against women. Violence against women and children has for reaching consequences harming families, societies and communities at large. The National Commission for Women (NCW) has received 1720 complaints the third highest number of cases of crime against women from Haryana during the year 2014-15 (Pioneer, 2017).

India today, a country where women are becoming more prominent yet increasing numbers of women are still fighting long standing prejudices. Unfortunately women in India and especially in Haryana have been a silent and helpless victim of violence against them as a result of patriarchal social system. There is enormous pressure to confirm to social norms and traditional roles in the family. Violence against women leads to for reaching physical, social and psychological consequences some with fatal consequences .Due to increase in crime rate as already mentioned above this sensitive issue of violence need to be addressed immediately on a platform where this problem can be discussed and the violence against women can be curbed to a greater extent. Therefore the study was conducted to understand the impact of crime women and their families.

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MATERIALS AND METHODS

The study was conducted in Karnal and Sirsa districts of Haryana state. From these districts, one block from each district i.e., Indri from Karnal and Bada Gudha from Sirsa were selected randomly. From the selected blocks, four villages, namely, Kheri Maan Singh and Jain pura Sidhana (Indri), and Biru Wala and Burj Bhangu (Bada Gudha) were drawn randomly. From the selected villages, 200 respondents were also selected randomly. Interview schedule was prepared to collect the desired information as per objectives of the study. Finally, selected respondents were surveyed with the help of interview schedule. Data were analyzed and tabulated to draw the inferences.

RESULTS AND DISCUSSION

The emphasis of this particular study was to know the perceived impact of violence on women and their families. Out of 200 respondents120 respondents (60.00%) reported multiple negative influences on their health due to violence faced by them.

Physical Consequences: Respondents perceived that their many physical health problems were due to domestic violence. Out of total 120 respondents, maximum number of respondents felt gynaecological problem (58.83%) followed by migraine (55.0%), sexual dysfunctional, frigidity and phobia (41.66%), miscarriage (36.66%), decrease efficiency of work (35.83%), irritable bowel syndrome (32.50%), have physical injuries (23.33%).

District- wise analysis revealed that maximum number of respondents faced physical consequences like migraine (55.71%), gynaecological problems (45.71%) and sexual dysfunctional, frigidity and phobia (32.85%) in Karnal district and simultaneously gynaecological problem (84.0%), migraine (54.0%) and decrease efficiency of work (50.0%) were faced in Sirsa district. Similar findings were also reported by Rodgers and Satija (2012), Salomi (2013) and Sharma (2014).

Psychological Consequences: Regarding the psychological level consequences, majority of respondents reported anxiety (66.66%) followed by depression symptoms (65.0%) and low self-esteem (57.5%), eating disorder (55.83%), fear and insomnia (55.0%), isolation (47.5%) and anger outburst (44.16%). The studies of Deolalikar *et al.* (2009); Chakraborty and Kim (2010); Ahlawat and Kumar (2012) also reported the impact of spousal violence on women was being confused, frustrated and angry. Kaur Preetinder (2011) also reported that women suffer isolation, powerlessness to work etc. due to violence in the family. Ahlawat *et al.* (2008) found that component-wise analysis of girls mental health revealed that respondents had very poor health in positive self-evaluation dimension which includes self-confidence, self-acceptance, self-identity, feeling of worth whileness and realization of one's potentialities. Reasons may be their socialization, lack of opportunities and inherent vulnerability during adolescence.

Family Level Consequences: Violence against women had not only repercussion on individual but also on family and in the society also. Maximum number of respondents felt unsuitable atmosphere for children at home (40.0%) and denial of human rights/basic needs by husband (39.16%). Similar findings were reported by Sen (1990); Patel (2007) and Trent and Soth (2012).

With regards to family level consequences, lack of interaction among family member (35.71%), unsuitable atmosphere for children at home and lack of intimacy with husband (32.85%)were found in Karnal district and denial of human rights/basic needs by husband (52.0%) and an unsuitable atmosphere for children at home (50.0) were found in Sirsa district.

Societal Level Consequences: Domestic violence against women also affects societal lives. Maximum number of respondents (44.16%) felt that the violence they faced had somehow affected their relationship with friends and family. Likewise, 38.33 per cent felt that they had to face humiliating, demeaning or undermining remarks or statements.

Further, regarding societal level consequences, effect on relationship with friends and neighbours (38.57%), facing demeaning, humiliating or undermining remarks or statements deprived of leading a normal life (27.14%) were found in Karnal district, while facing demeaning, humiliating or undermining remarks or statements (54.0%) and effect on relationship with friends and neighbours (52.0%) were found in Sirsa district. The findings are in accordance with the study of Kumar (2006), Kaur (2013) and Abrahams *et al.* (2014).

Out of 200 respondents, 120 respondents (60.00%) had multiple negative influences on health due to violence faced by them.

Impact on Children: Violence against women not only affected them but the negative impact was also seen on

Table 1: Consequences faced by the respondents

Consequences	Karnal (n=70)	Sirsa (n=50)	Total (n=120)
Physical consequences			
Have physical injuries	16 (22.85)	12 (24.0)	28 (23.33)
Gynaecological problem	32 (45.71)	29 (84.0)	61(58.83)
Migraine	39 (55.71)	27 (54.0)	66 (55.0)
Miscarriage	20 (28.57)	22 (44.0)	44 (36.66)
Decrease efficiency of work	18 (25.71)	25 (50.0)	43 (35.83)
Unwanted pregnancy	13 (18.71)	15 (30.0)	28 (23.33)
Irritable bowel syndrome	22 (31.42)	17 (34.0)	39 (32.50)
sexual dysfunctional, frigidity and phobia	23 (32.85)	27 (54.0)	50 (41.66)
Psychological Consequences			
Anxiety	42 (60.0)	38 (76.0)	80 (66.66)
Fear & insomnia	31 (44.28)	35 (70.0)	66 (55.0)
Anger outburst	29 (41.42)	24 (48.0)	53 (44.16)
Low self esteem	37 (52.85)	32 (46.0)	69 (57.5)
Eating disorder	39 (55.71)	28 (56.0)	67 (55.83)
Depression symptoms	41 (58.57)	37 (74.0)	78 (65.0)
Isolation	29 (41.42)	28 (56.0)	57 (47.5)
Suicidal ideation	14 (20.0)	12 (24.0)	26 (21.66)
Family level consequences			
Lack of intimacy with husband	23 (32.85)	20 (40.0)	43 (35.83)
Lack of interaction among family member	25 (35.71)	21 (42.0)	46 (38.33)
Unsuitable atmosphere for children at home	23 (32.85)	25 (50.0)	48 (40.0)
Denial of human rights/basic needs by husband	21 (30.0)	26 (52.00	47 (39.16)
causing harm to children	15 (21.42)	13 (36.0)	28 (23.33)
Societal level consequences			
Affected your relationship with friends and neighbours	27 (38.57)	26 (52.0)	53 (44.16)
Facing demeaning, humiliating or undermining remarks or statements	19 (27.14)	27 (54.0)	46 (38.33)
Deprived of leading a normal life	13 (18.57)	10 (20.0)	23 (19.16)
Impact on children			
Children live with fear and inability to trust other	18 (25.71)	17 (34.0)	35 (29.16)
Growing up believing violence as a normal part of family life	24 (35.71)	20 (40.0)	44 (36.66)
Children live isolated by an abusing parent who shift off the family from outside	16 (22.85)	18 (36.0)	34 (28.33)
Children feel responsible for abuse and powerless to stop it	23 (32.85)	21 (42.0)	44 (36.66)

Figures in parentheses indicate percentages (Responses were multiple)

the children of those families. Starting from the birth, they face discrimination in the family and as a result during adolescence they are vulnerable to several social and health risks. Ahuja *et al.* (2018). It was analyzed that 36.66 per cent of children felt responsible for abuse and powerless to stop it and grew up believing violence as a normal part of family. Similarly, 29.16 per cent reported that children lived with fear and inability to trust others.

Further, regarding impact on children growing up believing violence as a normal part of family life (35.71%) and children feel responsible for abuse and powerless to stop it (32.85%) were found in Karnal and simultaneously children feel responsible for abuse and powerless to stop it (42.0%) and growing up believing violence as a normal part of family life (40.0%) were found in Sirsa district. Isaac (2015) also reported that children who witness domestic violence within their family experiences constant fear and inconsistency hence the inability to grow and thrive.

Summarizing the results regarding crime against women not only affected their physical health, but also affected

their relation with family members and their position/status in the society also. Violence in the family also affected their children.

CONCLUSION

Violence against women had not only repercussion on individual but also on family and in the society also. 58.83 per cent women felt gynecological problem regarding physical consequences. In case of psychological problems 66.66 per cent of respondents who felt anxiety. At family levels, 40.0 per cent respondents felt that atmosphere was unsuitable for children, while 39.16 per cent respondents reported denial of human rights/basic needs by husband. The societal consequences reported were affected your relationship with friends and neighbours (44.16%) and resulting humiliation and demeaning remarks from others (38.3%). The impact of violence on women had an adverse effect on children. 36.7 per cent children felt responsible for abuse and powerless to stop it, 29.16 per cent reported living with fear.

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Festivals and Monsoon: The Paradigm Shift in Festivals Due to Deviated Monsoon

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ABSTRACT

Agricultural production and productivity is largely dependent on the number of rainy days in a particular cropping season. The monsoon rain deviation hampers the agricultural production by reducing the normal crop yield or by destroying the crops by disease- pest, flood or drought. Not only the crop production or productivity is hampered by deviated monsoon rain but also the marketability of the crops or amount of marketable surplus of the farmers is also hampered. The present study is conducted in Ghoragachha village under Saguna gram panchayet, Nadia, West Bengal. The numbers of respondents were 60 and they were selected randomly. The data were collected trough pilot survey, structured interview and focused group interview. The statistical tools used for data analysis were correlation coefficient, step down regression, path analysis and factor analysis. Family size (X_3), livestock (X_{10}), yield of rice (X_{11}), yield of pulses (X_{12}), yield of vegetables (X_{13}) are some of the variables those have created a significant impact on the festivals. The variables which were retained after step down regression are family size (X_3) that means this is the most important causal variable which affect the consequent variable.

Keywords: Family size, Festivals, Livestock, Monsoon, Yield

INTRODUCTION

Shanwad *et al.* (2010) were rightly mentioned that the Earth's resources are degrading at an alarming rate, up to 1000 times faster than their natural rate of extinction. Similar situation holds good to tropical and subtropical countries including India. Since the civilization, the Indian agricultural production and monsoon seasons are correlating with each other. The rivers are the witnesses of rise and falls of numerous dynasties, kingdoms and civilizations. Rivers have a lot to do with the establishment of civilizations and creation of the folkways and beliefs of the people live beside its banks. As most of the rivers are filled with monsoonal rainfall so, monsoon has a vast impact on the culture and festivals of the people. Ramsankar-Basu (2009) reported a series of investigations were carried out in an ancient sacred grove at Biharinath hill, Bankura district of West Bengal, with an objective to study the flora and to enlist them based on morphology and growth habits. This Gondwanaland hill system acquires an area of 324 hectares, altitude 447.75 m, have civilization of 1st part of Christian era and have Tropical Dry Deciduous Type of monsoon vegetation. That means, the monsoonal vegetation had given birth to a new civilization and also had reared it. So, it is clearly seen that river and monsoon are the parents of a number of dynasties and civilizations which have a wide spreading impact on the its culture and festivals, values and beliefs, rituals and folkways.

The present research has got the following objectives for proper justification of the topic and for bringing out the expected outcome-

- Identification of factors and their interaction with monsoon rainfall in terms of sociological components and functions.
- Generation of participatory data as to estimate the nature and impact of monsoon rainfall on the socio-cultural, agro-economic and techno managerial aspects.
- To generate micro level policies based on the empirical data in order to delineate the possible interventions to deal with the sociology of monsoon.

The area of investigation of this study is situated in the state of West Bengal located in the eastern part of India. The state of West Bengal in eastern India has a unique

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social and ecological background which influences the living standard and behavioural patterns of the people in many ways. The area of investigation belongs to the Haringhata block in Nadia district. The area of the study in village Ghoragachha under Rautari gram panchayat.

MATERIALS AND METHODS

State, district, sub division, block, panchayet and village is selected through purposive sampling. Sixty respondents are selected through random sampling. Here, in this study we have considered fifteen independent variables against one dependent variable that is festivals and monsoon (Y).

First of all 5% of the total sample (i.e. 3) has selected randomly for pilot study. These respondents are eventually discarded from main sample to reduce the sampling error. Then the rest respondents are interviewed with the help of an interview schedule listed with some specific and relevant questions. This interview has done with rapt attention and care so that putting word in mouth effect, any personal or communal biasness couldn't take place.

RESULT AND DISCUSSION

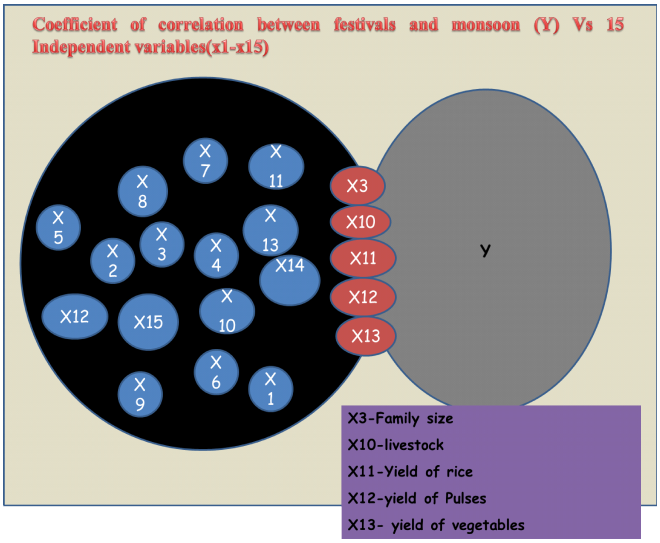
The qualitative data is quantified using specific numerical procedure. Then the quantified data were put under five statistical analysis that are- co-efficient of co-variance, step down regression, canonical co-variate analysis, path analysis and factor analysis. The findings and their revelations are discussed here under-

Table 1: Coefficient of Correlation (r):- festivals and monsoon (Y). vs. 15 independent variables (X_1-X_{15})

Variables	r value	Remarks
Age (X_1)	0.213	
Education (X_2)	-0.159	
Family size (X_3)	0.999	**
Size of holding (X_4)	-0.354	
Homestead land (X_5)	-0.669	
Family income (farm) (X_6)	-0.100	
Family income (off farm) (X_7)	-0.184	
Cropping Intensity (X_8)	0.093	
Crop mix (X_9)	-0.026	
Livestock (X_{10})	-0.515	**
Yield of Rice (X_{11})	-0.915	**
Yield of Pulses (X_{12})	-0.882	**
Yield of vegetables (X_{13})	-0.287	*
Exposure to media (X_{14})	-0.171	
Disease pest incidence (X_{15})	-0.170	

Result: Table 1 presents the coefficient of correlation between Y (festivals and monsoon) and 15 independent variables. It has been found that following variables viz. family Size (X_3), livestock (X_{10}), yield of rice (X_{11}), yield of pulses (X_{12}), yield of vegetables (X_{13}) have recorded significant correlation with the dependent variable.

Revelation: In west Bengal autumn festivals are hugely dependent on monsoon rainfall and monsoon behaviours as well. In most cases festivals are marred by delayed monsoon which sometimes goes extended up to last week of September. The monsoon analysis by the climate scientists depicts that post monsoon rainfall is increasing bi 10-15 per cent over the last 100 years and that's why the prospect of early vegetables which will be used in festivals are jeopardized. So, also for livestock enterprises as well as the enterprises related to the observant s of rituals and festivals.



Result: Table 2 presents the multiple regression analysis between exogenous variable festivals and monsoon vs. 15 causal variables. It has been found that the variable family size (X_3) has contributed to the substantive variance embedded with the consequent variable y_4.

The R^2 value being 0.9992, it is to infer that 99.92% of variants in the consequent variable has been explained by the combination of these 15 causal variables.

Table 3 presents the step wise regression and it has been depicted that the 1 causal variable that is, family size (X_3) has been retained at the last step.

The R^2 value being 0.5914, it is to infer that 59.14% of variants in the consequent variable has been explained by

Table 2: Step down Regression Analysis, festivals and monsoon (Y) vs. 15 causal variables (X_1-X_{15})

Variables	Beta	Beta x R	Reg.coef. B	S.E. of B	t value
Age (X_1)	-0.003	-0.061	0.000	0.000	0.511
Education (X_2)	-0.004	0.071	0.000	0.001	0.158
Family size (X_3)	1.002	100.277	0.067	0.001	76.487
Size of holding (X_4)	0.011	-0.376	0.004	0.006	0.601
Homestead land (X_5)	-0.016	1.054	-0.016	0.023	0.691
Family income (farm) (X_6)	-0.005	0.048	0.000	0.000	0.853
Family income (off farm) (X_7)	0.001	-0.025	0.000	0.000	0.275
Cropping Intensity (X_8)	0.004	0.035	0.000	0.000	0.652
Crop mix (X_9)	0.001	-0.003	0.000	0.000	0.278
Livestock (X_{10})	0.005	-0.249	0.001	0.001	0.689
Yield of Rice (X_{11})	-0.031	2.885	-0.006	0.006	0.972
Yield of Pulses (X_{12})	0.041	-3.660	0.315	0.167	1.601
Yield of vegetables (X_{13})	-0.003	0.095	0.000	0.000	0.595
Exposure to media (X_{14})	0.533	-9.126	0.038	0.038	0.986
Disease pest incidence (X_{15})	-0.528	9.034	-0.263	0.265	0.993

R-SQ=99.92%; S.E=.01

Table 3: Step down Regression Analysis, festivals and monsoon (Y) vs. 1 causal variable (X_3)

Variables	Beta	Beta x R	Reg.coef. B	S.E. of B	t value	VIF
Family size (X_3)	1.000	100.000	0.067	0.000	254.238	1.000

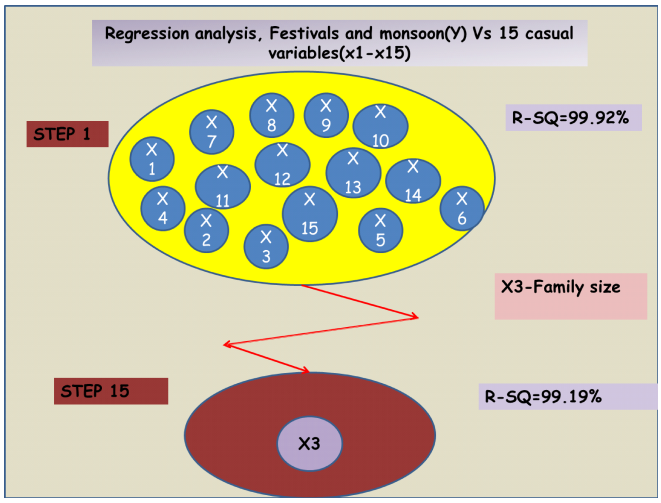
R^2 Value-59.14%; S.E-0.07

the combination of these 1 causal variable.

Revelation: The family size of the farmers can be related with autumn festivals in two ways. One is obviously if family size is big then there may be more source of alternative income. So, if one sector of income is collapsed then the other sectors could support the family and the family can enjoy the festivals. This is from the expenditure point of view. Now if we consider the family income we would find that if there persists a joint family then there would less of the fragmented land, so more crop diversification may be there, that implies more sellable goods during festive seasons and more income.

Factor Analysis: Table 4 presents the factor analysis, wherein 15 numbers of independent variables have been conglomerated into 5 dominant factors.

Factor 1 is consists of 5 variables viz. Family size (X_3), education (X_2), homestead land (X_5), livestock (X_{10}), yield of rice (X_{11}) and yield of pulses (X_{12}). These variables contribute about 29.49 per cent of variance, and the factor renamed as family resource.



Factor 2 consists of 4 variables *viz.* age (X_1), education (X_2), exposure to media (X_{14}) and perception on disease pest incidence (X_{15}). These variables contribute about 23.91 per cent of variance and are renamed as perception proficiency.

Factor 3 consists of 2 variables those are size of holding (X_4) and cropping intensity (X_8). Which contributes

Table 4: Factor Analysis: Conglomeration of 15 explanatory variables into 5 factors

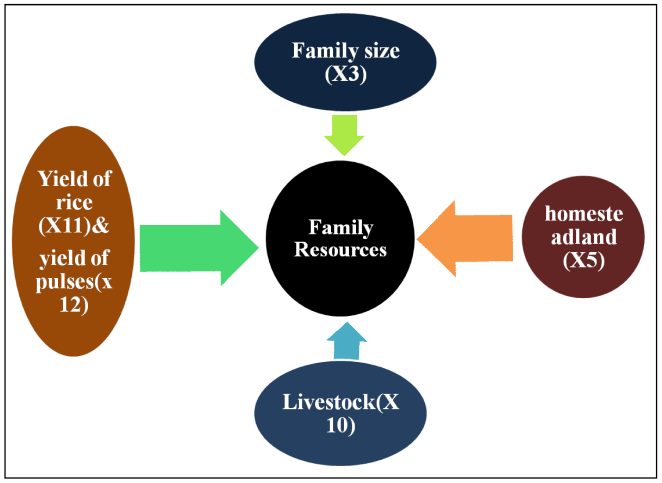
Factors	variables	Factor loading	Percent of variance	Cumulative (%)	Factor renamed
Factor 1	Family size (X_3)	-.899	29.495	29.495	Family resource
	Homestead land (X_5)	.844			
	Livestock (X_{10})	.552			
	Yield of Rice (X_{11})	.924			
	Yield of Pulses (X_{12})	.900			
Factor 2	Age (X_1)	-.620	23.918	53.413	Perception proficiency
	Education (X_2)	.927			
	Exposure to media (X_{14})	.927			
	Perception on Disease pest incidence (X_{15})	.927			
Factor 3	Size of holding (X_4)	.639	12.301	65.714	Farm resource
	Cropping Intensity (X_8)	.752			
Factor 4	Family income(farm) (X_6)	.580	9.157	74.871	Family enterprise
	Yield of vegetables (X_{13})	-.670			
Factor 5	Family income (off farm) (X_7)	.584	7.164	82.035	Agro ecological proficiency
	Crop mix (X_9)	.734			

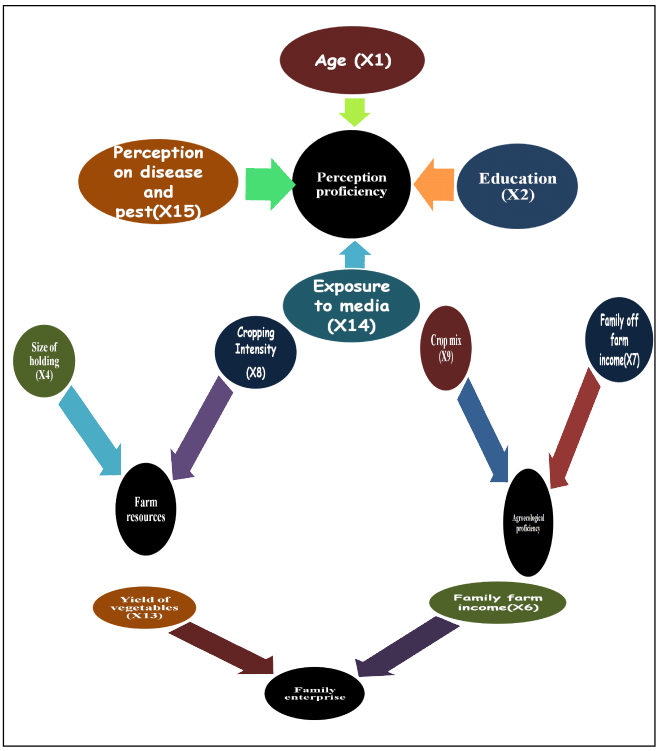
about 65.71 per cent of variance and is renamed as farm resources?

Factor 4 consists of 2 variables *viz*. Farm family income (X_6) and yield of vegetables (X_{13}). These 2 variables contribute 74.87 per cent variance and is renamed as family enterprise.

Factor 5 consists of 2 variables viz. Farm income (X_7) and crop mix (X_9). These 2 variables contribute 82.03 per cent of variance and is renamed as agro ecological proficiency.

The variable exposure to media (X_{14}) has enrooted the highest indirect effect (for 6 times) on the consequent





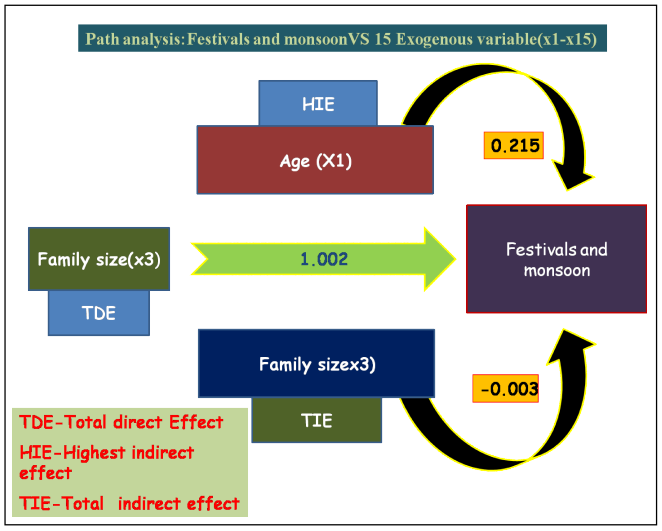
variable. Table 5 presents the path analysis to decompose the TE into direct, indirect and residual effect. It has been found that the variable family size (1.002) has highest direct effect, while the variable age (0.215) has exerted the highest indirect effect on the perception of festivals and monsoon. Family size has highest direct effect on the dependent

Table 5: Path analysis: Decomposition of total effect (r) into Direct, Indirect and Residual effect [festivals and Monsoon VS 15 consequent variables (X_1-X_{15})]

Variables	Total effect	Direct effect	Indirect effect	Highest indirect effect
Age (X_1)	0.213	-0.002	0.215	X_{14}(-0.315)
Education (X_2)	-0.159	-0.004	-0.155	X_{14}(0.524)
Family size (X_3)	0.999	1.002	-0.003	X_{15}(0.090)
Size of holding (X_4)	-0.354	0.010	-0.364	X_{15}(0.037)
Homestead land (X_5)	-0.669	-0.015	-0.654	X_{12}(0.029)
Family income (farm) (X_6)	-0.100	-0.004	-0.096	X_{14}(-0.065)
Family income (off farm) (X_7)	-0.184	0.001	-0.185	X_3(-0.184)
Cropping Intensity (X_8)	0.093	0.003	0.09	X_3(0.093)
Crop mix (X_9)	-0.026	0.001	-0.027	X_{14}(0.054)
Livestock (X_{10})	-0.515	0.004	-0.519	X_3(-0.512)
Yield of Rice (X_{11})	-0.915	-0.031	-0.884	X_3(-0.917)
Yield of Pulses (X_{12})	-0.882	0.041	-0.923	X_3(-0.886)
Yield of vegetables (X_{13})	-0.287	-0.003	-0.284	X_{14}(0.079)
Exposure to media (X_{14})	-0.171	0.532	-0.703	X_{15}(-0.528)
Disease pest incidence (X_{15})	-0.170	-0.528	0.358	X_{14}(0.532)

Residual-00.00%

variable income and monsoon rightly suggests that, the more numbers of family members, more diversified income opportunities are there, so , if one source of income is collapsed, others can compensate it and the whole family can enjoy the festivals all together. , the more relevant market information would be gotten.so; it creates a positive impact on income. Similarly, age has contributed highest associative impact on this consequent variable as, if the respondents are of higher age means they are having higher experience of how deviations in monsoon rain can affect the festivals and related industries.



The residual effect being 0.00 per cent, it is to infer that with the combination of these 15 exogenous variables, 100 per cent of variance can be explained.

So, the predominated factors, as formed by internationally accommodating them based on factor loading, can offer a strategic implication by effectively downsizing the sphere of variables into well textured factors.

CONCLUSION

According to Kulkarni *et al.* (2013) Forest preserved on religious grounds is known as Deorai or Deorahati or Sacred grove. It is a traditional heritage of nature conservation in Indian culture and civilization. That means nature and festivals are very much interlinked with each other. The Harappans may be the most advanced ancient civilization that most Westerners have never heard of. They flourished in the Indus River basin on the Indian subcontinent around the same time the Egyptians were building the pyramids along the Nile and the Mesopotamians were digging irrigation channels fed by the Tigris and the Euphrates.Till now monsoon has a great impact on the overall cultural lives of the communities. It is a common belief in rural people that if the first rain of the monsoon season well wet the crops, then the year's

production would be good. In this paper we have seen that if the deviated monsoon hampers the crop yield, it would create a devastating impact on the overall farm income and if farm income hampers then the participation of farmers and their families in festivals would be lessen. On the other side if the yield of rice, pulses, vegetables are less in a festive season then the price of such things would rise and that will definitely affect the purchasing power of common people. So, as a whole we can conclude that monsoon is a two way serrated saw, if the normal pattern deviates; then it would affect the producers as well as the buyers and ultimately will create an impact on the festivals too.

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Role of Women as Decision Makers with Respect to Farm Operations in Malwa Belt of Punjab

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ABSTRACT

Some historians believe that first crop plants were domesticated by woman and so the art and science of farming was started. Despite their significant contribution in various agricultural activities, women are mainly ignored when it comes to taking decisions related to farm operations. Therefore, the present study was undertaken with the objectives to examine the role of farm women as decision maker in farm related decisions and to find out the extent of involvement they may have in farm related decisions. The study was conducted in Bathinda district of Punjab state and 20 women from each of the four randomly selected villages were selected purposively, thus comprising a total sample of 80 women. Personal interview method was used for data collection. Results revealed that there was negligible participation of women in decision-making regarding farm related activities.

Keywords: Agriculture, Decision-makers, Farm activities, Farm women

INTRODUCTION

Involvement of women in agricultural activities varies from region to region and even within a region, their involvement varies widely among different farming system, castes, classes and socio-economic status families (Mishra and Badodiya, 2015). Rural Indian women are extensively involved in agricultural activities. They contribute about 60-70 per cent of the labor required for these activities, thus playing a pivotal role in sustaining economy. Globally there is empirical evidence that women have a decisive role in ensuring food security and preserving local agro-biodiversity. Women perform all un-mechanized agricultural tasks that are most tedious and back breaking. Their labor plays a key role in the survival of millions of families (Singh *et al.,* 2018). The decision-making process is segment of every household because it makes implementation of a plan or programme quite easy. In rural areas of the country, both husband and wife are jointly responsible for making decisions on matters like family obligations, purchase of household articles etc. However, women suggestions are not given due considerations in the decisions pertaining to agriculture sector. The poor participation of women in agriculture is also confirmed in a study conducted by Sethi (1991), where women's opinion is not normally considered in the matters related to participation in development activities. It is because the majorities of women are illiterate, have little time to know about latest techniques in farming and restricted mobility due to several cultural taboos. Another study conducted in Haryana, revealed that farm women did not decide independently about any farm operation but participated in almost all the decisions more related to home sphere i.e. storage of farm produce, purchase/sale off animal and credit (Bala, 2003). So, it is clear that despite their importance to agricultural production, women face severe handicaps, when it comes to farm related decisions making. Since the extent of participation in the decision-making activities in household and agriculture related and other socio-economic-culture affairs reflects the status of women in the family and society, Present study was therefore planned with the following objectives:

- To examine the role of farm women as decision maker in farm related decisions.
- To find out the extent of involvement they may have in farm related decisions.

MATERIALS AND METHODS

The study was conducted in Malwa region of Punjab state. Four villages from Bathinda district were randomly selected

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out of which 20 women from each village were selected purposively thus making a sample of 80 farm women. Only those farm women were selected who had agriculture as their main occupation and had fairly large farm size. They were personally interviewed through pre structured interview schedule. The data thus collected was analyzed and simple percentages were worked out. Further ranks were given to areas in which decisions were taken.

RESULT AND DISCUSSION

Socio economic profile of the respondents: It is clear from Table 1 that majority (65%) of the farm women were above 50 years of age had studied up to middle (6th to 9th class) (40%) and had family size between 4-8 family members (75%). More than fifty per cent of the respondents had joint families however all of them (100%) had farming as major occupation and ninety per cent of them were married and had annual income falling between 2-3 lakh (45%). Further 70 per cent had a land size between 10-30 acres and 75 per cent of them were engaged in self cultivation with above sixty percent (65%) having 2-6 animals at their farm. Further, all of the respondents owned tractor, trolley, and cycle and eighty-five per cent had motorcycle followed by fifteen per cent having car and jeep and scooter was owned by only 5 per cent of the respondents. Regarding house ownership, all the respondents owned a house followed by pucca houses

Table 1: Socio-economic profile of respondents

Category	Number	Percentage
Age (years)		
Below 34	04	05
35-49	24	35
50 & Above	52	65
Education		
Illiterate	16	20
Primary (up to 5th class)	28	35
Middle (6th to 9th class)	32	40
Matric	04	05
Family Size		
Upto 4	04	05
4-8	60	75
Above 8	16	20
Type of Family		
Nuclear	32	40
Joint	48	60

Table 1 contd.....

Category	Number	Percentage
Occupation*		
Farming	80	100
Labour	-	-
Allied	04	05
Service	12	15
Marital Status		
Married	72	90
Widow	08	10
Separated	-	-
Annual Income (Rs.)		
Upto 2 lakh	16	20
2-3 lakh	36	45
Above 3 lakh	28	35
Size of Land (acres)		
Upto 10	16	20
10-30	56	70
Above 30	08	10
Kind of Farming		
Lease –in	04	05
Lease out	04	05
50-50	12	15
Self	60	75
No. of Animals		
Upto 2	04	05
2-6	52	65
6+	24	30
Vehicles owned*		
Tractor	80	100
Trolley	80	100
Scooter	04	05
Car	12	15
Cycle	80	100
Jeep	12	15
Motorcycle	68	85
House ownership		
Own	80	100
Rented	-	-
Type of Kitchen		
Kachha	-	-
Pucca	72	90
Both	08	10

*Multiple response

(90%) and ten percent had both pucca and kuchha houses respectively.

Prioritized areas of decision making among respondents: Although in domestic areas women emerged as major decision makers like what food to be cooked and relations with relatives, they remained all time low at decisions regarding farming operations, all these decisions were taken by males of the households. It is clear from Table 2 that women were frequently engaged with the decisions in the areas of food, house care, child care and clothing were taken by the respondents followed by relation with relatives, neighbors, birth/death ceremony and marriage of the child. However, farming related decisions were mostly taken by males (Rank 10) followed by Child education, handling servants and family disputes. These findings are in line with those of study by (Chauhan, 2011) who shows similar results that majority of the decisions regarding farm management were husband dominated. Regarding financial matters and purchase of durables/house/shop/vehicles again males dominated in this area of decision making. These findings are in conformity with those of (Chaudhary, 2004) who says that major decisions regarding purchase of every household item are taken by males. As the male members control the finance, this creates an adverse impact on women's access to household assets and other household activities

Table 2: Prioritized areas of decision making among respondents

Areas of Decision	Rank
Food	1
Clothing	4
Purchase of durables	17
Child Birth	15
Child care	3
Child Education	11
Child Marriage	9
Financial Matters	14
Purchase of Vehicles	20
Purchase of House/shop	18
Birth ceremony	8
Death ceremony	7
Relation with relatives	5
Relation with Neighbors	6
Relation with Friends	16
House Care	2
Carriers of Family members	19
Family Disputes	13
Farming Related	10
Handling Servants	12

Decision makers in different areas of farming operations: Table 3 shows that the major decision makers in agricultural activities are men even though women perform more in agricultural related activities than men. Even they are not consulted at the time of sowing, crop care and management/employment of labour for farm related activities. Pal and Haldar (2016) in a study also reported that 20 per cent of the farm women had no participation in decision making in any area of farm production. It is clear from the Table 3 that majority of the women are involved in decisions related to storage of produce. These findings are in conformity with those of Singh *et al.* (2004) that maximum participation and decisions were taken by women in the farm operations related to storage and processing of farm produce. Similar results were also reported by Chayal and Dhaka (2010). However, Table 3 further depicts that less than 10 per cent of respondents were involved in sale of produce (7.5%) followed by only five per cent taking decisions on the budgeting next crop and profit/loss management. So overall it is clear that women were not involved in decisions related to sowing, crop care, fertilizer/pesticide application and all these decisions were taken either by their husband or other male members of the family. Similar results were reported by Choudhary and Singh (2003) that the role of women in ploughing of field, application of manure and fertilizer was found to be very less. Chayal *et al.* (2013) in a study also concluded that involvement of farm women in decision making process in agriculture field was quite minimal. Manure/fertilizer type and manure/fertilizer application were the activities where in involvement was very poor. Patel *et al.* (2016) in a study conducted in Anand district of Gujarat also reported similar results that great majority of the farm women were not taking decision about dose of fertilizers for seed treatment and selection of bio-fertilizer for seed treatment.

Extent of advice taken from the respondents: Table 4 clearly depicts that respondent's advice was never taken in areas of fertilizer selection, crop care and fertilizer/pesticide/insecticide application. Little above forty per cent of the respondents (41.25%) stated that their advice was taken regarding sowing operations and Harvesting

Table 3: Decision makers in different areas of farming operations

Areas of Decision	Who Decides				
	Self	Husband	Father-in-Law	Brother-in -Law	Son
Sowing	-	45 (56.25)	9 (11.25)	7 (8.75)	19 (23.75)
Fertilizers	-	54 (67.50)	-	7 (8.75)	19 (23.75)
Crop Care	-	33 (41.25)	21 (26.25)	7 (8.75)	19 (23.75)
Fertilizer application	-	33 (41.25)	21 (26.25)	7 (8.75)	19 (23.75)
Insecticide application	-	33 (41.25)	21 (26.25)	7 (8.75)	19 (23.75)
Pesticide application	-	33 (41.25)	21 (26.25)	7 (8.75)	19 (23.75)
Harvesting Method /time	-	33 (41.25)	21 (26.25)	7 (8.75)	19 (23.75)
Labour Employment/Management	-	33 (41.25)	21 (26.25)	7 (8.75)	19 (23.75)
Produce Storage	49 (61.25)	24 (30.00)	-	7 (8.75)	-
Produce Sale	7 (8.75)	47 (58.75)	-	7 (8.75)	19 (23.75)
Budgeting next crop	4 (5.00)	29 (36.25)	21 (26.25)	7 (8.75)	19 (23.75)
Profit/ loss Management	4 (5.00)	29 (36.25)	21 (26.25)	7 (8.75)	19 (23.75)

Figures in parentheses indicate percentage

Table 4: Extent of Advice taken from respondents

Areas of Decision	Extent of Advice taken		
	Advice not taken	Advice taken	
		Advice partially accepted	Advice fully accepted
Sowing	47 (58.75)	26 (32.50)	7 (8.75)
Fertilizers	80 (100.00)	-	-
Crop Care	80 (100.00)	-	-
Fertilizer application	80 (100.00)	-	-
Insecticide application	80 (100.00)	-	-
Pesticide application	80 (100.00)	-	-
Harvesting Method /time	47 (58.75)	26 (32.50)	7 (8.75)
Labour Employment/Management	67 (83.75)	7 (8.75)	6 (7.50)
Produce Storage	-	24 (30.00)	7 (8.75)
Produce Sale	35 (43.75)	29 (36.25)	9 (11.25)
Budgeting next crop	35 (43.75)	29 (36.25)	12 (15.00)
Profit/ loss management	35 (43.75)	29 (36.25)	12 (15.00)

Figures in parentheses indicate percentage

Method/time but it was only partially accepted for 32.5 per cent respondents and fully accepted for about sixteen per cent respondents by their male counterparts. Regarding labor Employment/Management nearly eighty-five per cent respondents (83.75%) stated that their advice was never taken in this area and out of 16.25 per cent whose advice were taken only 7.5 per cent stated that it was fully accepted while making decision regarding this area. In regards to storage of produce, advice of 38.75 per cent respondents was taken and was fully accepted for thirty per cent of respondents. However, 43.75 per cent respondent's advice was never taken in the areas of produce sale, budgeting next crop and profit/loss management. The findings are supported by Chayal and Dhaka (2010).

Reasons for not taking advice from respondents: Efforts were also made to know the reasons for not seeking of advice of the respondents in different farm operations. Table 5 clearly depicts that for 58.75 per cent of the respondents, being women was the main reason for not seeking of their advice in area of sowing; the same reason was for 61.25 per cent of the respondents for fertilizer selection, crop care, fertilizers/insecticide/pesticide application activities followed by low educational level of

Table 5: Reasons for not seeking advice of respondents by their male counterparts

Areas of Decision	Reasons for not seeking of advice				
	Age	Education	Deliberately ignore	Feel no need	Being Women
Sowing	3 (3.75)	37 (46.25)	37 (46.25)	9 (11.25)	47 (58.75)
Fertilizers	3 (3.75)	37 (46.25)	37 (46.25)	9 (11.25)	49 (61.25)
Crop Care	3 (3.75)	37 (46.25)	9 (11.25)	9 (11.25)	49 (61.25)
Fertilizer application	3 (3.75)	37 (46.25)	37 (46.25)	9 (11.25)	49 (61.25)
Insecticide application	3 (3.75)	37 (46.25)	37 (46.25)	9 (11.25)	49 (61.25)
Pesticide application	3 (3.75)	37 (46.25)	37 (46.25)	9 (11.25)	49 (61.25)
Harvesting Method /time	-	7 (8.75)	-	21 (26.25)	19 (23.75)
Labour Employment/Management	-	-	-	67 (83.75)	-
Produce Sale	-	-	-	31 (38.75)	13 (16.25)
Budgeting next crop	-	-	-	26 (32.50)	28 (35.00)
Profit/ loss Management	-	-	-	23 (28.75)	25 (31.25)

Multiple responses
Figures in parentheses indicate percentage

respondents and ignoring deliberately (46.25%). About 11.25 per cent respondents reported that their male counterparts feel no need to take their advice and 3.75 per cent of respondents stated age as a factor for not taking their advice in these areas. However, regarding sale of produce 38.75 per cent respondents stated that male members feel no need to consult them regarding these farm operations followed by budgeting next crop (32.5%) and profit/loss management (28.75%) respectively. Further 16.25 per cent, 35 per cent and 31.5 per cent feel being women their advice was not taken in these areas.

CONCLUSION

The present study concludes that majority of the decision-making in farm related operations was male dominated and women had major role in decisions related to household activities. However, women were involved in decision making related to the storage of farm produce. Women's advice was sought regarding the method and time of sowing and harvesting but advice of only16 per cent respondents was accepted by their male counterparts. "Being women" was the main reason for not seeking any advice of females in agricultural activities. But as women play an important role in agriculture and are involved in tedious and exhausting farm operations, they should be equally involved in the decision-making regarding farm operations as their male counterparts. Their advice should be sought and decisions related to agriculture and household activities should be taken jointly by husband and wife.

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Analyzing Economic Gains in Zero Tillage Method of Wheat Cultivation under Farmer FIRST Programme in Madhya Pradesh

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ABSTRACT

Zero tillage method is emerged as an eco-friendly practice to achieve higher production and profitability with sustainable use of natural resources. This technology mainly adopted in rice-wheat cropping system for wheat sowing. In this study, an attempt has been made to analyse the yield and monetary benefits of zero tillage method. This study revealed that increase in yield over conventional method due to contribution of technology and inputs. The economics shows that net income found higher in zero tillage method than conventional method. The study shows that zero tillage method has potential to generate additional income to the farmers with conservation of natural resources Zero tillage reduces carbon emission and increases carbon stock in soil and organic matter that improves soil condition. It is a climate resilient practices not only reduces negative environmental consequences but also provide opportunity for diversification and escape wheat crop from terminal heat stress.

Keywords: Zero tillage, Rice-wheat cropping system, Yield, Economic gains

INTRODUCTION

Farmer FIRST programme was started as ICAR initiative to uplift small holders' agriculture through enhancing farmers scientists interaction to move beyond production and productivity. The programme is based on resource management, climate resilient agriculture, production management including storage, market chains, value chains, innovation systems, information system. Wheat (*Triticum aestivum* L.) happened to be second major cereal crop and most important crop of rice-wheat system in India. In India, area of wheat was 295.76 lakh ha with 99.70 million tonne production and productivity as 3371 kg/ha during 2017-18, however, in Madhya Pradesh, wheat covers an area 53.2 lakh ha, 15.91 million tonne production and 2993 kg/ha yield and contributes 17.97 per cent in area and 15.90 per cent share in all India production (Anonymous, 2018).

Wheat plays important role in nutritional security of India. In rice-wheat cropping system, late maturity varieties of rice delayed sowing of wheat crop. There is need for timely sowing of wheat to get higher yield. But in rice-wheat cropping system it is difficult as rice - wheat cropping areas wheat sowing is delayed by many reasons i.e. preparation of field, uncertain rainfall and harvesting method. Out of these reasons preparation of field is main reason which causes delay in sowing of wheat. Delayed sowing of wheat also expose crop to high temperature during grain filling stage. These condition's ultimately decreases yield and reduces farmer's income.

In zero tillage method, seed is directly sown without field preparation in crop stubbles of previous crop. It helps in improving organic matter in soil and improves physical condition with higher nutrient uptake in crop. In addition, it also saves cost of fuel and energy efficient (Jat *et al.,* 2014). Zero tillage in wheat improves water and nutrient-use efficiency (Kumar *et al.,* 2015). It also helps in conserving beneficial organisms and reduces air pollution by accumulation of organic carbon into soil. This method reduces cost of cultivation in field preparation. In this practice wheat yield are either equal or more than as compared to conventional practices because of timely sowing of wheat, effective control of weed with efficient utilization of fertilizers. This study is based on the on-farm trials conducted by the FFP centres operational in Madhya Pradesh focused on the conservation agriculture through zero tillage and its effect on yield and economic gains for wheat growers.

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MATERIALS AND METHODS

Farmer FIRST programme is operational at five centres in Madhya Pradesh viz. ICAR-IISS Bhopal, ICAR-DWR, Jabalpur, JNKVV, COA, Balaghat, RVSKVV- ZARS, Morena, NDVSU, Jabalpur. In the programme activities were carried out under six modules i.e. crop module, horticulture module, NRM module, enterprise module and IFS module. In present study under crop module, trials were conducted on zero tillage sowing of wheat in two locations viz., Jabalpur and Morena district of Madhya Pradesh. In Jabalpur district, trials were conducted by involving 45 farm families on advance sowing of wheat by zero tillage technology and used improved variety GW 273 with improved package of practice in irrigated condition. While in Morena district, trials conducted on zero tillage sowing of wheat involving 420 farm families on late sowing of wheat by zero till seed drill of custom hiring centre and used MP 1203 variety. The critical inputs were provided to the farmers after getting the farmers priority during the interactive meetings with farmers before laid out the demonstrations. Observations were recorded by the project staffs for 2017-18 and 2018-19. The yield performance of wheat crop of each trials as well as and farmer practices was recorded in a systematic manner by the project staffs.

RESULTS AND DISCUSSION

Area, production and yield of wheat in Madhya Pradesh: Based on the secondary data trend for area, production and yield of wheat crop was analysed. Fifteen years data on area, production and yield in Madhya Pradesh has been presented in Figure 1, 2, and 3. The trend analysis shows that area, production and yield of wheat is significantly increasing over the years. It is clear from the trends that both area and productivity has been increasing with that shows significant contribution of extension strategies in enhancement of productivity and farmers were adopting improved technology of wheat cultivation including zero tillage technology.

Savings of time, fuel and labour from zero tillage technology: The perusal of data presented in the Table 1 showed promising characteristics of the technology. In zero tillage method, 90 percent time saves in land preparation, 75.96 percent saving in fuel consumption and 78.57 percent saving in labour than conventional method. Zero tillage wheat have shown primarily positive impacts on yield and reduced input needs (Mrinal *et al.,* 2018). With adoption of this technology, the number of field operations for wheat crop decreased from an average of seven to only one (Malik *et al.,* 2002a).

Yield performance of wheat in under early sown condition: The data showed that mean yield (47.42 q/ha) was found both year under zero tillage sowing method in irrigated condition as compared to conventional method (40.25 q/ha). This increase in yield may be attributed due to better resource utilization and improved soil health condition with increased uptake of nutrients. The results were in consonance with the study of Naresh *et al.* (2007) and Sharma *et al.* (2008) who reported that zero tillage sowing of wheat without burning of crop residues, not only limited air pollution but also conserves beneficial

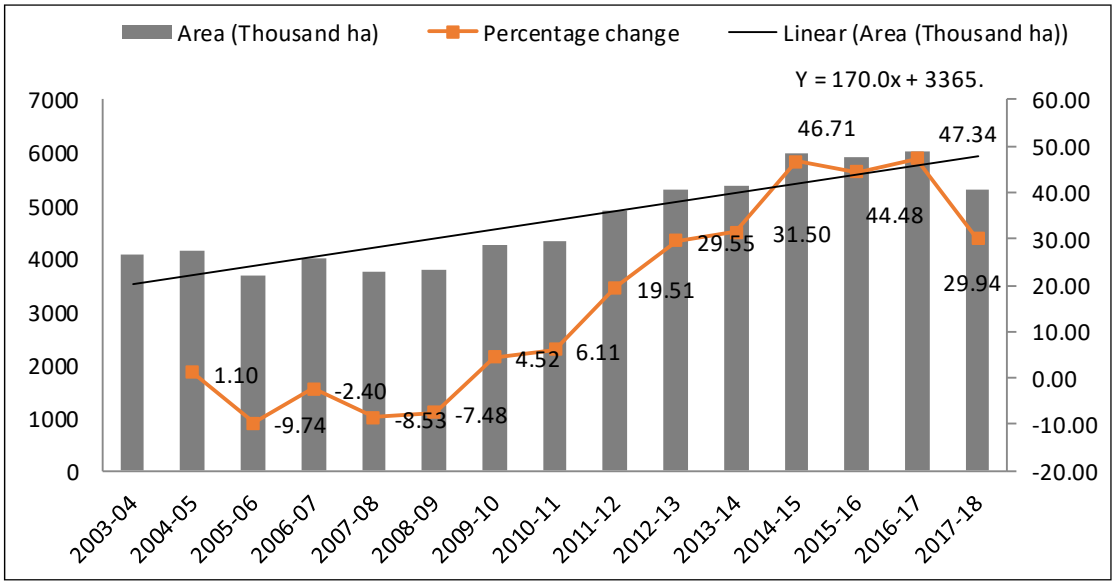

Figure 1: Area (Thousand ha) under wheat in Madhya Pradesh
Source: Directorate of Economics and Statistics, DAC&FW

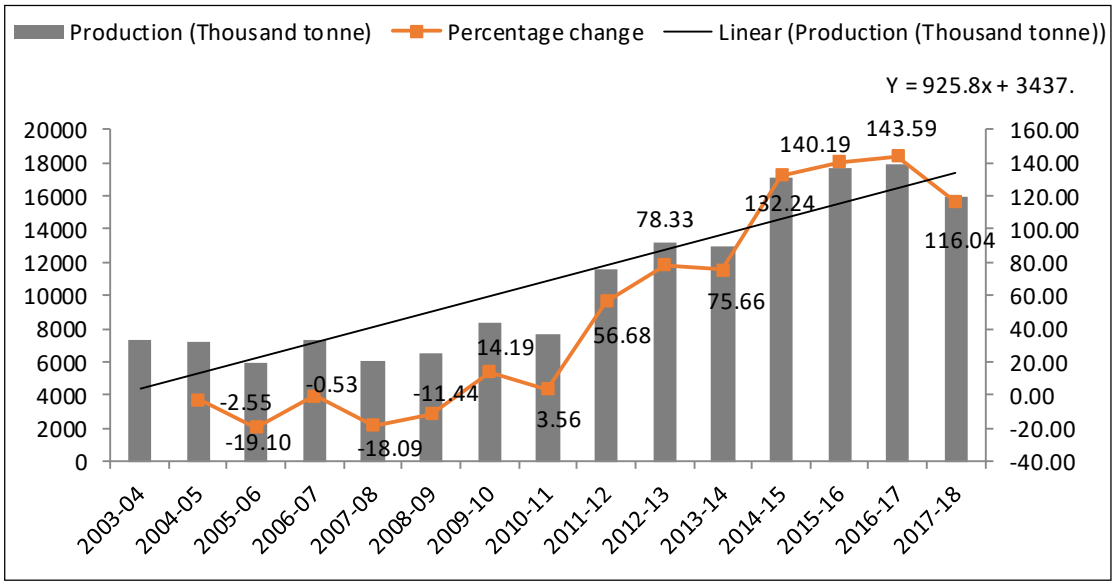

Figure 2: Wheat production (Thousand tonne) in Madhya Pradesh
Source: Directorate of Economics and Statistics, DAC&FW

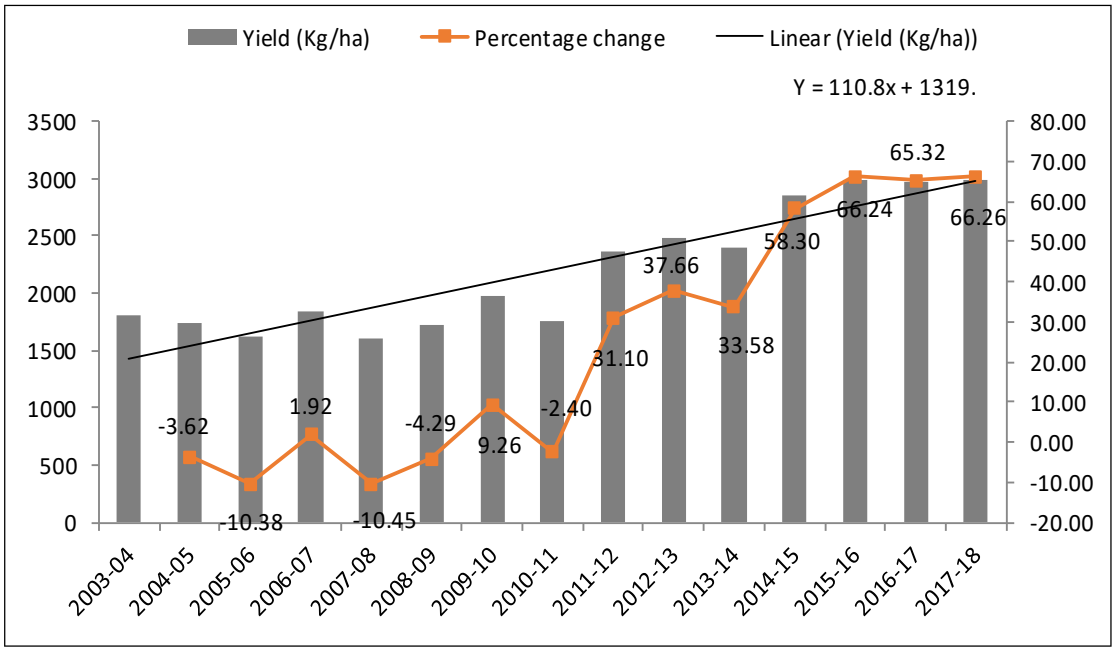

Figure 3: Wheat yield (kg/ha) in Madhya Pradesh
Source: Directorate of Economics and Statistics, DAC&FW

Table 1: Savings from zero tillage technology

Particulars	Conventional tillage without crop residue	Zero tillage with crop residue	Saving (Unit)	Percentage (%)
Time(hr/ha)	10	1	9	90
Fuel (Lit./ha)	52	12.50	39.50	75.96
Labour (man days)	14	3	11	78.57

Table 2: Yield of wheat under early sown condition

Particulars	2017-18		2018-19		Mean data of both year	
Technology used	Zero tillage sowing	Conventional method	Zero tillage sowing	Conventional method	Zero tillage sowing	Conventional method
Yield (q/ha)	48.23	40.14	46.60	40.35	47.42	40.25
% change in yield	20.15	-	15.48	-	20.12	-

micro-organism, increases nutrient uptake by crop and improves organic matter in soil.

Economic impact of zero tillage sowing of wheat under early sown condition: The data presented in Table 3 shows that mean gross return in zero tillage and conventional method were Rs. 82659 and Rs. 70235 per hectare. Adoption of zero tillage technology along with improved variety (GW 273) of wheat crop fetched higher net income Rs. 59128/ha as compared to conventional method Rs. 36849/ha. The average cost of cultivation per hectare amounted to Rs. 23531 in zero tillage method and Rs. 33386 in conventional method. The lower cost of cultivation was due to lesser input cost i.e. lower expenses on human labour, machines and irrigation in zero tillage practice than conventional method. The higher B:C ratio of 3.51 was observed in zero tillage than conventional method.

Yield performance of wheat under late sown condition: The perusal of data presented in Table 4 showed that mean yield (44.61 q/ha) was found under zero tillage sowing method in late sown condition as compared to conventional method (38.90 q/ha). In late sown condition, yield is increased due to escape of time in land preparation, low weed pressure, high water use efficiency and judicious use of input using zero tillage method.

Economic impact of zero tillage sowing of wheat under late sown condition: The cost and return estimation of zero tillage sowing and farmer practice of cultivation of wheat presented in Table 5. Mean Gross return in zero tillage and conventional method were Rs. 86613 and Rs. 76160.50 per hectare. Adoption of zero tillage technology along with improved variety (MP 1203) of wheat crop received increased net income Rs. 56063/ ha as compared to conventional method Rs. 46210.50/ ha. The average cost of cultivation per hectare amounted to Rs. 30550 in zero tillage method and Rs. 29950 in conventional method. The higher B:C ratio of 2.84 was

Table 3: Economic impact of zero tillage sowing of wheat under early sown condition

Particulars	2017-18		2018-19		Mean data of both year	
Technology used	Zero tillage sowing	Conventional method	Zero tillage sowing	Conventional method	Zero tillage sowing	Conventional method
Cost of cultivation (Rs./ha)	21990	31072	25072	35700	23531	33386
Gross return (Rs./ha)	79574	66226	85744	74244	82659	70235
Net income (Rs./ha)	57584	35154	60672	38544	59128	36849
% increase in net income	63.80		57.39		60.64	
B:C ratio	3.62	2.13	3.41	2.07	3.51	2.10

Table 4: Yield of wheat under late sown condition

Particulars	2017-18		2018-19		Mean data of both year	
Technology used	Zero tillage sowing	Conventional method	Zero tillage sowing	Conventional method	Zero tillage sowing	Conventional method
Yield (q/ha)	43.30	38.60	45.91	39.20	44.61	38.90
% change in yield	12.17		17.12		14.67	

Table 5: Economic impact of zero tillage sowing of wheat under late sown condition

Particulars	2017-18		2018-19		Mean data of both year	
Technology used	Zero tillage sowing	Conventional method	Zero tillage sowing	Conventional method	Zero tillage sowing	Conventional method
Cost of cultivation (Rs./ha)	26100	27900	35000	32000	30550	29950
Gross return (Rs./ha)	81160	70800	92066	81521	86613	76160.5
Net income (Rs./ha)	55060	42900	57066	49521	56063	46210.5
% increase in net income	28.34		15.23		21.32	
B:C ratio	3.11	2.53	2.63	2.55	2.84	2.54

observed in zero tillage than conventional method. These results are in accordance to Sindhu *et al.* (2007). Thus zero tillage technology also helps in minimizing environmental problems, increasing crop production and brought changes in social and living status of the farmers through higher income.

Impact of adopted technology: Zero tillage technology has been proved better option for farmers. In early sown conditions, average yield of wheat exhibited 20.12 per cent increase in yield compared to conventional method, while in late sown condition average yield exhibited 14.67 per cent increase in yield than conventional method. This is due to introduction of latest technology and improved varieties. Effects of zero tillage technology in the form of improved soil structure, soil fertility and microbial activities in soil by adding organic matter (Malik *et al.,* 2002a). Zero tillage technology has reduced the incidence of weeds, nematodes infestation and enhanced earthworm population in soil (Mrinal *et al.,* 2018); (Malik *et al.,* 2002b). These effects also contribute in yield enhancement. Besides increase in yield zero tillage technology also saves 9 hr/ha in field preparation, 39.50 lit./ha fuel and 11 man days. Thus, zero tillage technology not only sustains production but also enhance income of the farmers.

CONCLUSION

Traditional farming practices of wheat cultivation require a large quantity of inputs. Increasing input cost and labour shortage in farming requires alternative technologies to sustain crop production and double farmer's income. The results of present study have sown that zero tillage technology has potential to increase farmer's income and yield of wheat with sustainable use of natural resources. Both yield and net income were significantly higher in advanced sowing condition by 20.12 and 60.64 percent respectively. Similarly, in late sown condition yield and net income increased by 14.67 and 21.32 percent respectively than conventional method. Thus, zero tillage is better alternative to the farmers to increase wheat production and saving input cost, machinery labour, irrigation water and protection from terminal heat stress during maturity stage.

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Evaluation of Wheat Varieties for Timely Sown Condition in District Bijnor (Uttar Pradesh) with Special Reference to the Yield Gap and their Adoption in District

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ABSTRACT

A study was undertaken to assess the yield performance, yield gap and adoption of six timely sown wheat varieties viz. HD-2967, DBW-88, HD-3086, PBW-550, DBW-17 and PBW-343, under rice- wheat cropping system during 2014-15to 2016-17. The analysis of the data indicated that there was considerable yield increase ranging from 8.77 to 29.91 percent between varieties over farmers practice. Variety HD-2967 yielded 54.54 qt/ha with the net return of Rs. 76809.77/ha and benefit cost ratio of 2.82.

Keywords: Timely sown wheat varieties, Yield gap analysis and adoption

INTRODUCTION

Wheat is the pre-eminent among the world's crops with regard to its antiquity and its importance as a staple food of mankind. Thus wheat plays an important role in food security and poverty alleviation as a strategic crop and has an important role in economy (Anon., Cereal Annual Report 1998 ICARDA Aleppo, Syria). Blum (1988) suggested that breeding for tolerance to drought involves combining good yield potential and the selection of traits that provide drought stress tolerance. India, one of the greatest success stories of green revolution, is the second largest producer of wheat in the world after china and contributes more than 12% to the global wheat basket. Wheat is the second most important crop after rice in India. In India wheat is grown in about 314.65 lakh ha area with an average productivity of 2750 kg/ha (2014-15), according to Annual Report of Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare Government of India-2016-17. Out of which around one-third (11.0 m ha) lies in the state of Uttar Pradesh alone. The productivity of the state is close to the national average as the major constraints are cultivation of old low yielding and disease susceptible varieties, and adoption of poor wheat production technologies. In Bijnor district total area under wheat is about 1, 15,000 to 1, 18,000 ha. The choice of right varieties under timely sown condition is one of the crucial points determining the yield of wheat. The yield and productivity of timely sown wheat varieties is less or stagnant due to farmers unawareness about high yielding varieties and also non availability of varieties having significantly higher yield as compared to the existing varieties under changing climatic conditions.

Seven Timely sown wheat varieties viz. HD-2967, DBW-88, HD-3086, PBW-550, DBW-17 and PBW-343, were selected for the higher yield gap analysis and adoption in present study.

MATERIALS AND METHODS

The trial was conducted at farmer's field during *rabi* 2014-15 to 2016-17. There are eleven blocks in Bijnor district, all of the eleven blocks were selected randomly. Thus the 22 villages were selected for the study. A village-wise list wheat growers, was prepared and from that list 44 farmers were selected randomly. Six timely sown wheat varieties including farmers practice, namely HD-2967, DBW-88, HD-3086, PBW-550, DBW-17 and PBW-343 were used for evaluation. The wheat variety PBW-343 is selected as local check. These varieties are selected due their higher yield potential and suitability for the district. The source of technology is HD-2967 and HD-3086 from IARI, New Delhi, PBW-550 and PBW-343 from PAU, Ludhiana) and DBW-17 from IIWBR, Karnal. The total 44 farmers were selected with the 11 ha total land area (each demonstration

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field having 0.25 ha land). The seed yield and net returns data were analysed. For the estimation of technology gap, extension gap and technology index, the formulae were used as per method of Sagar and Chandra (2004).

Technology gap = Potential yield – Demonstration yield

Extension gap = Demonstration yield – farmers yield

Technology Index = [(Potential yield – Demonstration yield)/Potential yield] x 100

RESULTS AND DISCUSSION

From the data in Table 1 it is quite clear that the per cent increase in the yield over local check FP (PBW-343) was 29.91, 24.88, 19.13, 8.77 and 9.03 for HD-2967, DBW-88, HD-3086, PBW-550 and DBW-17 respectively. The seed yield increased significantly in the range of 46.36 to 54.54 qt/ha in timely sown wheat varieties as compared to farmers practice (42.75 qt/ha). This indicates that field demonstrations were quite successful in bridging up yield gaps between improved and farmer practices (Rana *et al.*, 2002). Singh and Rana (2006) reported that seed yield increased up to 20.70 qt/ha by Pusa Barani variety of mustard crop. Singh *et al.* (2011) reported varietal differences in the terms of seed yield and yield gaps between newly and old varieties of wheat in late sown condition. Biswas *et al.* (1998) also reported varietal differences of grain yield in scented rice. In 2011 Singh *et al.* (2011) also reported that increasing seed yield in basmati rice variety Pusa Basamti-1401.

The economics of demonstrations are depicted in Table 2, indicate that the additional net return of timely sown wheat varieties over farmers practice ranged from Rs. 7957.50/ha to Rs. 31186.27/ha. It is high in HD-2967 (Rs. 31186.27/ha). Singh *et al.* (2013) reported about the additional net return in analysis of timely sown wheat varieties. The gross return of timely sown wheat varieties ranged between Rs. 99281.50 to 118908.90/ha and net return Rs. 55450.00 to 84050.61/ha also. The highest net return of Rs. 76809.77/ha of HD-2967 are in line with the finding. Singh and Rana (2006) reported about Rs. 13149.00/ha of net return in mustard crop. Singh and Singh (2012) also reported about Rs. 111057.84/ha, of net return in basmati rice.

The benefit cost ratio (Table 2), of timely sown wheat variety HD-2967 ranked first (2.82) followed by DBW-88 (2.62), HD-3086 9(2.49), PB550 (2.43) and DBW-17 (2.17). Hedge (2006) reported that mustard crop by nature is hardy and mostly grown under rainfed condition can impart stability of production system under harsh condition. The benefit cost ratio of HD-2967 was also higher in all the blocks in comparison to local check in district Saharanpur of Utter Pradesh (Singh and K Singh, 2015).

Technology gap (Table 1) ranged from 10.56 to 20.17 per ha, with an overall mean differences of 15.95 qt/ha. This gap was minimum in HD-2967 (10.56) and maximum in HD-3086 (20.17). The gap between potential and front line demonstrations is due to climatic, edaphic, socio-economic and management practices. Kadian *et al.* (1997) reported that technology gap can be narrowed down only by location specific technology based recommendations. Verma *et al.* (2017) reported that Technology gap ranged from 5.2 to 7.40 qt/ha, with an overall mean difference of 6.41 qt/ha in basmati rice.

Table 1 showed, that the extension gap ranged from 3.61 to 12.79 qt/ha, with an overall mean differences of 7.79 qt/ha. High extension gap (12.79 qt/ha.) was recorded from variety HD-2967, followed by DBW-88 (10.64), HD-3086 (8.18) PBW-55(3.75) and DBW-17 (3.61) qt/ha. This

Table 1: Productivity, yield gap, extension gap of timely sown wheat varieties

Varieties	No. of trials	Avg. Yield (qt./ha)			% Yield	Technology	Extension	Technological
		PY	DY	FP	increased	gap (qt./ha)	gap (qt./ha)	index
HD-2967	50	66.10	55.54	42.75	29.91	10.56	12.79	15.97
DBW-88	15	69.90	53.39	42.75	24.88	16.51	10.64	23.62
HD-3086	10	71.10	50.93	42.75	19.13	20.17	8.18	28.36
PBW-550	10	62.40	46.50	42.75	8.77	15.90	3.75	25.48
DBW-17	10	63.00	46.36	42.75	9.03	16.64	3.61	26.41
Mean	**-**	**-**	**50.54**	**42.75**	**18.34**	**15.95**	**7.79**	**23.96**

PY = Potential yield, DY= Demonstration Yield, FP = Farmers practice

Table 2: Economics of timely sown wheat varieties

Varieties	Grain yield qt/ha	Cost of cultivation Rs/ha	Gross return Rs/ha	Net return Rs/ha	BCR	% of Additional yield over local check (qt/ha)	Additional net return over Local check (Rs/ha)
HD-2967	55.54	42099.13	118908.90	76809.77	2.82	29.91	31186.27
DBW-88	53.39	43965.00	115370.50	71405.50	2.62	24.88	25782.00
HD-3086	50.93	44118.75	110215.50	66121.75	2.49	19.13	20498.25
PBW-550	46.50	45005.50	109761.00	64753.50	2.43	8.77	19130.00
DBW-17	46.36	45700.50	99281.50	53581.00	2.17	9.03	7957.50
Mean	**50.544**	**44177.78**	**110707.5**	**66534.3**	**2.506**	**18.344**	**20910.80**
FP (PBW-343)	42.75	46312.50	91396.88	45623.50	1.97	—	—

Table 3: Adoption of timely sown wheat varieties district Bijnor

Block	Area under wheat crop (ha)	Area covered by varieties					
		HD-2967	DBW-88	HD-3086	PBW-550	DBW-17	Others
Kotwali	13898	9850	1250	320	120	110	610
Jalilpur	13030	3300	1000	180	80	60	460
Budhanpur	6520	3000	950	140	80	77	477
Najibabad	8898	2550	900	210	110	85	585
Dhampur	6725	2900	850	150	90	90	350
Kiratpur	7187	3600	765	210	110	76	276
Jhalu	13777	2450	650	130	70	70	270
Afjalgarh	12560	5300	755	170	100	67	367
Devmal	11405	2850	780	120	70	70	275
Nehtor	6536	2900	950	250	150	65	350
Noorpur	12412	3300	700	220	120	80	380
Mean	**112948**	**42000**	**9550**	**2100**	**1100**	**850**	**4400**

indicates that there is need to educate the farmers through various extension tools. Gupta and Sharma (2005) also confirmed these results. Singh and Singh (2012) reported about extension gap in basmati rice varieties. Singh *et al.* (2018) also confirmed these results. There is clear-cut and significant yield gap between farmers practice and demonstration field. The choice of late sown wheat variety is also an important factor leading to additional net return. The extension and technology gap can be bridged by sustained effort of extension agencies and by adopting location specific technologies.

Table 3 showed, that the Adoption level of timely sown wheat varieties in district Bijnor. It has significant impact on seed yield vis a vis yield gap. Yield increased in demonstration field due to adoption of newly released variety. Adoption level of wheat variety HD-2967 ranged between 2450 to 9850 in different blocks of district with a mean of 42000 ha. Presently district status about timely sown newly wheat varieties range between 2100 to 42000 ha. It is maximum in HD-2967 (42000 ha) followed by DBW-88 (9550 ha) Rana *et al.* (2002) reported that the demonstration is quite successful in farmer practice. In 2011, Singh *et al.* (2011) also reported that the adoption of basmati rice variety Pusa Basamti-1401 in farmers practice. Singh *et al* (2018) also confirmed these results.

CONCLUSION

From the above findings, it can be concluded that use of appropriate scientific methods and better technology of cultivation under front line demonstrations on large scale reduced the technological gap to a considerable extent thus leading to increased productivity. Better and maximum, extension programmes of the district need to provide more technological support to the farmers through

demonstrations, training programmes, exposure visit to other demonstration field and field day programme which increased the horizontal spared of the technology between maximum number of farmers in the district. The demand of quality seed of these varieties is also increasing which has led to participatory seed production at farmer's field.

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Utilization of Rice Fallow through Cluster Frontline Demonstration Programme: An Adaptive Research Trial on Mustard

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ABSTRACT

Cluster frontline demonstrations programme of mustard is a noble initiative of Ministry of Agriculture and Farmers Welfare, GOI, under NMOOP to minimize yield gaps in oilseed production through higher technological adoption. Thus, under cluster frontline demonstrations programme on mustard, a study was conducted during the *rabi* seasons of 2016-18 involving 104 numbers of tribal farmers in rice fallow areas of Wokha district in Nagaland for enhancing the cropping intensity and profitability by using proven technology through scientific soil and crop management practices. The results revealed that mustard seed yield varied from 1001 to 1121 kg/ha under CFLD programmes as compared to 547 to 625 kg/ha in farmer's practice; thereby showing a technological gaps of 379 to 500 kg/ha and extension yield gaps of 441 to 513 kg/ha in the current study area. It was also inferred that by adopting improved production technologies, mustard productivity could be enhanced by 75.3 to 93.8 percent over traditional cultivation practice. The improved technology package has also provided an additional profit of INR 15,446-17,959 per ha with an incremental benefit–cost ratio of 2.72-3.06:1. Technology index value varied from 25.3 to 33.3%, thereby revealing that adoption of technologies demonstrated under CFLD programme was quite feasible in the prevailing farming situations of Nagaland. The demonstrated technologies had also improved soil residual nutrient status by increasing available N, P and K content marginally. Therefore, it is concluded that CFLD under NMOOP has great potential to scale up mustard productivity and livelihood of farmers in Nagaland.

Keywords: CFLD, Mustard, NMOOP, Rice fallow, Livelihood, Nagaland

INTRODUCTION

Mustard is the second most important oilseed crop in the world, occupying an area of 37.0 m ha, with production and productivity of 63.1 m tonnes and 1.85 tonnes/ha, respectively. Compared to other edible oils, the quality of mustard oil is considered to be superior as it contains two essential fatty acids, namely, linoleic and linolenic acids. India is one of the largest rapeseed-mustard growing countries in the world, occupying the first position in area (5.76 m ha) and second in production (6.82 m tonnes) after China. Generally rapeseed-mustard requires low production cost and show adaptive nature in different agro-climatic situations. However, the area, production and productivity of rapeseed-mustard in India have been fluctuating due to various biotic and abiotic stresses like, frequent weather aberrations, unavailability of location specific superior varieties, quality seed, lack of sound crop protection measures, poor transfer of technologies, farmer's unawareness about improved production technologies, lack of price support policies, poor water and fertilizer management. In recent past it was observed that the productivity of mustard is increasing but the area under cultivation is declining, resulting in stagnant production. Further mustard yield is likely to reduce in both irrigated as well as in rainfed situations due to climate change impacts (Boomiraj *et al*., 2010).

National mission on oilseeds and oil palm (NMOOP) programme launched by Ministry of Agriculture and Farmers Welfare, GOI, during 2014-15, envisages increasing production and productivity of oilseed crops and oil palm by addressing major production constraints through promotion of relevant technological interventions

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with sound backup of adaptive/strategic research strategies to bridge the yield gap (GOI, 2017). Introduction of oilseed crops in fallow and mono-cropped areas is one of the major focus of the programme. In Nagaland about 86,030 ha area under lowland/WTRC rice cultivation is kept fallow during *rabi* season, which offers a huge scope of area expansion for rapeseed-mustard (GOI, 2016). Presently, rapeseed-mustard is grown only in 27,450hectare area of Nagaland (GOI, 2018). Farmers of the state cultivate mustard for both vegetable and oil purposes in a limited area. Its cultivation under rainfed and constrained production system, use of local varieties, application of higher seed rate, imbalanced/limited application of fertilizers, non-adoption of plant protection measures leads to low productivity of about 1 ton/ha as against the potential productivity of 1.5-2.0 t/ha. Similarly, in Wokha district, delayed sowing coupled with water stress due to limited rainfall during growth period and absence of improved production technologies result in poor yield of the crop. Hence, there is an opportunity to enhance average productivity and production of mustard in the state through scientific interventions at farmers' fields. Therefore, an attempt was made to popularize mustard cultivation in rice fallow areas of Nagaland through cluster frontline demonstrations programme (CFLD) under NMOOP. The objectives were (i) to diversify and intensify farming activities through mustard cultivation, (ii) to promote scientific soil and crop management practices, and (iii) to identify the yield and adoption gaps for further improvement in the research and extension programmes.

MATERIALS AND METHODS

Study area: Adaptive research trials on mustard under NMOOP were conducted in different locations of Wokha district (26°00'02"-26°26'98" N latitude and 93°55'12"-94°23'15" E longitude, 98-1970 m altitude) of Nagaland during *rabi* seasons of 2016–2018 (Table 1). The demonstrated area falls under mild tropical hill agro-climatic zone. The average monthly temperature during the study years varied widely between 7.4°C to 30.1°C. Average annual rainfall was 1996 mm, of which 24.4% received as pre-monsoon, 72.7% received as monsoon (June-September) and 2.9% received as post monsoon rainfall.

Soil analysis: Composite surface (0-20 cm) soil samples were collected from the fields before and after the demonstration. Soils were analyzed for texture, pH, OC, available N, P, K and B by following standard methodologies as described by Page *et al.* (1982).

Cluster frontline demonstrations on mustard: Cluster frontline demonstrations (CFLDs) on mustard were conducted covering an area of 50 ha and involving 104 numbers of farmers (Table 1). The selected farmers were trained and provided with detailed information about recommended package of practices for successful mustard cultivation. The interventions made in the demonstration fields are outlined in Table 2. Special emphasis was given on the cultivation with improved cultivar, adoption of proper spacing and seed rates, scientific nutrient-management practices as per soil test results and crop

Table 1: Location of CFLD area of mustard in Wokha district, Nagaland during 2016-18

Sites	GPS Location	No. of farmers involved		No. of demonstration conducted		Area covered (ha)	
		Year I	Year II	Year I	Year II	Year I	Year II
Yanpha	26°00.989'N 093°54.122'E	16	1	12	1	5	0.6
Old Ralan	26°00.279'N 093°57.987'E	15	30	12	24	5	15.8
Chandalashung B	26°01.726'N 093°57.256'E	5	4	3	3	2.5	2.8
Chandalashung New	26°02.187'N 093°57.812'E	6	10	4	7	3.5	7.6
Liphanyan	26°03.267'N 093°58.990'E	8	9	5	6	4	3.2
Total		**50**	**54**	**36**	**41**	**20**	**30**

Table 2: Demonstration package and farmers' practice of mustard in CFLD area in Wokha

Particulars	Demonstrated technologies	Farmers' practice
Variety	TS-67	M-27
Seed rate (kg/ha)	5.0	10
Spacing	Row to row 30 cm, Plant to plant 10 cm	Close spacing
Seed treatment	*Tricoderma veridi*	Nil
Sowing method	Line sowing	Broadcasting
Biofertilizer	PSB+ *Azotobactor* as seed treatment	No
Fertilizer dose (N:P:K)	54-100:37-46:31-60	4.0-11.3:12-20:5-10
Micronutrient (Zn+B)	Zn @1-2 kg/haB as foliar application at three times	Nil
Plant protection	Neem based pesticides and organic fungicides	Nil
Technical guidance	Need based	Nil

protection measures, as these were the major constraints of mustard production in Nagaland. Critical inputs such as seeds, inorganic fertilizers and pesticides were made available for the selected farmers. The crops grown by following traditional practices in the adjoining fields, served as control/local check. Mustard was sown during last week of October to 1st week of November and harvesting was completed by the month of January. Scientists regularly visited demonstration plots to diagnose the farmers' problems and to ensure timely application of critical inputs. The extension activities like awareness and field day programmes were also conducted at the demonstration sites to disseminate information to other farmers of the localities.

The primary data on seed yield were collected by following random plot cutting (5m x 5m) method. Observations on agronomic attributes like plant height, siliqua count per plant, seeds per siliqua and 1000 seeds weight were recorded from each demonstration field by randomly selecting 5 representative plants and averaging out the mean value. Similar observations were also recorded from control plots.

Yield analysis: The yield enhancement in the demonstration plots over farmers' practice was calculated by using the following formula (Choudhary *et al.,* 2009):

Percentage yield increase over farmers' practice) = (Average demonstration plot yield-Farmer's average plot yield)/ Farmer's average plot yield X 100

The technology gap, extension gap, and technology index was estimated by using the following formulae (Samui *et al*., 2000):

Technology gap = Potential yield – Average demonstration plot yield

Extension gap = Average demonstration plot yield – Farmer's average plot yield

$$\text{Technology Index} = \frac{\text{P-D}}{\text{P}} \text{ X } 100$$

Where, P is potential yield of crop and D is average demonstration plot yield

Economics of CFLDs of mustard: Cost of cultivation of mustard includes expenditure incurred towards inputs such as seed, fertilizers, pesticides, hired labour, land preparation, sowing and harvesting charges. The gross and net returns were worked out by taking the cost of cultivation and price of mustard seed yield into consideration. Additional costs in CFLDs include the expenditure incurred towards improved technological inputs over farmers' practice. Similarly, the incremental benefit–cost ratio (IBCR) was worked out as a ratio of additional returns and corresponding additional costs (Vedna *et al.,* 2007).

Impact analysis of CFLD programme of mustard: Primary data were collected by a pre-tested structured interview schedule through direct interview method after completion of demonstration programme for assessing impact of the programme.

Statistical analysis: The yield and soil data recorded from demonstration and control plots were analyzed by following paired t-test using statistical the statistical software SPSS (version 16).

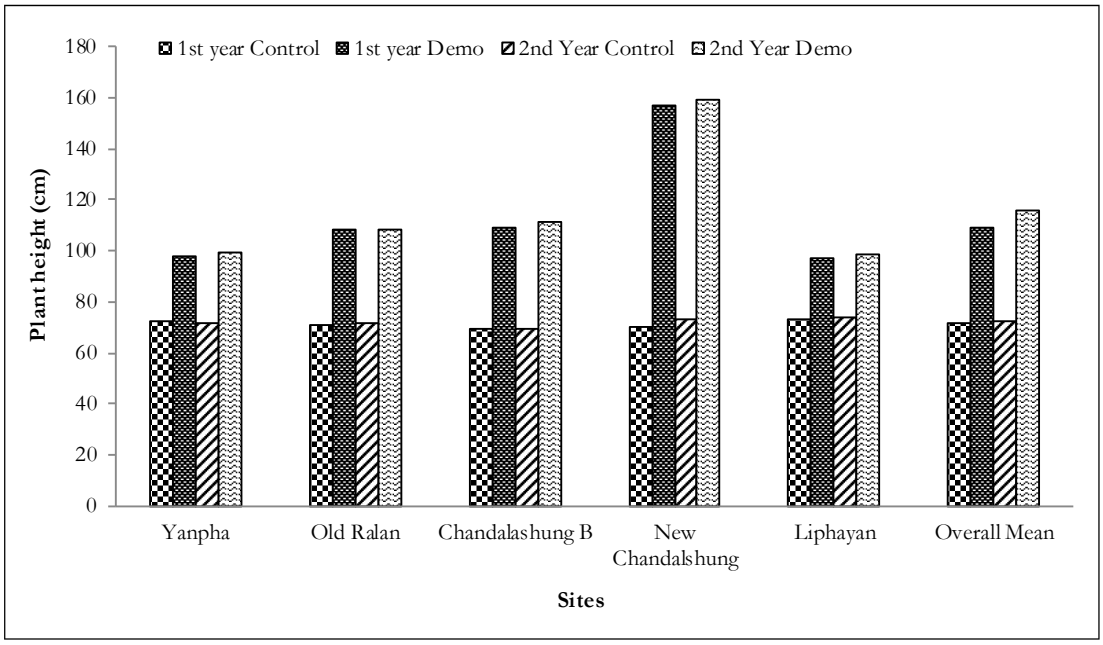
RESULTS AND DISCUSSION

Growth performance of mustard: The improved package of practices followed under frontline demonstration programme appreciably influenced the growth attributes of mustard (Table 3). Plant height of mustard at the demonstration plots varied from 97 to 159 cm with overall mean value of 109.2 and 116.1 cm for 1st and 2nd year of study, respectively, as against the corresponding mean values of 71.5 cm (1st year) and 72.2 cm (2nd year) in the fields under farmer's practice. The variation in plant heights could be due to genetic variation in mustard varieties cultivated in demonstrated (TS 67) and in farmers practice plots (M-27/local). Adoption of scientific method of cultivation and promotion of high yielding cultivars enhanced number of siliqua in demonstration plots ranging from 182 to 223.8 per plant (Figure 2) with overall mean value of 187.5 and 191.0 for 1st and 2nd year, respectively. But in the farmers practice plots, number of siliqua per plant varied from124.5 to 130.8 at different sites during the study period, with overall mean value of 128.6 and 129.0 for 1st and 2nd year, respectively.

Similarly, numbers of seeds per siliqua were considerably higher in demonstration plots ranging from 16.4 to 18.8, with overall mean value of 17.1 and 18.5 for 1st and 2nd year, respectively, where as in farmers' fields the numbers of seeds per siliqua varied from 6.2 to 7.8 with mean value of 7.0 in the 1st year and 7.3 in the 2nd year of study (Figure 3). No differences were noticed for thousand grain weight in both the demonstrated as well as in farmers' practices. Thousand grain weights of mustard in demonstrated plot varied from 3.80 to 4.05 g and 3.82 to 4.09 g for farmers practice plots during the study period (Figure 4).

Mustard productivity and yield enhancements: Promotion of improved production technologies enhanced mustard yield in the farmers' fields. The mean mustard seed yields obtained in the demonstration plots ranged from 1001-1121 kg/ha, whereas it was 547-625 kg/ha in the control plots. The data thus showed that there was 75.3-93.8% increase in yields in the demonstration plots compared to the respective adjoining control plots. The differences between the mean seed yield as recorded from demonstrated plots and control plots were significant during both 1st (399.96 kg/ha) and 2nd (606.02 kg/ha) years as indicated by the paired-t test values of 58.43 and 80.03 for 1st and 2nd year respectively (Table 3). There were 34 demonstration sites where mustard was grown during both the years. The paired-t test value (25.19) showed that the mean yields produced during 2nd year (1143.6 kg/ha) was significantly higher over the yield of 1st year (976.8 kg/ha) with yield difference of 201.56 kg/ha (df 33). Enhancement of mustard yield in demonstrated plots indicated that the introduction of HYV and adequate application of agri-inputs respond well on yield performance. Compared to 1st year, the yield improvement in demonstration plots during 2nd year could be due to the enhanced knowledge and skill of the farmers in respect to

Figure 1: Variation in plant height



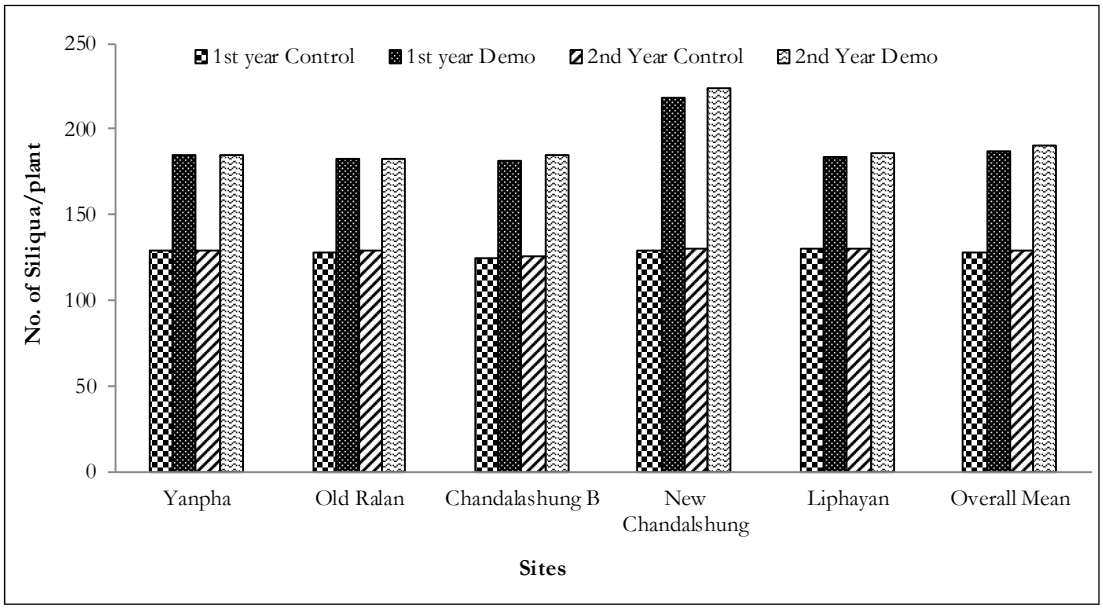


Figure 2: Variation in number of siliqua/plant

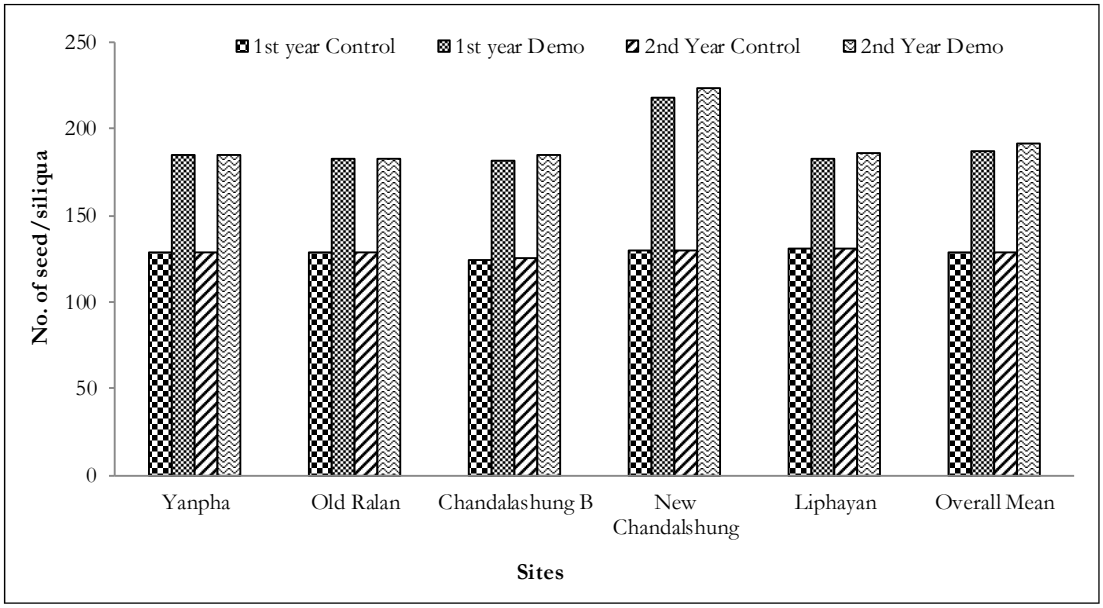


Figure 3: Variation in number of seeds/ siliqua

Table 3: Year-wise paired t test on yield difference in demonstrated plot over control plots

Year	Mean Yield in DP	Mean Yield in FP	Mean yield difference	Pair t test value	df
1st	1000.5	546.8	399.96+48.402	58.43	49
2nd	1120.7	624.5	606.02+55.648	80.03	53

DP: Demonstration plot; FP: Farmers' plot;

demonstrated technologies and relatively better imposition of technologies in field condition. The enhancement in mustard yield through adoption of improved farm technologies was also reported by other researchers (Singh *et al.* 2011; Dhaliwal *et al.* 2017).

Yield gap analysis: Variation in the technological gaps, ranging from 379.3 to 499.5 kg/ha (Table 4), was noticed among the demonstration sites. The higher technological gaps may be attributed to mustard cultivation in marginal lands under rainfed farming, lack of irrigation facilities and variation in soil fertility in demonstration areas. Therefore, strengthening of irrigation infrastructures and site-specific crop-management recommendations are needed to bridge the gap between potential and demonstration yields.

Figure 4: Variation in thousand grain weight

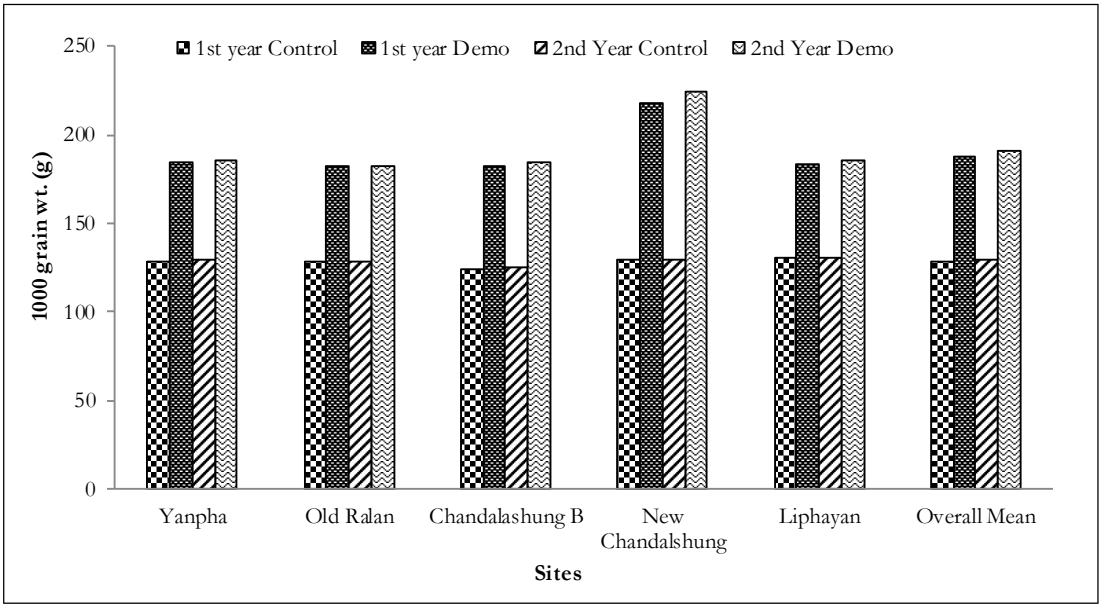


Table 4: Technology gap, extension gap, and technology index in mustard

Sites	Mean yield over (kg/ha) the years		Technological gap (kg/ha)	Extension gap (kg/ha)	Technological index (%)
	FP	DP			
Yanpha	556.8	1047.9	452.1	491.1	30.1
Old Ralan	624.5	1120.7	379.3	496.2	25.3
Chandalashung B	559.2	1000.5	499.5	441.3	33.3
Chandalashung New	546.8	1059.9	440.1	513.1	29.3
Liphanyan	611.4	1071.9	428.1	460.5	28.5

DP: Demonstration plot; FP: Farmers' plot

The demonstration sites varied in respect to the extension gaps in terms of mustard seed yield (Table 4). The maximum extension gap of 513.1 kg/ha was observed in Chandalashung new areas, whereas, lowest extension gap of 441.3 kg/ha was in Chandalashung B. Wide extension gap (441.3 to 513.1 kg/ha) indicates lack of awareness and knowledge and meager adoption of improved farm technologies in the given areas; and there is a dire need to further educate and motivate the farmers to adopt improved oilseed production technologies. Considerable extension gap in cultivation of mustard was also reported even in rural Delhi (Singh *et al.,* 2016).

The technology index indicates that the feasibility of introduced farm technology in the farmers' fields under the prevailing farming situations (Choudhary *et al.,* 2009). The technology index in mustard varied from 25.3 to 33.3% among the different demonstration sites (Table 4). Lower technology index as recorded in the given study indicated a greater feasibility of improved technology under farmers' fields in the given area. It could be due to the fact that mustard is a popular crop in the study area.

Soil fertility status: Soils of the demonstration sites were characterized as sandy loam and sandy clay loam in texture, strongly acidic in reaction, moderately medium to very high in soil organic carbon, very low in available N, very low to low in available P and available K and low to medium in hot water soluble B (Soltanpour and Schwab, 1977). The soil test values recorded after completion of the study period indicated that the introduced package of practices did not affect the above mentioned soil fertility parameters (Table 5) but the positive difference was noticed with residual N, P and K.

Economic analysis: The cost of cultivation in the demonstration plots (Rs. 13,985-Rs. 14,563 per ha) was relatively higher than in prevailing farmers practice (Rs. 8,123-Rs.8,530 per ha). However, introduced package of practice sharply increased both gross and net returns over

Table 5: Soil test parameters before and after demonstrations

Parameters	Soil test values in range		Paired differences			t	df	Sig.
	Initial	Final	Mean	SD	SE Mean			(2tailed)
pH	4.24-5.11	3.98-5.02	-0.2441	0.1585	2.718E-02	-8.983	33	NS
OC (%)	0.61-1.11	0.60-1.03	-7.529E-02	7.254E-02	1.244E-02	-6.052	33	NS
N (kg/ha)	86.5-111.2	86.5-111.2	31.394	17.1499	2.9412	10.674	33	NS
P (kg/ha)	8.20-16.3	9.68-18.5	1.194	2.4498	0.4201	2.843	33	NS
K (kg/ha)	99.9-168.2	111.8-158.7	2.264	10.1938	1.7482	1.295	33	NS
B (mg/kg)	0.27-0.61	0.27-0.59	-6.765E-03	3.565E-02	6.114E-03	-1.106	33	NS

Table 6: Economic analysis CFLD in mustard in Wokha district of Nagaland

Sites	Cost of cultivation (Rs./ha)		Gross returns (Rs./ha)		Net returns (Rs./ha)		Additional Cost	Additional returns (Rs./ha)	IBCR
	DP	FP	DP	FP	DP	FP	(Rs./ha)		
Yanpha	14,360	8,200	36,677	19,488	22,317	11,288	6,160	17,189	2.79
Old Ralan	14,563	8,456	39,225	21,858	24,662	13,402	6,107	17,367	2.84
Chandalashung B	14,210	8,522	35,018	19,572	20,808	11,050	5,688	15,446	2.72
Chandalashung New	13,985	8,123	37,097	19,138	23,112	11,015	5,862	17,959	3.06
Liphanyan	14,152	8,530	37,517	21,399	23,365	12,869	5,622	16,118	2.87

IBCR: incremental benefit cost ratio.

the farmers practice (Table 6). The additional cultivation cost of Rs. 5,622- Rs. 6,160 per ha incurred towards introduced package of practice resulted in an additional returns of Rs. 15,446-Rs.17,959 per ha with incremental benefit cost ratios (IBCR) of 2.72-3.06:1. Higher IBCR suggests a positive impact of improved farm technology on profitability of mustard cultivation due to enhanced productivity. Similar findings were also reported by earlier workers (Sagar and Chandra, 2004; Vedna *et al.,* 2007; Choudhary *et al.,* 2009).

Overall, this economic analysis highlights that use of improved technology in oilseeds had substantially increased the farm gains over farmers' practice, which emphasizes use of HYVs of mustard coupled with scientific package and practice can greatly improve the livelihood and profitability of the farming community of Nagaland in general and Wokha district in particular.

Impact analysis of CFLD on mustard: The cluster frontline demonstration programme on mustard showed positive impacts on tribal farmers. At the end of the study period, 75% farmers mentioned about moderate to high level of improvement in their knowledge and skill. Similarly, 93% of farmers said that the programme helped them to increase their family income. Overall the farmers expressed their satisfaction towards the demonstrated technology.

CONCLUSION

In Nagaland mustard is cultivated in very limited area by using old cultivars with negligible quantity nutrient application. Introduction of mustard HYV (TS 67) along with the recommended nutrient management and improved crop husbandry significantly increased the mustard yield, and both gross and net income in demonstration plots. As indicated by high IBCR of introduced package of practices, there exists great opportunity of popularizing mustard cultivation in rice fallow areas of Nagaland.

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Traditional Knowledge on Medicinal Plants Used by the Bhil Tribe in Pali District of Rajasthan, India

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ABSTRACT

An ethno-botanical survey was carried out among the ethnic groups (Bhil) in Arawali Hills, Pali district of Rajasthan. The tribal communities of Bhil nurture rich knowledge about medicinal plants and its uses. Therefore, we have done an exhaustive ethno-botanical survey in this area. In this present investigation, it is observed that the tribal's use 74 wild valuable plant species belonging to 66 species and 43 families were identified with relevant information and documented in this paper with regard to their botanical name, family, local name, parts used and utilization by the local tribal (Bhil) people for different human ailments. The common diseases treated by the herbal practitioner were asthma, digestive problems, paralyzes, skin diseases and diabetes. The findings of the study were found seed and tender twigs were recorded as the least used plant parts. However, leaves were found most frequently used part and constituting 51.35 percent followed by root (13.51%), whole plant (9.60%), fruits (6.76%), seeds (4.54%) and bark (4.54%), respectively. Maximum use of leaves medicinal purpose indicates either these plants are easily availability or they may have strong medicinal properties. This study provides an ethno-botanical data of the medicinal plants used by the tribal people of Bhil to cure different diseases. Moreover, this study will promote a practical use of botanicals and must be continued focusing on its pharmacological validation.

Keywords: Aravalli hills, *bhil*, Medicinal plants, Traditional use

INTRODUCTION

Plants have been used in traditional medicine for several thousand years. The knowledge of medicinal plants has been accumulated in the course of many centuries based on different medicinal systems such as *Ayurveda, Unani* and *Siddha*. In India, it is reported that traditional healers use 2200 plant species and 95 species of plants serve as regular sources of medicine Pei (2001). During last few decades there has been an increasing trend in the study of medicinal plants and their traditional use in different parts of the world Lev (2006). Herbal remedies are considered the oldest forms of health care known to mankind on this earth. Prior to the development of modern medicine, the traditional systems of medicine that have evolved over the centuries within various communities, are still maintained as a great traditional knowledge base in herbal medicines Mukherji and Wahil (2006). Traditionally, this treasure of knowledge has been passed on orally from generation to generation without any written document Samy and Ignacimuthu (2006) and is still retained by various indigenous groups around the world.

Documenting the indigenous knowledge through ethno-botanical studies is important for the conservation and utilization of biological resources. Ethno-botanical survey has been found to be one of the reliable approaches to drug discovery Fabricant and Farnsworth (2001). Several active compounds have been discovered from plants on the basis of ethno-botanical information and used directly as patented drugs Carney *et al.* (1999). As indigenous cultures are closely maintained by the tribal and other forest dwellers throughout the world, the ethno-botanical investigation is a prerequisite for any developmental planning concerned with the welfare of tribal and their environment. It is an urgent, necessity to record as quickly as possible all information about plants and the role of tribes in conserving them. The main focus of the present study is to ascertain the detailed information on the use of plants and their therapeutic practices among Bhil tribal of Aravalli hills, Sothern Rajasthan.

MATERIALS AND METHODS

An ethno-botanical survey was carried out in Aravalli hill area, which is found in Kumbhalgargh Sanctuary, Pali

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district, Rajasthan. Kumbhalgarh forest is a part of Aravalli hills covered with mixed deciduous vegetation. The Aravalli hill is situated at 1220 meters above the sea level with a total area of 5678.6 ha and it lies 28·43'N longitudes and 77.28' E latitude (Figure 1). The hills are the home to some of the most magnificent species of mammals, birds, reptiles, birds etc. There are several national parks and wildlife sanctuaries that fall within the belt of Aravalli Hills. Sariska National Park, Kumbhalgarh Sanctuary and Mount Aabu Sanctuary are among them. These sanctuaries provide shelter to large number of animals and birds such as monkeys, langurs, sloth bear, spotted deer, sambar deer, hyena, jackal, jungle cat, python, great Indian bustard, eagles, Indian wolf, flying squirrel and many more. The ethno-botanical survey was carried out among local population and the tribe called *Bhil* living in this area. The tribal community was met in their residential areas. The field visit was conducted several times to the study area. Ethno-botanical data were collected according to the methodology suggested by Jain (1994) through questionnaire, interviews and discussions among tribal practitioners in their local language. Our questionnaire

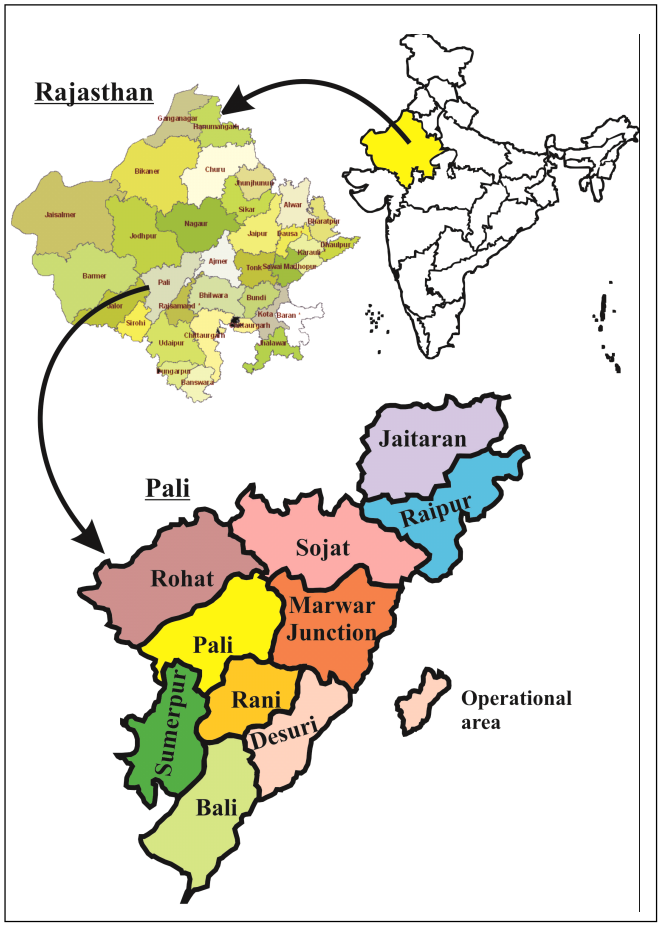

Figure 1: Location of the study area

allowed descriptive response on the plant prescribed, such as part of the plant used, medicinal uses, and detailed information about mode of preparation (*i.e.,* decoction, paste, powder and juice) form of usage either fresh or dried and mixtures of other plants used as ingredients. There were 30 informants between the ages of 40 to 70 in the study area. Among them 10 were farmers and 20 were regular herbal practitioners. They were accompanied us to the forest area where they showed us plants that are used in their traditional medicines. The collected plant specimens were carefully identified with the help of experts in the Division of Botany CAZRI, Jodhpur. Details regarding their uses, medicinal importance, mode of administration and their local names were recorded. Data are tabulated with plant name along with family, local name, parts used, method of preparation and utility (Table 1).

RESULTS AND DISCUSSION

The result of this study have revealed 74 plant species belonging to 66 species and 43 families that are used for various purposes by herbalists, traditional healers and tribal people of Aravalli hills (Table 1). Seed and tender twigs were recorded as the least used plant parts. However, leaves were found most frequently used part and constituting 51.35% followed by root (13.51%), whole plant (9.46%), fruit (6.76%), and bark (4.54%) (Table 1). Maximum use of leaves medicinal purpose indicates either these plants are easily availability or they may have strong medicinal properties. The methods of preparation fall into seven categories. The plant parts applied as a paste (43.24 %), boiled (4.05%), decoction (24.32%), juice extracted from the fresh plant parts (9.54%), powder made from dried plant parts (5.41%), fumigate (8.11%), and infusion (5.41%) (Table 2 and Figure 2). Paste is the main methods of preparation, either for oral or for external administration. The underground parts *viz.* roots, rhizomes, tubers, etc. were preferably harvested either at the time of senescence or before dormancy break to retain maximum potency of crude drug.

The mode of administration of these formulations is concerned about 48 preparations were prescribed to consume orally and 26 formulations were reported for external use only. Largest number of remedies are skin diseases (17.57%) followed by stomachic problem (16.21%), wound healing (14.86%), fever (9.45%), diarrhea (6.75%), diabetes (6.75%), genetically disorder (6.75%), respiratory (5.40%), paralyzes (4.05%), snake bite (4.05%) & toothache (1.35%), respectively (Table 3 & Fig. 3).

Table 1: Medicinal Plants used by Bhil Tribe of Pali district, Rajasthan

B. name /family	Local name	Habit	Part	Preparation Mode of uses	Ailments treated
Adina cordifolia Hkf. *(Rubiaceae)*	*Kadabh*	Tree	Bark	Fresh bark is ground with brown sugar and cumin. The paste of this mixture is taken internally to treat female asthenia.	Body Weakness & Uterus related problems
Strebulus asper Lour (*Moraceae*)	*Khoi*	Shrub	Leaf	Leaf paste is applied topically to treat measles like swellings on the skin	Skin diseases
Asparagus racemosus Willd.(*Liliaceae*)	*Sattawari*	Shrub	Leaf & Root	Leaf and root powder is mixed with breast milk. The paste is taken internally to improve immunity of children	Weakened immunity
Cardiospermum helicacabum Linn.(*Sapindaceae*)	*Kapal phodi*	Climber	Leaf	Paste of leaves with onion and coconut oil is taken orally for joint pain	Arthritis
Randia dumetorum Lamk.(*Rubiaceae*)	*Kaarai othasi*	Shrub	Seed & Fruit	Fruits are rubbed on hard substances & paste is applied topically to cure skin diseases	Dermatitis
Andrographis paniculata Nees.*(Acanthaceae)*	*Kalmegh*	Shrub	Leaf	Leaf paste is taken orally for snake bite and to reduce pain	Snake bite, *Chikun gunia*
Ziziphus oenoplia Mill. *(Rhamnaceae)*	*Makhoy*	Shrub	Fruit & Bark	Bark and Fruit paste along with cumin is taken internally to treat diarrhea	Diarrhoea
Caesalpinia sepiaria Roxb. (*Caesalpiniaceae*)	*Railan*	Shrub	Leaf	Leaves are cooked and taken orally with food for digestion problems	Stomach disorder
Amaranthus spinosus Linn.(*Amaranthaceae*)	*Jangli chollai*	Herb	Leaf & Root	Leaf paste along with lemon juice is taken with food to cure stomach ulcer	Stomach ulcer
Acacia torta Craib. (*Mimosaceae*)	*Nutan*	Climber	Leaf & Young twig	Leaf is cooked with onion and taken with food. It facilitates the expulsion of gas.	Stomach disorder
Ziziphus mauritiana Linn. (*Rhamnaceae*)	*Jharberi*	Tree	Leaf	Paste of leaf along with the leaves of *Ailanthes excels* Roxb. is taken internally as well as topically to treat paralyze	Paralyze
Sida acuta Burm. (*Malvaceae*)	*Bairaya*	Herb	Leaf	Crush the fresh leaves and the juice is applied topically to treat boils	Boils
Spilanthes acmella Murr. (*Asteraceae*)	*Akakkara*	Herb	Flower	Flowers are crushed and applied on the site of toothache	Toothache
Ailanthees excels Roxb. (*Simarubaceae*)	*Ardusa*	Tree	Leaf	Decoction is prepared from leaves and taken internally to treat paralyze	Paralyze
Hemidesmus indicus R.Br. (*Asclepiadaceae*)	*Dhudhali*	Climber	Leaf	Root and Leaf decoction is taken orally to regulate digestion	Stomach disorder
Argemone Mexicana Linn. (*Papaveraceae*)	*Sattayanasi/ Kateli*	Herb	Latex	Latex of the plant is applied topically on the site of boils	Boils
Mimosa pudica Linn. (*Mimosaceae*)	*Chhoomui*	Herb	Leaf	Root and Leaf infusion is applied on the wounds	Wound healing
Leucas aspera Spreng. (*Lamiaceae*)	*Goma/ Madhupathi*	Herb	Leaf	Leaf paste or crushed leaf is taken both externally & internally to treat snake bite, it is also applied topically on the forehead to cure one side headache	Snake bite, One side headache
Ruellia patula Jacq. (*Acanthaceae*)	*Kirayata/ Kalapnath*	Herb	Leaf	Leaf paste is applied topically all over the body to treat children fever	Children fever

Table 1: contd.....

B. name /family	Local name	Habit	Part	Preparation Mode of uses	Ailments treated
Crissus quadrangularis Linn.(*Vitaceae*)	*Harzorra*	Lianas	Stem & leaf	Paste of stem and leaf is taken orally with food for easy digestion and to increase appetite	Stomach disorder
Achyranthes aspera Linn. (*Amaranthaceae*)	*Chakauri*	Herb	Leaf	Paste of leaf with onion is applied externally on the bitten site of dog and to cure skin diseases	Rabies, Skin diseases
Syzygium cumini Linn. (*Myrtaceae*)	*Jamun*	Tree	Seed	Seed powder mixed with either hot water or cow's milk are taken orally in empty stomach to treat diabetes	Diabetes
Abrus precatorius Linn. (*Fabaceae*)	*Ghoonghachi*	Climbing shrub	Seed	Decoction of seed is taken orally to increase sperm count and to treat stomach pain	Stomach problems and sexual disorder
Lantana camera Linn. (*Verbanaceae*)	*Ganeri/Lalten*	Shrub	Leaf	Leaf paste is applied topically to treat wounds	Wound healing
Solanum nigrum Linn. (*Solanaceae*)	*makoia*	Herb	Leaf & Fruit	Leaves and fruits are chewed and swallowed to cure mouth ulcer	Mouth ulcer
Sesbania aegyptiaca Pers. (*Fabaceae*)	*Jayanto*	Shrub	Tender twig & seed	Tender twig and seeds are infused with coconut oil and applied topically on the hair regularly for healthy and black hair	Problems in hair growth and body heat
Tridax procumbens Linn. *(Asteraceae)*	*Khalmooriya*	Herb	Leaf	Leaf juice is applied topically on wounds	Wound healings
Phyllanthus amarus Linn. (*Euphorbiaceae*)	*Amalli*	Herb	Root & fruit	Roots and fruits are crushed and mixed with goat's milk. The mixture is taken orally to cure jaundice and liver problems	Liver problems
Euphorbia hirta Linn. (*Euphorbiaceae*)	*Baddi Dudhi*	Herb	Leaf & fruit	Leaf and fruit powder is mixed with cow's milk and taken orally to treat Leucorrhoea and to keep the body cool	Leucorrhoea
Jatropha curcas Linn. (*Euphorbiaceae*)	*Jamalghota*	Shrub	Bark & latex	Decoction prepared from bark and mixed with water. The water is used to take bath for the treatment of stomach problems during pregnancy. Latex is taken orally for same purpose	Stomach related problems during pregnancy
Bauhinia retusa Ham. (*Fabaceae*)	*Ambhajoi*	Shrub	Leaves and fibres	Leaves are fumigated and s inhaled to get relief from fever. The stem fibres are used in coir production.	Fever
Azima tetragantha Lamk. (*Salvadoraceae*)	*Harara*	Herb	Leaf	Decoction prepared from leaves and is taken orally to treat cold and cough	Cold and cough
Flacourtia ramontchi (L) Herit.(*Bixaceae*)	*Bilangra*	Herb	Fruit	Ripened fruits are taken orally to keep the body cool	Body heat
Cassia tora Linn. (*Fabaceae*)	*Charata*	Herb	Shoot tip	Tender twigs are cooked with onion and taken with food	Used as a vegetable
Solanum xanthocarpum Schard(*Solanaceae*)	*Raimgani/ kateli*	Herb	Fruit	Unripe fruits are cooked and taken with food	Used as a vegetable
Solanum indicum Linn. (*Solanaceae*)	*Kanidu*	Herb	Fruit	Unripe fruits are cooked and taken with food to expel tapeworms. These fruits are used to preparing pickles	Expelling worms

Table 1: contd.....

B. name /family	Local name	Habit	Part	Preparation Mode of uses	Ailments treated
Ficus retusa Linn. (*Moraceae*)	*Kattala*	Tree	Leaf and fruit	Paste of Leaf along with their fruit combined with cumin is taken orally to cure swellings, Lung blockage. It is best for treat diabetes and applied topically over the fractured bones.	Diabetes, bone fracture, cold, swellings
Spilanthes calva Wt. (*Asteraceae*)	*Akarkara*	Herb	Leaf	Leaf paste is applied directly on wounds	Wound healings
Capparis sepiarira Linn. (*Violaceae*)	*Kanthari*	Herb	Fruit abd Root	Leaves are pasted with lemon juice and are applied topically to treat swellings. The fruits are edible.	Swellings
Launaea pinnatifida Cass. (*Goodeniaceae*)	*Pathari*	Herb	Leaf	Leaf decoction is taken internally to get relief from fever	Fever
Oxalis corniculata Linn. *(Oxalidaceae*)	*Amull*	Small herb	Root	Paste of Root is taken orally to treat common fever	Fever
Euphorbia heterophylla Linn.(*Euphorbiaceae*)	*Baddi dudhi*	Herb	Leaf	Leaf is cooked with coconut oil and onion. It is taken with food for stomach problems and to treat dysentery	Stomach problems and dysentery
Ocimum basilicum Linn. (*Lamiaceae*)	*Ramtulasi*	Herb	Leaf	Dried leaves are kept in fire and the smoke is inhaled to cure Asthma	Asthma and other breathing problems
Croton sparsiflorus Morang (*Euphorbiaceae*)	*Bantulsi*	Herb	Latex	Plant latex is applied externally on the site of wasp sting	Wasp sting
Cocculus hirsutus Diels. *(Menispermaceae)*	*Patalgiri*	Climber	Leaf	Paste is prepared from leaves and it is administered orally to treat Leucorrhoea	Leucorrhoea
Abutilon indicum G. Don. (*Malvaceae*)	*Kandhi*	Herb	Leaf	Leaf is cooked with onion and taken orally to treat piles	Piles
Eulipta prostrate Linn. (*Asteraceae*)	*Bhrangraj*	Herb	Whole plant	The powder of *Eclipta prostrata*, *Leucas aspera* and *Phyllanthus niruri* are mixed with butter milk and taken orally to cure jaundice	Jaundice
Lawsonia inermis Linn. (*Lythraceae*)	*Mehandi*	Shrub	Leaf	The fresh leaves are ground and gargled to treat mouth ulcer.	Mouth ulcer
Datura metel Linn. (*Solanaceae*)	*Dhatura*	Leaf	Herb	The fresh leaves are boiled with gingelly oil and applied topically on joints to cure swellings	Swelling in joints
Mukia maderaspatans Linn.(*Cucurbitaceae*)	*Agumakki*	Leaf	Climber	Boil the leaf juice with gingelly oil and applied topically on the head before taking bath to cure Asthma	Asthma
Trianthema decandra Linn.(*Aizoaceae*)	*Gadabani*	Root	Herb	The root of this plant is taken internally to treat Elephant dialysis	Elephantiasis
Santalum album Linn. (*Santalaceae*)	*Chandan*	Tender twig	Tree	The paste of tender twig mixed with the juice of *Phyllanthus emblica* are taken orally to treat urinary tract infection and it is best for diabetes	Urinary tract infection and diabetes
Plumbago zeylanica Linn. (*Plumbaginaceae*)	*Chitrak*	Root	Herb	Root is pasted with gingelly oil and applied topically to cure piles	Piles

Table 1: contd.....

B. name /family	Local name	Habit	Part	Preparation Mode of uses	Ailments treated
Bauhinia tomentosa Linn. *(Caesalpiniaceae)*	*Kachnar*	Leaf	Shrub	The leaf powder is mixed with honey are taken internally to treat digestive problems and vomiting	Digestive disorders
Rubus ellipticus Sm. (*Rosaceae*)	*Kala jamoo*	Root	Climber	The root paste is taken internally to treat paralyzes	Paralyze
Cipadessa baccifera Miq. (*Meliaceae*)	*Nalbia*	Root, leaf and bark	Tree	The paste of root, leaf and bark is applied topically to cure psoriasis	Skin diseases
Cassia hirsute Linn. (*Caesalpiniaceae*)	*Charota*	Root	Shrub	The root is pasted with cumin and taken internally to treat stomach burning after a meal.	Digestive disorders
Glycosmis pentaphyllac Orrea.(*Rutaceae*)	*Banniboo*	Root	Shrub	The root is pasted with cumin and taken internally to treat Asthma.	Asthma
Alangium salvifolium Wang.(*Alangiaceae*)	*Ankol*	Whole plant	Climber	The fresh plants are fried and taken internally to treat chest burning	Burning sensation
Grewia tiliaefolia Vahl. (*Tiliaceae*)	*Dhamani*	Bark	Tree	The decoction of bark is apply all over the head before taking bath to treat mental illness	Mental illness.
Terminalia bellarica Roxb. (*Combretaceae*)	*Baheda*	Bark and root	Tree	The bark and root are grind & took extract, which is applied topically to treat unnecessary peelings on the skin.	Skin diseases
Curculigo orchioides Gaetrn.(*Hypoxidaceae*)	*Kalimoosali*	Whole plant	Tree	The leaf paste taken internally to increase sperm count.	Genital disorder
Rubia cordifolia Linn. (*Rubiaceae*)	*Majitha*	Leaf	Climber	The leaf paste is applied topically to scorpion sting and dizziness	Scorpion sting
Boerhaavia diffusa Linn. (Nyctaginaceae)	*Gaddakand*	Whole plant	Herb	The plant is pasted with cumin and taken internally to cure digestive problems	Digestive disorder
Lantana whitiana Wall. *(Verbanaceae)*	*Laltain*	Leaf	Shrub	The leaf is ground with *Cipadessa baccifera* root, leaf and bark & applied topically to treat Psoriasis	Skin disease
Adhatoda vasica Nees. (*Acanthaceae*)	*Aamssa*	Leaf	Shrub	The leaf decoction is taken internally to cure cold and cough.	Cold and cough
Jasminum angustifolium Vahl.(*Oleaceae*)	*Vanmallikka*	Leaf	Shrub	The leaf is boiled in water and taken with food to cure diahhroea	Diahhroea
Murraya paniculata (L) Jack.(*Rutaceae*)	*Kamini*	Leaf	Shrub	The leaf paste is applied over the wounds to heal	Wounds
Citrullus colocynths (Cucurbitaceae)	*Tumba*	Fruit	Kipper	Powder of dry fruits for uses of abdomen pain	Abdomen pain
Laptadenia pyrotechnic (Asclepiadaceae)	*Kheenp*	Tender twin	Shrub	For paste of tender twin uses in warm season loo used	Paste
Calligonum polygonoides (Polyganaceae)	*Phog*	Stem	Shrub	Paste of bark used for wound	Wound
Capparis deciduas L. (Capparaceae)	*Kher (Tint)*	Pod	Shrub	Dried fruit used for fever and ulcer	Fever
Prosopis cineraria (Fabaceae)	*Sangri (khejari)*	Whole plant	Tree	The bark paste is applied over wound to heal,Green pods are used for diabetes patients	Wound/diabetes

Table 2: Plant parts used by Bhil tribes for various ailments

Plant parts used	Numbers	Percentage
Bark	3	4.54
Leaf	38	51.35
Root	8	10.81
Seed	3	4.54
Fruit	5	6.76
Whole plant	7	9.46
Others	10	13.51
Total	**74**	**100.0**

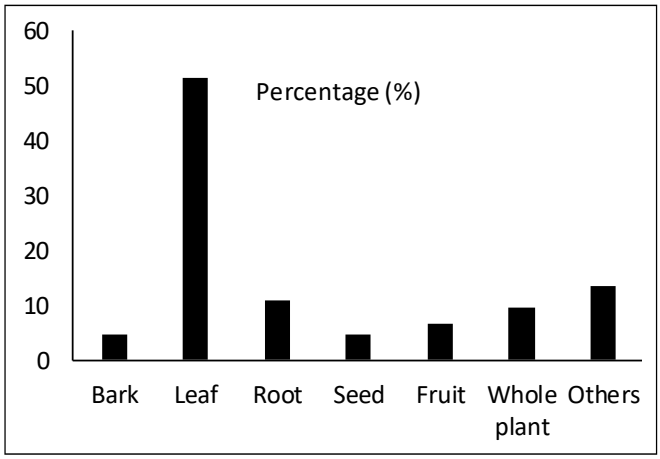

Figure 2: Plant parts used

Table 3: Methods of preparation of medicine by natural plants used

Methods of preparation	Number	Percentage
Juice	7	9.45
Powder	4	5.41
Paste	32	43.24
Boiled	3	4.05
Decoction	18	24.32
Infusion	4	5.41
Fumigants	6	8.11
Total	**74**	**100.0**

Common health ailments in the study area were skin problems such as wounds, boils, psoriasis and the larger number of the remedies were used to treat these ailments. Common medicinal plants such as *Achyranthus aspera*, *Lantana camera*, *Indigofera aspalathoides*, *Terminalia bellarica* are used for skin diseases. Among the plants surveyed, *Ocimum basilicum*, *Adhatoda vasica* are used frequently for the preparation of medicines for the treatment of respiratory disorders. The result showed

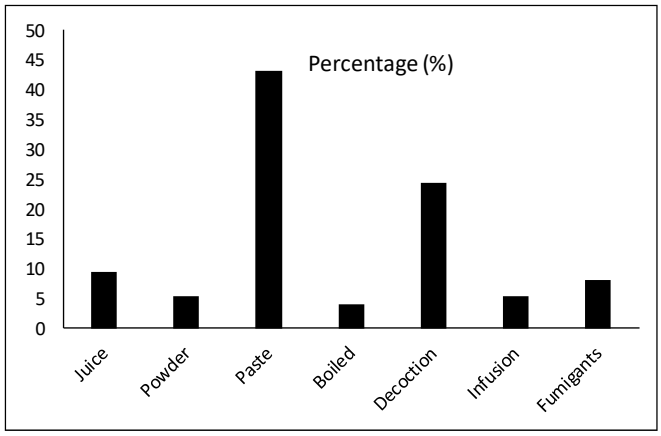

Figure 3: Methods of preparation of medicine by natural plants used

that *Cassia tora*, *Solanum xanthocarpum* are weeds, which is used as a vegetable. Fruits of *Flacourtia ramontchi*, *Zyzyphus oenoplia*, and root of *Hemidesmus indicus* are used as edible by the tribal people. The tribal people mostly eat vegetables of leafy varieties which grown as wild weeds.

Herbal remedies are considered the oldest forms of health care known to mankind on this earth. Prior to the development of modern medicine, the traditional systems of medicine that have evolved over the centuries within various communities, are still maintained as a great traditional knowledge base in herbal medicines Mukherji and Wahil (2006). Traditionally, this treasure of knowledge has been passed on orally from generation to generation without any written document Samy and Ignacimuthu (2000) is still retained by various indigenous groups around the world. People use more than one plant either separately or mixed together. They mix several plants as ingredients to cure diseases immediately. Generally, fresh part of the plant is used for the preparation of medicine. When fresh plant parts are not used as simple drugs and some plants are used with some other plant parts. The information collected from this study is in agreement with the previous reports (Jain, 2001; Sandhya, 2006; Ganesan *et al.,* 2004; Udsyan *et al*., 2005; Mahapatra and Panda, 2002). From this survey herbs (46%) were found to be most used plants followed by shrubs (26%), trees (14%) and climber (14%) in descending order. Many Species of the family *Euphorbiaceae*, *Fabaceae*, *Solanceae* and *Asteraceae* are frequently used in this study area. The first two families contribute to 10 remedies; the information is showed.

The parts of the plant used for medicinal purposes are leaves, root, stem, fruits, the complete aerial parts, the whole plant, barks (root and stem) and flowers. However,

Table 4: Drug preparation methods for various ailments

Name of disease	Numbers used	Percentage
Diabetes	05	06.76
Genetically disorder	05	06.76
Paralyzes	03	04.05
Respiratory disorder	04	05.40
Toothache	01	01.35
Fever	07	09.45
Diarrhea	05	06.76
Skin disease	13	17.57
Snake bite /Scorpio bite	03	04.05
Stomachic problem	12	16.21
Wound healing	11	14.86
Others	05	06.75
Total	**74**	**100.00**

Table 5: Habits of medicinal plants used by tribes in study areas

Habits	Numbers	% of plant habits
Tree	11	14.86
Herbs	30	40.54
Climbers	09	12.16
Shrubs	24	32.43
Total	**74**	**100.0**

leaves were found most frequently used part. Common health ailments in the study area were skin problems. Bhil tribes in Aravalli hills of Rajasthan were using 14 plants for the treatment of skin problems Ayyanar and Ignacimuthu (2005). Tribal's of southern district used 52 herbal preparations from 31 plants for skin diseases, a nearest state of Gujarat Harsa *et al.* (2003) and people of Eastern Cape Province, South Africa used 38 plant species for the treatment of wounds Grierson and Afolayan (1999). Several studies have enumerated the plants used for wound healing and skin diseases in various parts of the world (Chah *et al.,* 2006; Ayyanar and Ignacimuthu (2005); Harsha *et al.* (2003) and Ghorbani 2005) reported 16 plant species that were used for respiratory diseases and 48 plants for the treatment of gastrointestinal disorders in north Iran. Safety and efficacy of the treatment for respiratory tract infections were reviewed Coon and Ernst (2004). Traditional healers of Pali district used ten plant species to treat stomach problems among them 3 plants to treat stomachache and 6 plants to cure digestive problems Chellaiah *et al.* (2006) and Muthukumarasamy *et al.* (2003) have reported the use of 21 medicinal plants from 20 families to treat gastro-intestinal complaints by using *Garasia* community.

The tribal people of Southern Rajasthan of India used 13 plants for the treatment of Jaundice Samvatsar and Diwanji (2000). In the present study on *Phyllanthus amarus* and *Eclipta prostrate* were used for the treatment of jaundice. *Spilanthes acmella* was used to treat toothache. *Syzygium cumini*, *Santalum album* and *Ficus retusa* are reported to treat diabetes. It is in agreement with earlier reports in the treatment of oral diseases Topsoba and Deschampus (2006) and Hebbar (2004). *Andrographis paniculata*, *Catheranthus roseus* and *Gymnema sylvestre* were used to treat diabetes by the local traditional healers Chellaiah (2006). The tribal people of Sikkim and Darjeeling Himalayan region in India utilized 37 species of plants belonging to 28 different families as anti-diabetic agents Chherti (2005). In this present study ten remedies were used to alleviate problems of the respiratory system. Among the plants surveyed, *Ocimum basilicum*, *Adhatoda vasica* are used frequently for the preparation of medicines for the treatment of respiratory disorders. Whereas, 14 remedies were used to alleviate the respiratory problems, among the plants surveyed, *Adhatoda zeylanica* and *Vitex negundo* are used frequently Ignacimuthu *et al.* (2006); Sah and Kumar (2010); Singh *et al.* (2018) and Khadda *et al.* (2018).

From our survey of ethno-medicinal plants, the results obtained confirm the therapeutic potency of some plants used in traditional medicine. In addition, these results form a good basis for selection of potential plant species for further phytochemical and pharmacological investigation. The leaf paste of *Zizyphus mauritiana* along with the leaves of *Ailanthes excelsa* is taken internally as well as topically to treat paralyzes. *Andrographis paniculata* is used to treat poison bites; Leaf juice of *Mukia maderaspatana* with gingelly oil is applied topically on the head before taking bath to cure Asthma. Leaf and fruit powder of *Euphorbia hirta* is mixed with cow's milk and taken orally to treat Leucorrhoea, *Leucas aspera* (headache and snakebite) and *Cardiospermum helicacabum* (Arthritis) also documented.

CONCLUSION

The data collected shows that majority of the remedies are taken orally. Herbal medicines prescribed by tribal people are either preparation based on single plant or a combination of several plant parts. Most of the reported

preparations are drawn from a single plant; mixtures are used rarely. The fresh plant parts are used for the preparation of medicine. When fresh plant parts are unavailable, dried parts are also used. Generally, the people of the study area still have a strong belief in the efficacy and success of herbal medicine. The results of the present study provide evidence that medicinal plants continue to play an important role in the healthcare system of this tribal community. This study provides an ethno-botanical data of the medicinal plants used by the tribal people of Bhil to cure different diseases. Moreover, this study will promote a practical use of botanicals and must be continued focusing on its pharmacological validation. Further detailed exploration and collection of ethno-botanical information, chemical studies and screening for medicinal properties will provide cost effective and reliable source of medicine for the welfare of humanity.

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Evaluation of Farmer Producer Organizations of Telangana: A SWOT Analysis Approach

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ABSTRACT

The paper has evaluated the functioning and performance of farmers producer organizations of Telangana. The study is based on primary data collected through pre tested schedule from 60 member farmers of four FPOs of Janagaon and Siddipet districts of Telangana. The SWOT analysis revealed that the FPOs of the region are fortunate to have been supported by promoting institutions. The low level of participation ails the FPOs of the region as observed in other parts of the country. It is suggested by members that the liberal provisioning of capital is important for expansion of business and making FPOs a sustainable business entity.

Keywords: Backward and forward linkages, FPOs, SWOT analysis, Telangana

INTRODUCTION

The Farmer Producer Organization refers to any registered legal entity of primary producers engaged in farm/ of farm economic activities. They work for the benefits of shareholder members and share portion of profits among the members. FPOs as a legal entity was enacted in 2002 as per section IXA of the Indian Companies Act 1956 that will empower and improve the bargaining, net incomes and quality of life of small and marginal farmers/ producers (Venkatesan and Sontakki, 2017). Small Farmers' Agribusiness Consortium (SFAC) is recognised as the nodal agency for promotion of FPOs in the country. Different state departments and central agencies are involved in mobilising the primary producers into producer organisations under various schemes like Paramaparagat Krishi Vikas Yojana (PKVY), Rashtriya Krishi Vikas Yojana (RKVY) and Vegetable initiative for Urban Cluster (VIUC) etc. Among the central level institutions, SFAC and NABARD are the major institutions taking up the task of promoting FPOs in the country. Four states namely Karnataka, Madhya Pradesh, Tamil Nadu and West Bengal together account for more than fifty per cent of the number of farmers mobilised towards FPOs (Manaswi *et al.*, 2018). There is a lot of variation in formation and functioning of the FPOs across the states and regions of the country. It is important to understand the strengths and weaknesses of the FPOs as also the opportunities and threats faced by it so as to suggest suitable policies to improve the functioning of the FPOs in Telangana state in particular and country in general.

MATERIALS AND METHODS

The primary data was collected from members of 4 FPOs from Janagaon and Siddipet districts of Telangana. The sample of 15 members was drawn from each of the two blocks selected within a district with a total sample size of 60 farmers. The primary data were also collected from officials of 4 FPOs. Like most of the FPOs, these were also formed with the help of promoting institutions like CSA, CROPS and ADS. Therefore, the data were collected from officials of promoting institutions that helped in formation of sample FPOs. The data were also collected from the officials of the line departments *i.e.,* agricultural and horticultural departments. The officials of NABARD, SFAC and local banks were also interviewed to know their perceptions about FPOs. The sample FPOs which were intensively studied *viz.,* Enabavi Producers Cooperative Ltd (EPCL), CROPS Farmer Producer Company Ltd. (CFPCL), Suraksha Farmer Producer Company Ltd. (SFPCL) and Kotilingala Farmer Producer Company Ltd. (KFPCL). Except EPCL, all other sample FPOs were formed recently in 2016.

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RESULTS AND DISCUSSION

The basic profile of sample FPOs are depicted in Table 1. KFPCL was found to have drawn members from highest number of villages (14) compared to other sample FPOs under study. Equity base was found to be highest (Rs. 5.9 lakhs) in SFPCL and lowest (Rs. 59 thousand) in EPCL. It was observed that equity capital is positively related to number of members of FPOs. SFPCL is performing well with a turnover of Rs. 15 lakh while CFPCL was still under the formation stage, with no trading activity undertaken till date.

The most important crops advocated by FPOs are vegetables, cotton and paddy. Office space is found to be available with all the sample FPOs. Grading facilities were found to be available with EPCL and SFPCL. The KFPCL was the only one having the storage facility to meet the requirements of regular supply of agricultural inputs to the member-farmers. However, none of the FPO had infrastructure facilities like processing, cold storage, vehicles/ transportation to expand their business networks and move up in the retail chains through vertical integration of the available markets.

In a short period of time the FPOs have developed extensive forward and backward linkages which are presented in Figure 1. The FPOs procure the vegetables, cereals and pulses from member farmers. The member farmers bring farm produce to collection centres located in adopted villages where it is aggregated by FPOs. NABARD and State Agriculture Departments have provided funds to take up business activities. The FPOs are beneficiaries of various government schemes like *Paramparagat Krishi Vikas Yojana* (PKVY), Seed Village Programme etc. FPOs procure fertilizer from IFFCO to ensure timely availability of inputs to the member farmers. Seeds suitable for organic cultivation are procured from the promoting institutions like Centre for Sustainable Agriculture, who are involved in seed production and research. The FPOs seek assistance of Department of Agriculture, Telangana for technical advice and in coordination with them organize the extension meetings, farmers' field schools etc.

The FPOs of the region have developed deep seated forward linkage with processors who produce pickles, jam, cookies etc. The perishable farm produce like vegetables are directly marketed in the organic retail stores. Organic retail stores are established by the federation of producer companies like Sahaja Aharam Producer Company Ltd (SAPCL) which collects farm produce of various FPOs of 3 states namely Telangana, Andhra Pradesh and Maharashtra. The FPOs also take up organic certification for their beneficiaries through Participatory Guarantee

Table 1: Basic profile of sample FPOs

Particulars	EPCL	CFPCL	SFPCL	KFPCL
Year of registration	2008	2016	2016	2016
Membership status	51	385	541	455
Promoting institutions	CSA	CROPS	CSA	ADS
Sample districts of Telangana	Janagaon	Janagaon	Siddipet	Siddipet
No of villages linked	1	4	8	14
Schemes	SVP	PKVY	PKVY	ICRISAT
Equity base (Rs)	51000	385000	595100	300700
Turnover (Rs)	455000	-	1500000	625000
Crops concerned	Vegetables, Cotton, Redgram, Paddy etc	-	Vegetables, Cotton etc.	Maize, Cotton, Paddy, Red gram etc.
Facility available				
Office space	√	√	√	√
Grading facilities	√		√	
Storage structures				√
Supporting staff	√		√	

Note: *CSA- Centre for Sustainable Agriculture, CROPS- Centre for Rural Operations Programmes Society, ADS -Access Development Services, SVP- Seed Village Programme, PKVY- Paramparagat Krishi Vikas Yojana, ICRISAT assistance for watershed activities.*

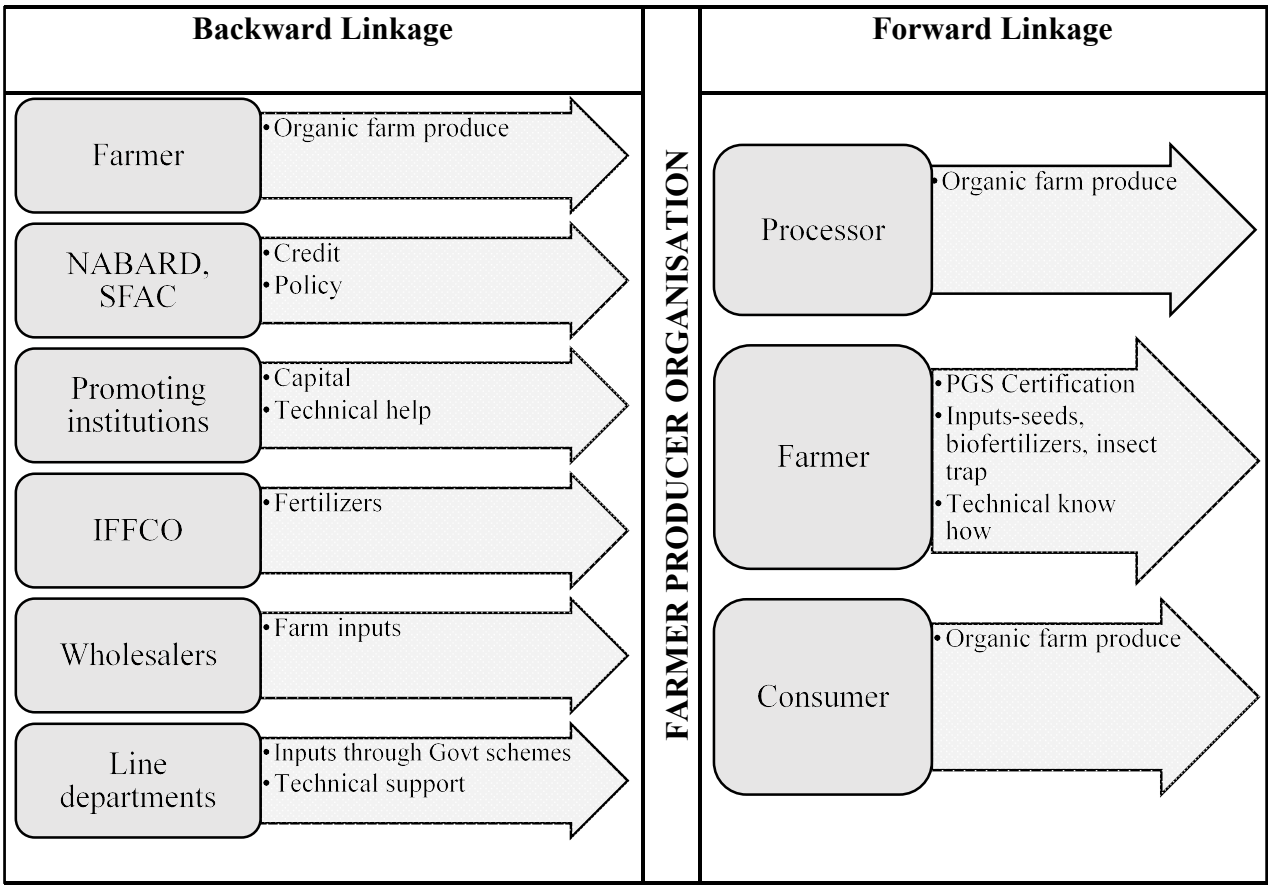

Figure 1: Backward and forward linkage of FPOs

Scheme (PGS) because of involvement of exorbitant costs in other systems of certification. Sale of inputs like seeds, fertilizers, bio- pesticides etc. are also undertaken looking into the needs of the farmers.

The various services offered by the sample FPOs are presented in Table 2. The perusal of the table reveals that leasing of machinery and marketing of seeds, fertilizers and other inputs are done by most of the FPOs. The FPOs like EPCL and SFPCL promote organic cultivation by arranging for supply of manures, bio-inputs, composting kit, pheromone traps, organic certification, grading of farm produce etc. Bulk procurement of vegetables and food grains were practiced by most of the FPOs. Productivity enhancing activities like extension meetings ahead of the season, regular field inspections along with technical advice to the farmers are offered by all the FPOs except CFPCL. However, exposure visits are effectively planned by EFPCL with the aid of promoting institution.

Except one FPO all others are still in formative stage. However, all the FPO members were initially members of cooperative society which is now rechristened as FPO. Therefore, the members have the experience of working in group which is a big strength for the FPOs. Since these FPOs are new, they are focusing on assisting farmers with supply of inputs and procurement of produce and in marketing the same. These FPOs are looking for funds from external sources for starting the processing facilities

Table 2: Services offered by the sample FPOs

Particulars	EPCL	CFPCL	SFPCL	KFPCL
Marketing of Seeds	√		√	
Leasing of machinery		√		
Distribution of DAP fertilizers				√
Arrangements for manures	√		√	
Distribution of bio-inputs	√			
Marketing of composting kit	√			
Marketing of pheromone traps	√		√	
Bulk procurement of final produce	√		√	√
Grading of final produce	√		√	
Conducting extension meetings	√	√	√	
Organic/export certification	√		√	
Field inspections/supervision		√	√	
Exposure visits to model farms	√			

so as to do value addition and market value added products.

The government schemes should be routed through FPOs which will serve as incentive for other famers to join FPOs. Larger is the membership more is the equity base and larger is size of business of FPOs. The FPOs have developed extensive forward and backward linkages with line department, input delivery agencies, processors, etc. The linkages need to be strengthened so as to increase the volume of business and reduce transaction cost.

Organizational structure of FPOs

Figure 2 represents the organizational structure of the sample FPOs in the study area. Farmers are the owners of the producer organization, contribute to individual share capital, procure inputs and market produce through FPO. Board of Directors are elected or selected by members (initially) who take important business decisions of the organization. Promoting institutions like CSA, ADS and CROPS have helped in formation of FPOs and provide technical advice and offer financial resources for effective functioning of FPOs (Manaswi *et al.,* 2019). The Chairman and CEOs are the key players in the organization. CEO regularly inspects the farms of the members, give them the required information regarding production, sources of inputs and marketing of the final produce. In the study area, it was found that CEO of the organization was relatively amore-educated youth rather than a professional graduate with agricultural degree.

FPOs have three departments namely production & inputs supply, marketing and finance. The three departments are headed by production and storage officer, marketing officer and audit officer who supervise the various activities of FPOs. The procurement, storage and distribution of inputs is done by the production and input supply department. It provides technical support and encourages farmers to take up organic certification under the framework of Participatory Guarantee Schemes. The marketing department procures the farm produce like vegetables on weekly basis and field crops at the end of the season. The farm produce is marketed through innovative marketing channels. The proceeds are credited to the bank accounts of the members thus ensuring the higher price realizations and lesser transaction costs in

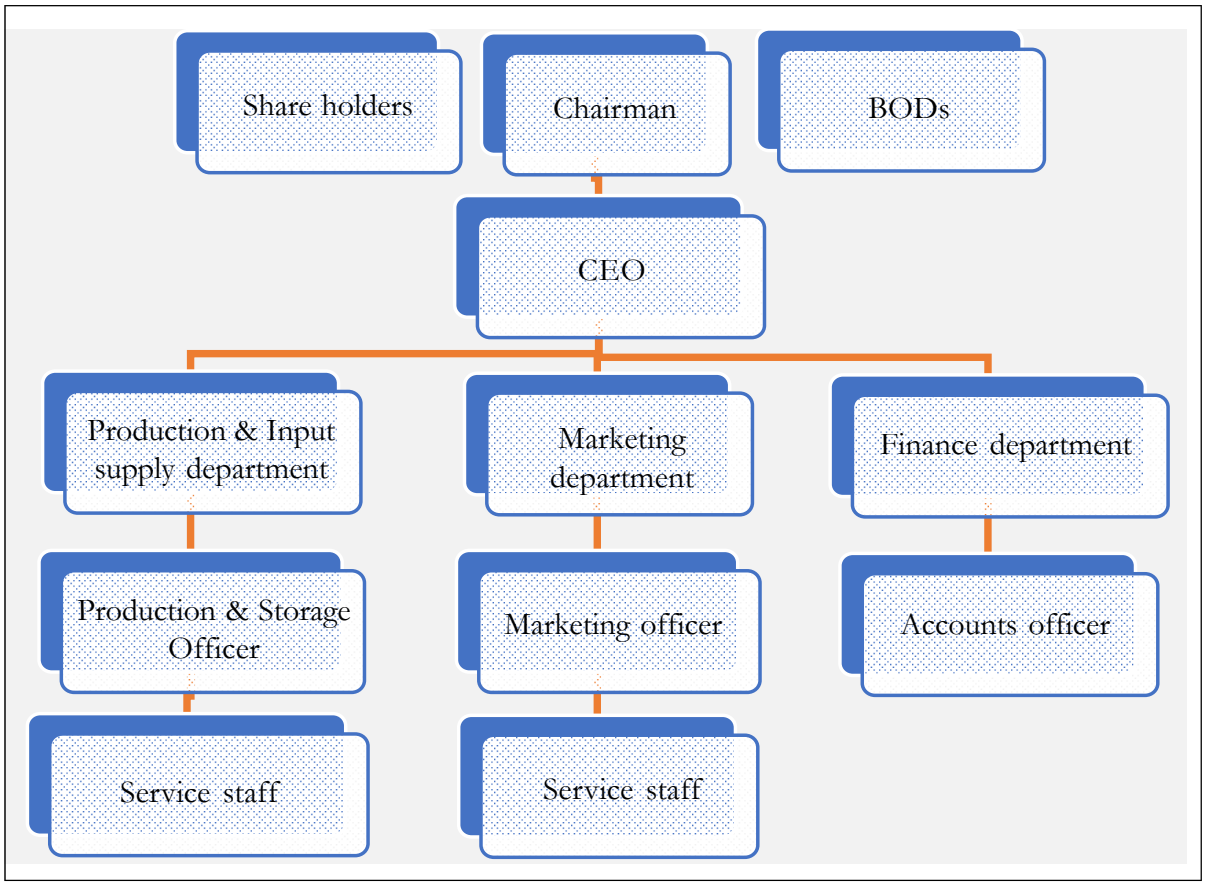

Figure 2: Organisational structure of the FPOs

marketing of produce. The finance department deals with the issue& receipts of cash and maintenance of accounts of FPOs. A few of services like annual audit and balance sheet preparation and filing of tax is usually outsourced to professional agencies or to retired chartered accountants. Thus, various activities of FPOs are dealt by specialized departments which are lean, efficient and generally managed by locally recruited personnel.

SWOT analysis of the sample FPOs: To analyse the performance of the sample FPOs in the study area, SWOT analysis is employed to understand the intricacies involved in functioning and performance of FPOs in Telangana. The internal (strength and weakness) and external (opportunities and threats) aspects of FPOs were analysed and are presented in Figure 3.

Strengths: It comprises of the internal characteristics and resources that contributes to successful functioning of an organization.

A. Direct marketing of fresh produce: FPOs undertake the marketing of fresh produce of vegetables and fruits directly to consumers. Indents are given to the farmers, a week before to supply the specified quality and quantity of the produce. The fresh and superior quality of produce is transported to Hyderabad where it fetches a higher price than the local markets. The brand value of *'Sahaja Aaharam'* allows for quality control and better prices. The number of intermediaries are reduced and the producers share in consumer's rupee increased from 53 to 65 percent (Manaswi, 2018).

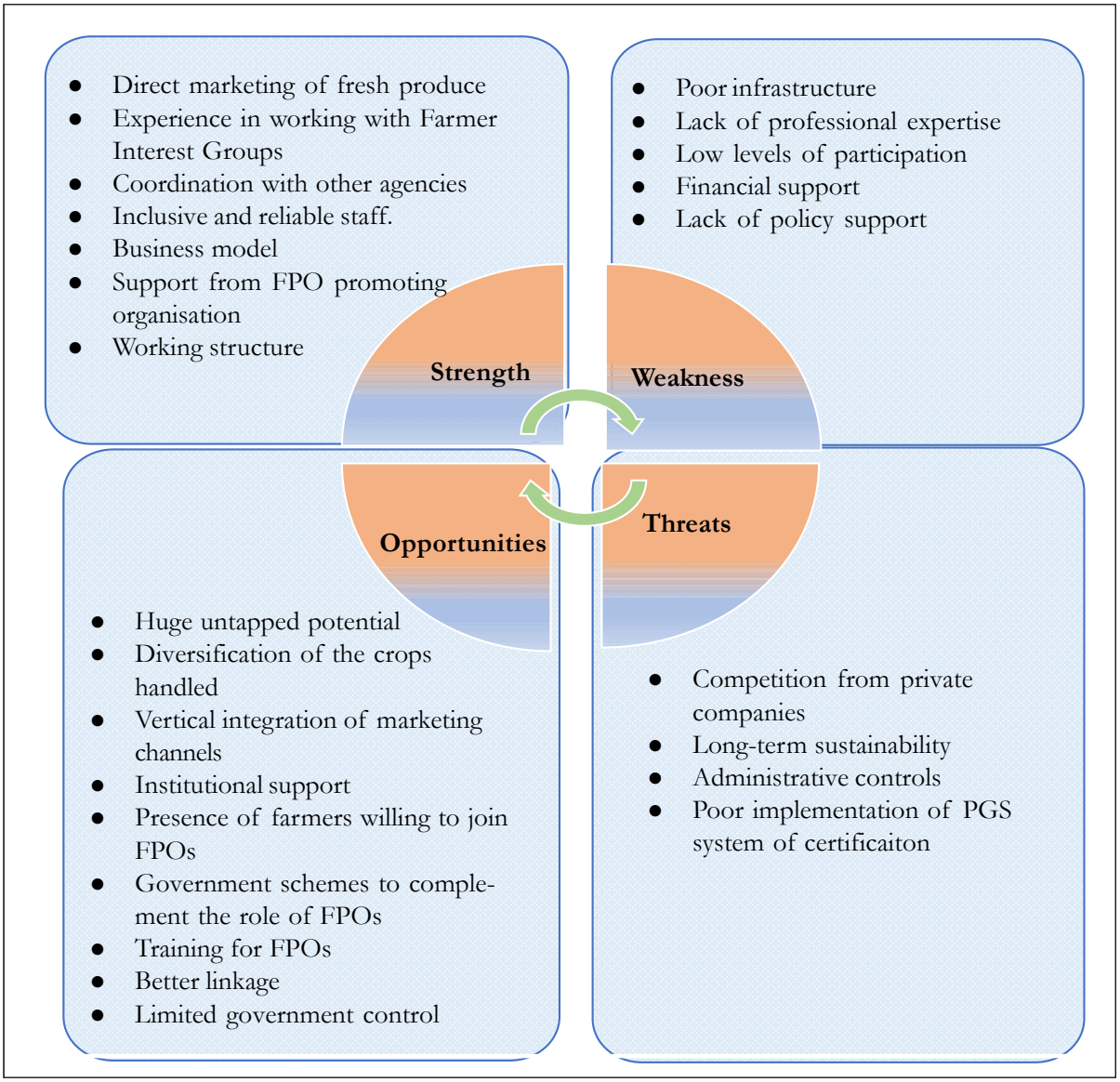

Figure 3: SWOT analysis of the sample FPOs in the study area

B. Experience in working with Farmer Interest Groups: NGOs like Center for Sustainable Agriculture and CROPS were instrumental in formation of FPOs in the study region. These agencies have rich experience in facilitating NPM (Non-Pesticidal Management) practices, organic farming, watershed development programme, mutually aided cooperative societies, *etc.,* that involves mobilizing farmers into groups for undertaking programme intervention work. Thus these NGOs have good understanding of cultural ethos of the region and help them in formation of FPOs. The intervention of local NGOs ensured timely supply of the farm inputs, procurement of farm produce, grading and increases motivation of the farmers in functioning of the FPOs.

C. Coordination with other agencies: Farmer producer organizations have entered into agreement with agencies like IFFCO and wholesalers for bulk supply of fertilizer, bio-pesticide, seeds, pheromone trap, etc. FPOs sought support of line departments like agricultural department, horticulture department, department of animal husbandry, *etc.,* working at mandal and village level for provisioning of technical advice, conduct of training for member farmers. The FPOs are able to seek the benefit of many government programmes like PMKVY, RKVY, etc.

D. Inclusive and reliable staff: Well trained and skilled personnel are required to manage the diversified activities of FPOs. In addition, well trained conveners of NGOs, Community Resource Persons (CRPs) also provide technical guidance to FPOs. FPOs are able to manage the affairs with the help of member farmers. This way the FPO is able to minimize the cost and maintain efficiency of the organization. The stakeholders work with greater zeal and passion so that collectively they win.

E. Business model: FPOs work on well-defined business model which is prepared in consultation with the member farmers. The farmers become oriented towards cultivation of crops as per the demand from the market. The member farmers strive to realize maximum price for the produce by maintaining quality, grading of produce, proper packaging, *etc.* The FPOs are overcoming the supply chain deficiencies in supply of perishables and high nutrition foods. The FPOs have been able to make farm-gate economies of scale through building up of crop specific production centre in terms of organic *chilli* or pulses.

F. Support from FPO promoting organization: The FPO promoting organization *i.e.,* Center for Sustainable Agriculture (CSA)is active in bringing various FPOs of the Telangana on one platform (federation) and is instrumental in providing technical backstopping to their member farmers. It has opened a number of organic stores (with the brand name of 'Sahaja Aaharam') in Hyderabad for sale of produce procured from FPO members. The FPOs are leveraging collaboration to optimize supply side costs and services. Rohit et al (2018) emphasized that the proper attention should be provided in developing the supporting institution for smooth functioning of the agricultural operations by the farmers

H. *Working structure:* The Board Members, Chairman and Chief Executive Officers (CEOs) are all selected from the members and no outsider can take any post in company. It brings transparency, ownership and trust among the members. Also there are annual general meetings generally in six months in which all activities, transactions *etc.*, are revealed and discussed. All members have equal right to give their views about the functioning of organization, which strengthens the working structure of an organization (Deepa *et al.,* 2018).

The organizational climate in FPOs was found to be very conducive as all member farmers endorsed and fostered such values as group cohesion, organizational commitment and work motivation. All members worked towards enhancing social capital, social responsibility and collective accountability (through participatory guarantee scheme of organic farming) in their own FPOs.

Weakness: The internal characteristics of the FPOs hinder the successful functioning of the organization**.**

A. Poor infrastructure: FPOs of the study area suffer from poor infrastructure, which was the main factor hindering the expansion of their business. It was observed that FPOs depended on apex institutions like NABARD, SFAC, etc., for financial support. Due to strict documentation procedures and poor financial performance of the FPOs, they could not avail capital assistance from banking sector (Venkatesan and Sotankki, 2017). Despite the FPOs being included in the priority sector the banks are not willing to lend credit support, as these FPOs possess poor risk management mechanisms.

B. Lack of professional expertise: It was observed that none of the employees had formal education in agriculture or business. The relatively better educated youths from among the farming community managed the day to day affairs of FPOs. External help from the promoting

institutions is essential for disposal of various services of FPO. The village youth lacked skills in grading vegetables, book keeping and financial management skills.

C. Low levels of participation: The members of FPO were found not to be actively participating in various activities of the organization. It is also observed that many of the farmers lack awareness that they are the owners of FPOs and hence they do not assume themselves as owners. This hinders the business potential and poses a big threat to sustenance of FPOs. This lack of sense of ownership hinders achievement of excellence, diversification and economic growth in their FPOs. Roy et al (2018) found the need of more technological backstopping and infrastructural assistance along with capacity building programmes for the self realization and enhancing decision making abilities among the women participants.

D. Financial support: The producer companies, when formed, are supported by NABARD or the public/private agencies for three years. However, with withdrawal of support after three years the sustenance of FPOs become difficult. The FPOs need longer term handholding of FPO promoting institutions to be able to overcome the initial hurdles of operation and management of FPOs.

E. *Lack of policy support:* The producer companies face difficulties in initiating any new business activity due to unavailability of license. Also, banks refuse to lend to these companies due to lack of guarantees from either Central or State Governments (Murray, 2009 and NRRA, 2009, Deepa *et al.,* 2018). Policy is also lacking on FPOs' growth, expansion, diversification, and capital wealth formation in rural areas.

The FPOs of Telanagana are marred by a number of hindrance inherent in FPOs in general. The liberal provisioning of capital is very important for expansion of business and making it a sustainable business entity.

Opportunities: They are the external factors that an organization can use to give itself a competitive advantage over its peers. Opportunities create the favourable environment or reduce the obstacles in functioning of an organization to have an edge over its competitors.

A. Huge untapped potential: It is observed that the FPOs were functioning in 1-14 villages and have membership ranging from of 51 to 541 (Table 1). There is great potential in mobilizing more farmers to enroll as members of FPOs and reap greater benefits.

B. Diversification of the crops handled: Vegetables and pigeon pea were the major crops which were procured from the beneficiaries by the FPOs. But there lies a huge potential of extending this service to other food grains and cotton crops. Licenses can be obtained to trade different crops in local APMC markets. SFAC used the FPO network to procure pulses at MSP.

C. Vertical integration of marketing channels: Producer organizations can develop into an effective business entity if they are supported in a holistic manner. None of the FPOs surveyed, have established either the processing and or cold storage facilities. They are still struggling with the primary activity i.e., marketing of the farm produce. Some FPOs like SFPCL are planning to establish pulse processing units which can increase their turnover and the market share.

D. *Institutional support:* NABARD and SFAC are taking lead role in formation and smooth functioning of FPOs. These institutions have engaged a number of FPO promoting institutions for formation and handling of FPOs. Thus a very good institutional ecosystem has been established for development of FPOs. Government policies are very favourable towards promotion of FPOs. It has recently brought out a law to absolve the FPOs from being taxed in their formative stage. Collectivization in the FPO is a very apt option to enhance access to inputs (at low whole sale prices), value addition and processing, and sale of processed food products (at high retail prices).

F. *Presence of farmers willing to join FPOs:* The farming sector in the country comprises predominantly of small and marginal farmers. The small holders face the problem of access of credit, technology and right kind of inputs. Their access to better market is limited making the farming unprofitable. These are class of farmers who are willing to come together under the cover of FPO to exploit economies of scale and reduce transaction cost and reap a better share of consumer rupee.

G. *Government schemes to complement the role of FPOs:* Infrastructure gaps needs to be addressed immediately such as requirement of collection centers, grading centers, pack houses, cold stores, primary processing, ripening chambers, pre-coolers, mobile vending carts and vehicles. To bridge the gap, these infrastructure requirement needs to be linked with MIDH and various other government schemes. The possibility of dovetailing the existing and new schemes of the governments like

RKVY, NHM, NFSM, *etc.,* with the activities of producer companies for effective delivery of such programmes as well as raising the funds for producer companies as done by IOFPCL in Kerala with NHM may be explored (NRAA, 2009 and Venkatesan and Sontakki, 2017).

H. *Training of FPO staff:* The staff of Farmer Producer Organizations needs to be trained on suitable business practices

- Localised project management and maintenance to upkeep its infrastructure
- Contract and Commercial negotiation practices
- Best practices in Post-harvest handling of target produce.

The training could be provided by institutions like MANAGE, Hyderabad, NAARM, Hyderabad, SAUs, KVKs and by promoting institutions.

I. Better linkages: As they are private entities, producer companies can link with other private companies for support and better marketing. For example, MRIDA linked their women members with Jaypore and Pero clothing companies. They made cotton bags for them and earned Rs. 6-7/ bag, whereas they would have got Rs. 1-2/bag in Bareilly. Thus, they made Rs. 5000-6000/month from their work.

J. *Limited government control:* The producer companies have limited government interference as they are autonomous, and thereby free to operate under their own terms and conditions. They can take over the responsibility of any one or more activities in the value chain of the produce, right from procurement of raw material to delivery of the final product at the ultimate consumers' doorstep which will benefit the members.

Telangana offers good opportunity for growth of FPOs. The biggest opportunity is the farmers who have demonstrated themselves to work in group as evidenced from good performance of programmes like Self Help Groups, Cooperatives, etc. The farmers have understood the ill effects of use of chemicals in agriculture. The farmers were willing to shift to organic cultivation which is amenable to group activity (Prabu, 2013). There exists opportunity to use the government scheme for the benefits of members of FPOs.

Threats: They are the external factors that have the potential to harm an organization.

A. Competition from private companies: Two of the sample FPOs *i.e.,* EPCL and SFPCL market the vegetables produced by members in Hyderabad where many private retailers provide tough competition for the market share. Involvement of higher transportation cost increased the sale price of farm products which is fraught with competition from large retailers and supermarkets.

B. Long-term sustainability: FPOs were dependent on external source of finance for business expansion. FPOs were not self-sustainable as they realize low profit margin for various business activities undertaken and marketing of produce and were not self-sustainable. The FPOs should invest in grading and packaging improved transportation model so as to realize higher price. Focus on niche markets within the metropolitan cities to realize better price. Long-term sustainability is doubtful if the government support is not extended to these organizations.

C. Administrative controls: The rich and relatively large farmers were at the helm of affairs of FPOs. This can pose a big threat to the functioning of FPOs since, it may hinder the participation of other small farmers. FPOs should evolve more provisions for small farmer participation for effective functioning of the business organization.

D. *Poor implementation of PGS system of certification:* The existing certification systems for organic food are cumbersome, time consuming and expensive. Paramparagat Krishi Vikas Yojana (PKVY)-the Centre's free certification programme for organic farmers is simple to understand and implement. However, the assessment of PKVY scheme reveals that all states, except Tripura, Odisha and Karnataka, have failed to utilize even 50 per cent of their funds under the scheme. While the Centre has increased allocation for the scheme by 44 per cent, the states should take adequate measures so as to improve the performance of the PKVY scheme and contribute toward "organic India" (Pandey and Sengupta, 2018).

There is looming threat from retail chains for market share which can be overcome through focus on creating niche markets, working on specialized products like organic foods, brand creation and brand building. Focus should be on grading, packaging and developing efficient value chains. The FPO should be on toes to adopt the latest technology for product, processing, and marketing to beat the competition.

Suggestions for improving the functioning of FPOs: Promoting institutions opined that the performance of

Table 3: Suggestions by promoting institutions

S.No.	Suggestions	Garrett Score	Rank
1.	More funds and subsidies through various schemes	3.51	1
2.	Reduce the documental procedures in the functioning of FPOs	3.32	2
3.	Easy funding from SFAC and NABARD	2.98	3
4.	Frequent training for the officials of NGOs	2.71	4
5.	Tax concession for the products traded through producer companies.	2.64	5
6.	FPOs can be extended with license to trade in APMC	2.12	6
7.	Improve market information systems	2.08	7
8.	Facilitation of norms with respect to export and branding	1.82	8

FPOs can be improved through the government support in the form of funds/grants and subsidies (Table 3).

Necessity for such financial support is felt more at later stages of FPOs for expansion, growth and diversification. Easy funding from SFAC and NABARD would strengthen the FPO movement and transform Agrarian scenario. Other major suggestions were to reduce the documentation procedures for formation and operation of FPOs.

The member farmers were of the view that FPOs should organise more of training and extension services on a regular basis (Table 4). The government schemes if it comes through FPOs would reduce transaction cost in availing benefits of such schemes. They would come to know about the schemes very quickly and adoption will be hassle-free. They were also of view that the FPOs should be encouraged to open retail stores in major cities so that they are able to access niche markets and get a better share of final consumer's rupee.

Benefits from joining FPOs: The benefits derived by farmers on association with FPOs was in the form of technology adoption, access to market and credit. The beneficiary farmers opined that higher price realization was the major benefit of joining the FPOs. The assured market with higher price realization increased the net income of the farmers (Table 5). The beneficiaries are less prone to erratic price fluctuations which are common in case of vegetables. Timely availability of input is the other important benefit which the farmers perceived after joining the FPOs. The farmers were receiving training and extension service from highly qualified personnel of state department of Agriculture, SAUs, KVKs, etc.

Table 5: Benefits as perceived by beneficiaries of FPO.

S.No.	Benefits	Average Score	Rank
1.	Higher price realization	69.42	1
2.	Timely availability of inputs	66.21	2
3.	Extension services	65.02	3
4.	Higher quality of inputs	62.84	4

CONCLUSION AND WAY FORWARD

The evaluation of FPOs was done using the primary data of members of four FPOs from Janagaon and Siddipet districts of Telangana. Most of the FPOs were formed recently and were facilitating in marketing of farm produce of members. The FPOs had drawn members from a number of villages. In a short period of time the FPOs could establish a very strong backward and forward linkage. The SWOT analysis revealed that the FPOs of the

Table 4: Suggestions by beneficiary farmers

S.No.	Suggestions	Garrett Score	Rank
1.	Regular training for farmers regarding improved cultivation practices	68.43	1
2.	Inclusion of FPOs under schemes of line departments	67.20	2
3.	Exposure visits to successful FPOs	65.18	3
4.	Leasing of machinery should be promoted at the FPOs level	63.46	4
5.	Improve market information systems for easy trading through FPOs	59.84	5
6.	FPOs should be encouraged to open the retail markets at major cities	57.92	6

region were fortunate to have been supported by NGO like Centre for Sustainable Agriculture. The low level of participation ails the FPO as in other parts of the country. The FPOs could not build the infrastructure needed for value addition and processing. They also need support in the form of liberal provisioning of capital in order to create the infrastructure. The opportunities abound for the success of FPOs in the form of dovetailing of the government schemes so that the members of the FPOs reap the benefits. Such policy support would help the members farmers to come and work together. The proximity of institutions like NAARM, MANAGE could also be used to learn the finer skills for better management of the FPO as a business entity. The FPOs face competition from major retail chains for market share. This needs to be averted by focusing on areas were they have comparative advantage. The FPOs have created monopoly in organic food business through the help of the NGO Center for Sustainable Development. The farmers have been motivated to cultivate organic foods which is aggregated by the member FPOs which is further transported to the Hyderabad market through another FPO which is hand holding the small FPOs dispersed across Telangana. The members really gained from the FPO in terms of better price realization and having gained access to niche markets. The timeliness of availability of good quality inputs are other benefits as a result of joining of the FPO.

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Association of Socio-personal Attributes of the Beneficiaries with Impact of KMA

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ABSTRACT

Kisan Mobile Advisory (KMA) is one of the popular ICT initiatives which provide platform for location-specific and crop specific farm advisory services to the farming community. Like other extension interventions, the success of this mobile based intervention has also been administered by several social, personal, psychological, and communication factors. Keeping importance of these factors in view, a research study was conducted in Barwani district of Madhya Pradesh to assess the association of socio-personal and psychological attributes of the beneficiaries with impact of KMA. The study was carried out on a sample of 140 beneficiaries of KMA programme of KVK, Barwani. Data were collected through personal interviews of respondents with the help of a structured interview schedule. The study concludes medium level of overall impact of Kisan Mobile Advisory based on the perception of beneficiaries. It can be summarized that the variables namely size of land holding, size of family, annual income, use of information sources, accessibility pattern of modern mass media, contact with extension workers, innovativeness, economics motivation, scientific orientation, and risk orientation had significant relationship with impact of Kisan Mobile Advisory at 0.05 level of probability whereas variables namely age, education, caste, type of land holding, type of family, social participation and sources of annual income had non-significant relationship with impact of Kisan Mobile Advisory.

Keywords: KMA and Socio-personal attributes

INTRODUCTION

Introduction of cell phone or mobile phone, as called popularly, is a major turning point in the communication revolution in all spheres of life. Kisan Mobile Advisory (KMA) is one such initiative of ICT which provides location-specific and crop specific farm advisory services and facilities to the farming community. KMA has been considered as a communication service by which messages are being provided in the form of SMS through KVKs. Main features of KMAis multi-language support through SMS facility (160 characters) and sending of two SMS in a week based on urgent local needs covering all important components of farming like crop production, horticulture, plant protection & animal science etc.

With the start of the service during last decade, it has been expended rapidly in different districts through Krishi Vigyan Kendras (KVKs). Presently, Kisan Mobile Advisory (KMA) is becoming one of the largest ICT initiatives in Madhya Pradesh for providing need based and regular farm advisory services to the farmers in shortest period of time. KMA delivers real-time based agricultural information and customized knowledge to improve farmers' decision making ability so that they are able to increase their production and productivity, better aligning the farm output to market demands; securing better quality and improved price recovery. Like any other extension intervention, the success of KMA has been administered by several social, personal, psychological, and communication factors. Keeping the importance of these factors in view, a research study was conducted in Barwani district of Madhya Pradesh to assess the association of selected socio-personal attributes of the beneficiaries with impact of KMA.

MATERIALS AND METHODS

Locale of the Study: The study was carried out in Barwani district of Madhya Pradesh. Barwani district is one of the

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tribal dominated districts of Madhya Pradesh. Barwani district is spread in an area of 3665 km^2. The total population of the district on the basis of 2011 census is 1,385,659. The temperature of Barwani during April and May goes as high as 48^{o}C making it one of the hottest places of India. The district consists of seven blocks; hence the sample of the study was drawn from all seven blocks viz.; Barwani, Thikri, Pansemal, Newali, Rajpur, Pati and Sendhwa.

Sampling Procedure: KVK Barwani has been implementing KMA programme in the district since last eight years. An inclusive block wise list of registered 5350 KMA beneficiaries was collected from KVK, Barwani to draw the sample. The number of respondents from each block of the district was decided from list of KMA beneficiaries following proportionate random sampling method with the formula given below.

$$n_h = \frac{N_h}{N} X\ n$$

Where,

n_h = sample size for stratum h

N_h = population size for stratum h

N = total population size

n = total sample size

Systematic random sampling method was adopted to draw the sample from the block wise list of beneficiaries of KMA. Thus, a sample of 140 beneficiaries of KMA programme of KVK, Barwani served as respondents of the study.

Association of socio-personal attributes of the beneficiaries with impact of KMA: The impact of KMA was assessed as per the responses of the selected beneficiaries on various parameters like need of message, understandability of message, subject matter covered, applicability of message, cost effectiveness and horizontal spread of message by the beneficiaries. The responses were collected on three and five - point continuum as per questions framed above parameters. The score of respondents on set parameters was obtained to assess the impact. To ascertain the overall impact of KMA, the respondents were categorized in to three categories viz. low, medium and high on the basis of mean and standard deviation of total score (cumulative) given by the respondents in all parameters of impact. The three categories further given scores i.e. 1, 2 and 3, respectively for establishing relationship with socio-personal attributes.

Correlation coefficient (r) value was calculated to assess the relationship of socio-personal attributes of the beneficiaries with impact of KMA. Coefficient of correlation is a measure of strength and direction of the linear relationship between two variables that is defined as the sample covariance of the variables divided by their product of their sample standard deviations. The coefficient of correlation values ranges from -1.00 to +1.00. It was calculated with following formula;

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)2][ny^2 - (\sum y)2]}}$$

Where,

n = number of pairs of scores

Σxy = sum of the product of paired scores

Σx = sum of x scores

Σy = sum of y scores

Σx^2 = sum of squared x scores

Σy^2 = sum of squared y scores

RESULTS AND DISCUSSION

The data presented in Table 1 exhibit that out of 140 respondents, 43.57 percent belong to young age group, 35.71 percent were from middle age group and only 20.72 percent were from old age group. These findings are similar to the Shaik (2008) and Agrawal *et al.* (2014).

Maximum respondents (28.57%) received education upto high school level followed by 16.43 percent who were educated up to middle level. It is notable that 14.28 percent respondents found to be in no formal education group whereas 13.57 percent had primary level education and 15 percent were educated up to graduation or above. A total of 12.14 percent respondents were educated up to higher secondary level. The findings of Sen (2008), Ganesan *et al.* (2013) and Agrawal *et al.* (2014) also on similar trend.

The highest number of respondents (36.43%) belong to SC/ST category followed by other backward castes (32.85%) and 30.72 percent of them come from general caste category. As far as family size is concerned, more than half of the respondents (50%) live in medium sized family followed by small (31.43%). Only 18.57 percent of the respondents live in large family. Similar result was reported by Agrawal *et al.* (2014).

Majority of the respondents (53.57%) living in joint family followed by nuclear family system which was considered an urban phenomenon earlier. More than one fourth (28.58%) respondents were completely dependent on agriculture for their income followed by those 24.28 percent respondent who earned their livelihood from agriculture as well as self-employment. One out of five respondents engaged in agriculture and service of some kind. The respondents were divided in to four groups on the basis of land holdings. It is clear from the data that maximum number of respondents (37.85%) has small followed by medium size of land holding (35%) whereas respondents with marginal and large size of land holding are equal i.e. 13.57 percent. Similar results were reported by Kanal (2005) and Agrawal *et al.* (2014).

About two third (66.43%) of the respondents had irrigated land while only 33.57 percent are having non-irrigated land holding. It is evident from the data that about half of the respondents (48.57%) categorized in low income group followed by medium and high income groups. The findings of the study are in line with the results reported by Kumar *et al.* (2011) and Kumar (2014).

It is clear from the data that a vast majority of respondents (70%) had active participation in social institutions which is good sign of social awareness. Out of social participants, 24.28 percent are office bearers in some social institutions. As far as frequency of participation in formal meetings/gatherings is concerned, the attendance is fairly high as about two-third of them had participation regularly or occasionally. 42.86 percent had medium level social participation whereas about one third of them (37.76%) showed high level of social participation. It is notable that rural extension officer followed by demonstrations, friends/neighbour/relative and agricultural magazines are still preferential sources of information regularly used by the respondents. When asked about frequency of contact with extension workers, the respondents preferred functionary from horticulture department over agriculture and animal husbandry. It is very interesting to notice that private input dealer is at par with the agricultural scientists in terms of frequency of contact that may be due to regular availability of local dealer when needed as compared to the scientists who look after relatively larger area. As far as availability and exposure of modern mass media to the respondents is concerned, there is a clear lead towards regular use of mobile phone followed by television and newspapers (Table 1).

Table 1: Socio-personal attributes of the respondents

Category	Frequency	Percentage
Age		
Young (upto 35 year)	61	43.57
Middle (36 to 50 year)	50	35.71
Old (Above 50 year)	29	20.72
Education		
No formal education	20	14.28
Primary	19	13.57
Middle	23	16.43
High School	40	28.57
Higher Secondary	17	12.14
Graduation & above	21	15.00
Caste		
SC/ST	51	36.43
Other Backward Caste	46	32.85
General	43	30.72
Land Holding		
Marginal (up to 1 ha)	19	13.57
Small (1 to 2 ha)	53	37.85
Medium (3 to 5 ha)	49	35.00
Large (Above 5 ha)	19	13.57
Type of land holding		
Irrigated	93	66.43
Non-irrigated	47	33.57
Family Size		
Small (up to 4)	44	31.43
Medium (5 to 8)	70	50.00
Large (Above 8)	26	18.57
Family Type		
Nuclear	32	22.86
Sub-nuclear	26	18.57
Joint	75	53.57
Extended	07	05.00
Source of Income		
Daily wage labour	15	10.72
Agriculture	40	28.58
Agri. + Animal husbandry	13	09.28
Agri.+ Animal husbandry + Poultry	10	07.14
Agri. + Services	28	20.00
Agri. + Self-employment	34	24.28

Table 1 contd.....

Category	Frequency	Percentage
Annual Income		
Low (up to 50,000)	68	48.57
Medium (50,001-1,00,000)	43	30.71
High (More than 1,00,000)	29	20.72
Extent of information sources used		
Low (up to 18)	23	16.43
Medium (19 to 24)	99	70.72
High (Above 24)	18	12.85
Contact with extension workers		
Low (up to 18)	27	19.28
Medium (19 to 23)	80	57.15
High (Above 23)	33	23.57
Exposure/availability of modern mass media		
Low (up to 15)	34	24.28
Medium (16 to 19)	81	57.86
High (Above 19)	25	17.86
Innovativeness		
Low (up to 12)	41	29.28
Medium (13 to 18)	73	52.15
High (Above 18)	26	18.57
Economic motivation		
Low (up to 13)	37	26.43
Medium (14 to 22)	74	52.85
High (Above 22)	29	20.72
Scientific orientation		
Low (up to 12)	38	27.14
Medium (13 to 20)	71	50.72
High (Above 20)	31	22.14
Risk orientation		
Low (up to 7)	36	25.71
Medium (8 to 10)	75	53.57
High (Above 10)	29	20.72

The findings indicate that more than half of the respondents (52.15%) shown medium level of innovativeness whereas 29.28 percent of them indicate low and 18.57 percent high innovativeness. More than half of the respondents (52.85%) had medium level of economic motivation while slightly more than one fourth of them (26.43%) showed low economic motivation and 20.72 percent were in high economic motivation category. Similar results were reported by Sandesh (2004) and Sharma (2000).

It is elucidated that 50.72 percent of respondents show medium level of scientific orientation followed by 27.14 percent who indicate low scientific orientation followed by 22.14 percent of those with high scientific orientation. The findings are in line with results reported by Ram (2005).

As far as risk orientation is concerned, it is clear from the data that 53.57 percent of respondents are falling under medium level whereas 25.71 percent had low level of risk orientation and about one fifth (20.72%) indicated high level of risk orientation. Similar findings are reported by Dhakar *et al.* (2013).

Impact was assessed on the basis of cumulative scores of the respondents on various parameters considered for impact assessment. The respondents were categorized (as per mean ± standard deviation) on the basis of their scores and presented in Table 2. It is evident that majority of the respondents i.e. 54.28 percent indicate medium level impact of KMA followed by those 22.86 percent who considered high as well as low impact of KMA. The findings of the study are almost in trend with the other fellow scientists like Saxena *et al.* (2011); Singh *et al.* (2011); Yadav *et al.* (2011); Parganiha *et al.* (2012); Dhakar *et al.* (2013); Singh *et al.* (2013); Kumar *et al.* (2014) and Patel *et al.* (2015) who worked on similar aspects/parameters of mobile based extension approach.

Table 2: Overall impact of Kisan Mobile Advisory

Category	No. of respondents	Percentage
Low (up to 47)	32	22.86
Medium (48 to 55)	76	54.28
High (Above 55)	32	22.86
Total	**140**	**100**

The correlation coefficient of each socio- personal, socio-economic, communication and psychological attribute with impact of KMAS as perceived by the respondents is presented in Table 3. The table illustrate the correlation coefficient values indicating the relationship of personal, socio-economic, communication and psychological characteristics of the beneficiaries with impact of KMAS. It is perceptible that the respondents' characteristics namely size of land holding, size of family, annual income, use of information sources, accessibility pattern of modern mass media, contact with extension

Table 3: Association of socio-personal attributes of the beneficiaries with impact of KMAS (n=140)

Characteristics/Attributes	Correlation Coefficient (r)
Socio-personal economic	
Age (X_1)	0.163
Education (X_2)	0.132
Caste (X_3)	0.116
Size of land holding (X_4)	0.209*
Type of land holding (X_5)	-0.037
Size of family (X_6)	0.212*
Type of family (X_7)	0.100
Source of income (X_8)	0.033
Annual income (X_9)	0.213*
Communication	
Information Sources (X_{10})	0.211*
Contact with extension workers (X_{11})	0.180*
Mass media exposure (X_{12})	0.213*
Psychological	
Innovativeness (X_{13})	0.200*
Economic motivation (X_{14})	0.170*
Scientific orientation (X_{15})	0.166*
Risk orientation (X_{16})	0.187*

*Significant at 5% level of probability

workers, innovativeness, economic motivation, scientific orientation and risk orientation had significant relationship with impact of KMAS at 0.05 level of probability. The result also depict that the characteristics namely age, education, caste, type of land holding, type of family, social participation and source of annual income had non-significant relationship with impact of KMAS.

CONCLUSION

The study concludes medium level overall impact of Kisan Mobile Advisory as per perception of beneficiaries. It can be summarized that the variables namely size of land holding, size of family, annual income, use of information sources, accessibility pattern of modern mass media, contact with extension workers, innovativeness, economics motivation, scientific orientation, and risk orientation had significant relationship with impact of Kisan Mobile Advisory at 0.05 level of probability whereas variables namely age, education, caste, type of land holding, type of family, social participation and sources of annual income had non-significant relationship with impact of Kisan Mobile Advisory. It is interesting to know that the, communication and psychological variables had positive and significant relationship with impact of KMA whereas socio-personal and economic variables are not significantly associated with impact of KMA. It might be due to beneficiaries of cosmopolite nature are innovative and using modern means of ICTs. The farmers with strong communication network may have more insight about KMA programme.

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Organic Agriculture and Sustainable Livelihood: Assessment of Different Organic Agriculture Systems for its Suitability to Family Farms of South-West India

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ABSTRACT

The study was carried out in Kerala state of India to assess contribution of organic agriculture to the ecological, economic and social sustainability of family farms of different organic agro-ecosystems of the state. Results showed that traditional homestead organic system as best in crop diversity with a diversity index (H) of 2.2 but, most advantageous system in terms of crop yield was certified organic farming system. In agro-ecosystem sustainability analysis certified organic farming system found benefited more ecologically (mean rank 95.37) and economically (mean rank 76.72). Also, organic-by-default system and traditional homestead organic system were identified as severely affected with lack of technological backup because of inaccessibility to information sources. In fact, though organic agriculture performed reasonably well to keep small family farms sustainable failure of the approach in meeting the social goals may negate its ecological and economic benefits as food is the basic human right worldwide.

Keywords: Family farms, Homestead organic farms, Land equivalent ratio, Organic agro-ecosystem

INTRODUCTION

The food basket of any country is served mostly by its small family farming units. The Food and Agriculture Organization (FAO) define family farming as means of organising agricultural, forestry, fisheries, pastoral and aquaculture production which is managed and operated by a family and predominantly reliant on family labour, both women's and men's (Garner *et al.*, 2014). There are about 570 million family farms around the world that occupy nearly 70-80 per cent of the world's farm land. These family farm holdings are responsible for about 80 per cent of the world's food production. Though about 59 per cent of these small farming units locate in two countries viz., China and India, family farms of several other countries also have significant role in ensuring the world food security. For instance, the share of family farming in the total agricultural production is 40 per cent from 25 per cent of the farmland in Brazil, 84 per cent from 78 per cent farmland in USA and 84 per cent from 47.4 per cent farmland in Fiji (FAO, 2014). In this way the global and national food security is closely tied to small family farming units. Estimations show that the world food supplies need to be increased by 70 per cent by 2050 to feed a population of nine billion (FAO, 2009). But, most of the conventional farms are already under high impact of chemical fertilisers and pesticides with an unsustainable consumption of natural resources. Currently, in every nine months, we consume what the planet's ecology can provide sustainably in any given year and from that point until the end of the year, we meet our ecological demand by liquidating resource stocks (Global Footprint Network, 2011 as cited by Mateo and Ortiz, 2012). For example, India occupy only 2.4 per cent of the world geographical area but the country uses 13 percent of the world's extracted water and 87 per cent of this is used for irrigation. But, the irrigation water use efficiency of the country is only 35-40 per cent in surface irrigation and 65-75 per cent

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when pumping groundwater (Global Harvest Initiative, 2014). In fact, agriculture is responsible for 70 per cent of global freshwater withdrawals worldwide (FAO, 2014) and if this trend continues the future agriculture is going to be challenged with severe natural resource constraints.

Different national and international studies emphasise on the need for a shift to a sustainable model that promotes good yields with better resource use efficiency and ecosystem services (McIntyre *et al.,* 2009; Foresight, 2011), with no further expansion of agriculture into natural forests (Khumalo *et al.,* 2012). Quite a number of innovative technologies and agricultural models have emerged in the past half century with a potential to improve the agriculture of poor countries but, that has not been reflected in creating a major poverty reduction in the developing countries (FAO, 2014). Because resource poor farmers need readily available and low-cost technologies suitable for their farm situations that can increase the local food production and farm income (Pretty *et al.,* 2006). Only those resource conserving agricultural models that aim for long term sustainability of rural livelihoods provide an opportunity to resolve the issues of feeding the world population through small family farms. Some researchers argue that organic agriculture has considerable potential for improving the circumstances of small holders in developing countries (Willer and Yussefi, 2007) as it eliminates their dependence on expensive chemical inputs (Mendoza, 2004); that in turn make them resilient to the input price shocks (Eakin, 2000).

The recent statistics on the trends in world organic agriculture shows that India ranks first in the number of organic producers (600,000) followed by Uganda (189,610) and Mexico (169,707). But, in terms of cultivable land under organic certification, India stands far below with an area of 0.5 million hectare. Though the total land under organic certification is 5.71 million hectares in the country only 1.49 million ha is under organic cultivation and the rest 4.22 million hectares is forest and wild area for wild collection of minor forest produces (APEDA, 2016). This shows that most of the organic producers in India own a very small piece of land to support their livelihood and needs support from the government to continue with their way of agriculture. The National Project on Organic Farming (NPOF) is operational since 2004 in the country and India declared its organic farming policy in the year 2005 with an objective to promote technically sound, economically viable, environmentally non-degrading, and socially acceptable use of natural resources in favour of organic agriculture. However, out of the twenty nine Indian states, two states viz., Kerala (a southern state) and Sikkim (a north eastern state) came up with their own state organic farming policies in the year 2007 and 2010 respectively in order to convert the whole cultivated area of state under organic agriculture. Among these two states, Kerala is famous for its small family farming systems called homestead farms that is considered as organic, self-sustainable and integrated farming system model. But, the variability in the farm management skills of organic farmer of different regions makes the way of practicing organic agriculture diverse in different localities.

A pilot study conducted in Kerala revealed that there are mainly four agriculture systems where organic farming technologies are being adopted in varying levels viz., traditional homestead organic farming systems, organic-by-default, uncertified organic farming system and certified organic farming system. Farmers follow the same year-old practices evolved before the advent of synthetic agrochemicals for conserving the natural resources in the traditional agriculture systems (Bennett and Franzel, 2013) whereas farmers are prevented to use chemical fertilisers because of its unavailability in the organic-by-default systems (Walaga, 2005). Localisation of safe food is the goal of the uncertified organic farming systems. But, in a certified organic farming system market orientation is too high as certification of organic products according to specific standards is largely a marketing strategy (Bennett and Franzel, 2013). Realising the need for a comparison between these four organic agriculture systems the study was carried out to explore the differential contribution of four organic agriculture systems in sustaining the family farms and the livelihoods of the family famers.

MATERIALS AND METHODS

Kerala, the southernmost state of India lies between north latitudes 8°18' and 12°48' and east longitudes 74°52' and 77°22'. The state that wedges between the Lakshadweep Sea and the Western Ghats occupies nearly 2.76 per cent of country's population. The unique climatic conditions of three natural divisions: lowland, midland, and highland allow farmers of the state to raise a wide variety of crops throughout the year. There were nearly 138 million farm households in Kerala operating in an area of 159.6 million hectare and 85 percent of them belonged to the small and marginal category (GoI, 2012). The study was conducted

during 2010-11 and adopted multistage random sampling procedure to select thirty small and marginal family farms each from the four organic agricultural systems. The four organic agricultural systems were selected from four agro-ecological zones locate in four districts of Kerala; traditional homestead organic farms from central midlands of Thrissur district, organic-by-default farms from the Palakkad plain and high ranges of Palakkad district, uncertified organic homestead farms from the southern midlands of Thiruvananthapuram district and certified organic homestead farms from the high ranges of Wayanad district (Figure 1). Tools used for data collection were personal interview and focus group discussion with the help of a semi structured schedule developed for the purpose. Cropping pattern, crop diversity and yield, farm management practices, and technology adoption pattern of the four organic agriculture systems were documented and analysed. We also studied farmers' perception on contribution of different organic or resource conserving technologies towards the agro-ecosystem sustainability and major technological and economic constraints associated with the four organic agriculture systems.

Crop diversity within each system was calculated using Shannon Index (H), the formula developed by Claude Shannon (Magurran, 2004).

$$H = \sum_{i=0}^{n} pi \ln pi \quad \text{... (1)}$$

Here, the quantity pi is the proportion of individuals found in the i^{th} species and ln pi is the natural logarithm of this proportion

Yield benefits of the four selected organic agricultural systems through mixed cropping were calculated using the Land equivalent Ratio (LER). It is the relative area of the pure crop or crops required to produce the same yield or yields of the same crop in an intercropping system (Mead and Willey, 1980). LER is an important tool for the evaluation of intercropping systems and formula used by Vanloon *et al.* (2005) was adopted for the study.

$$LER = \frac{\Sigma Y(P)_{Ci}}{\Sigma Y(M)_{Ci}} \quad \text{... (2)}$$

Here, the quantity $\Sigma Y(P)_{Ci}$ is sum of yields of each crop in the intercrop/mixed crop system and $\Sigma Y(M)_{Ci}$ is the yield of the same crop when they grown in the sole crop system.

Three dimensions of sustainability viz., ecological, economic, and social were considered; twelve parameters were used (Table 1) to assess the agro-ecosystem sustainability. Data analysis was carried out using SPSS 20

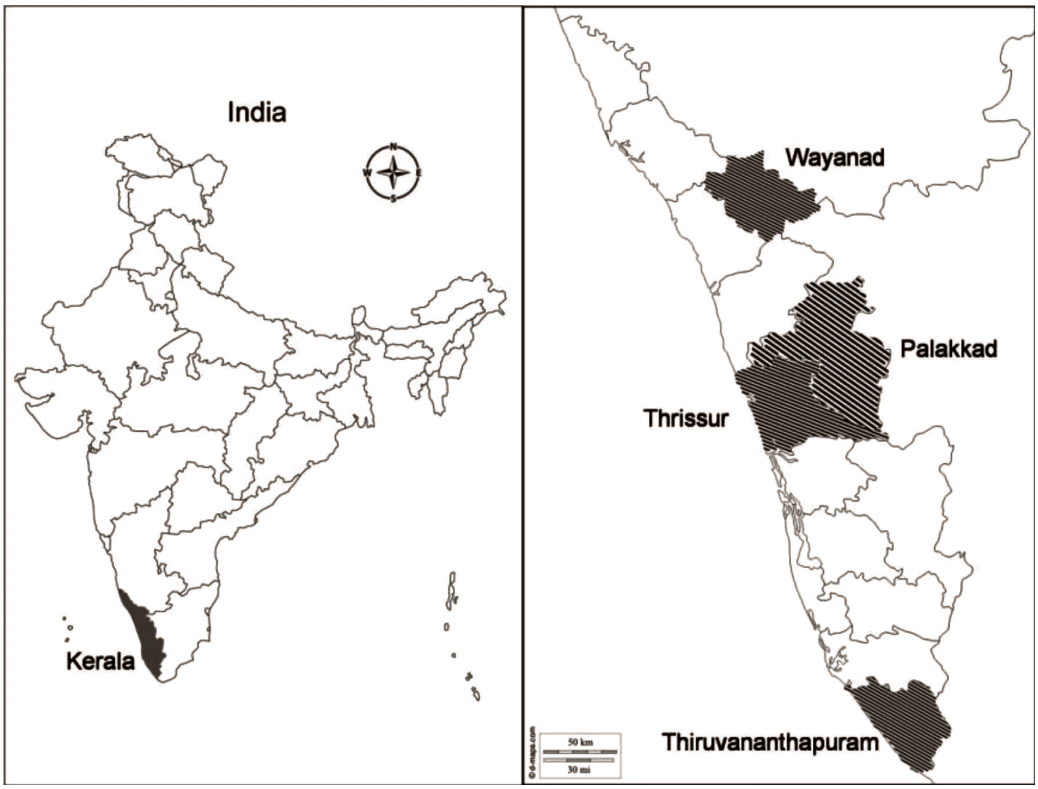

Figure 1: Map of India and Kerala State with study area and locations of the study site

Table 1: Parameters for the assessment of sustainability dimensions

Ecological sustainability	Economic sustainability	Social sustainability
Reduction in soil erosion	Reduction in cost of cultivation	Recognition of indigenous knowledge
Agro-ecosystem bio-diversity	Improvement in net farm income	Availability of chemical free food to the whole society
Improvement in soil health	Improvement in the standard of living of farm family	Localization of safe food at reasonable price
Recharge of farm resources	Generation of working capital for new enterprises	Inclusion of rural poor in the farming approach

software and XLSTAT software. Kruskal-Wallis test, a non-parametric alternative to one-way ANOVA with a multiple comparison procedure was used to test the significance of sustainability dimensions in the four organic agriculture systems. Also, to identify the severity of various techno-economic constraints in the four agriculture systems, Friedman's test, another non-parametric test was used. A correlation test (Spearman's rank correlation) was also carried out to find out the association of the rate of technology adoption with various socio-economic variables.

RESULTS AND DISCUSSION

Agro-ecosystem Characteristics

Cropping system and crop diversity: A mixed-multistoried and mostly rainfed farming model prevailed in the four agricultural systems studied. The traditional homestead organic farms and non certified organic farms had a coconut (*Cocos nucifera*) based cropping system whereas the organic-by-default, and certified organic farms had coffee (*Coffea* sp) based cropping system. These four systems were dominated by high value low volume crops like pepper (Piper nigrum), ginger (*Zingiber officinale*), turmeric (*Curcuma longa*), and arecanut (*Areca catechu*). The cropping intensity was also high in all the four organic agro-ecosystems and commercial crops were grown simultaneously with a number of fruit and vegetable crops in the family farms. The Shannon Index calculated to assess the crop diversity of each agro-ecosystem showed highest crop diversity in the traditional homestead organic farming system with a diversity index (H) of 2.2 followed by certified organic farming system (1.43), organic-by-default system (1.38), and uncertified organic farming system (1.2). Organic farms were reported to be rich in crop diversity earlier also and some of those researchers observed the dominance of home gardens for its highest plant diversity compared to other cultivated fields (Gajaseni and Gajaseni, 1999; Coomes and Ban, 2004). The Shannon index increases as both the richness and the evenness of the community increases (Magurran, 2004). Hence, the highest crop diversity index of traditional homestead organic system in our study proved the species richness and evenness of crop plants in the traditional homestead organic farms compared to the family farms of the other three organic agro-ecosystems. On the other hand, the crop diversity of small family farms might be considered as another measure of agro-ecosystem sustainability as it helps the farmer to withstand the seasonal fluctuations in agricultural produce prices.

Farm Management Practices: The organic-by-default system located inside a forest ecosystem was characterised by undulating slopes. Major soil health management activity was construction of temporary bunds against the slops using locally available materials like stones, and waste woods to prevent soil erosion. Tillage activities were almost zero in this system and there was no organic manures application. However, keeping the crop basins mulched with green as well as dried leaves throughout the year identified as a major activity. Even though farmers had not adopted any pest and disease management practices, the incidences of pest and diseases were observed to be low in this agro-ecosystem compared to the other three systems. The reason behind this phenomenon was already reported by some researchers as there would be enhancement of natural enemies and more effective biological control where wild vegetation remains in close association with crops (Altieri, 1994 as cited by Altieri and Nicholls, 1999). Since the agro-ecosystem located inside forest ecosystem diverse vegetation surrounding the farm field acts as alternate host plants and feed the insect pests (McNeil *et al.,* 2012). In the farms of traditional homestead organic system deep tillage practices were less because of high crop intensity however opening of basins for coconut palm was found to be a regular activity before the south-west monsoon (May-June) in order to enhance the infiltration rate of rain water into the soil. Mulching of these basins also done with green leaves of *Gliricidia maculate*, dried coconut husk and spathe (boat shaped structure covering the coconut inflorescence), dried leaves as well as the weeds removed from the interspaces by the

end of the south-west monsoon to conserve soil moisture. Benefits of mulching in improving the soil ecology and physicochemical properties of soil were well reported (Singh et al 2008, Muhammad *et al.,* 2009). In addition to enhance the soil fertility farmers adopted application of farmyard manure, poultry manure, goat manure, and wood ash in their farm fields. Cultural and mechanical management of insect pests and diseases recorded as another important activity of the traditional organic farmers. In the coffee based certified organic farming systems intercultural operations confined to 2-3 hand weeding in a year and opening shallow basins to apply organic manures. It is well known that no tillage or minimum tillage systems are rich in soil humus content, species diversity and soil carbon storage (Pekrun, 2003 as cited by Sheahan *et al.,* 2012) that makes the agro-ecosystem more productive. However, to get the best quality produce most of the certified organic farmers adopted the use of compost prepared in the backyard compost pits, neem cake, and ground nut cake available locally along with farmyard manure for plant nutrition. The management of pests was mostly done through mechanical control methods like light traps, fruit traps, tulsi (*Ocimum sanctum*) jaggery trap, banana trap, spraying of neem (*Azadiracta indica*) seed kernel extract, tobacco (*Nicottiana tabacum*) decoction, chilli (*Capsicum frutescens*) extract, and neem oil garlic (*Allium sativum*) emulsion. In the uncertified organic farming systems, soil health management practices were more or less similar to that of traditional homestead organic farming systems whereas pest and disease management practices were similar to that of certified organic farms. Along with farmyard manure use of different biodynamic preparations like *Panchagavya* and *Dasagavya*, fish jaggery extract, egg lemon extract, and pumpkin-papaya-banana extract were also a part of the system.

Assessment of yield advantage: LER value does not reflect an absolute crop yield but, it represents the increased biological efficiency due to the synergetic effect of two or more crops growing together in a specific environment (Reddy, 1990). The value of calculated LER varied significantly over the four organic agricultural systems. Certified organic farming system showed the highest LER (1.40) followed by traditional homestead organic farming system (1.29), uncertified organic systems (1.11) and organic-by-default (0.879). The results conveyed the yield advantage of mixed cropping systems over the sole cropping systems in three out of the four organic agro-ecosystems. The LER value of 1.40 of the certified organic farming systems conveyed that to produce that same yield productivity from intercropping system there is an additional 40 percent land is required in sole cropping systems. This land requirement figures would be 29 per cent for the traditional homestead organic farming systems and 11 per cent for the uncertified organic farming system to produce the same yield productivity from a sole cropping system. Sermenli *et al.* (2007) also reported the yield advantage of intercropping over sole cropping from the organic farming of Mediterranean region of Turkey. But intercropping combinations had significant effect on the LER values as low negative completion between crops results more biological yield (Dariush *et al.,* 2006) and the variation in the LER values of four organic agro-ecosystems was because of this reason. However, the possible reason behind the low value of LER (<1) in the organic-by default system might be the low crop yield due to the loss of fertile top soil in soil erosion (Shinogi *et al.,* 2014). Further, its isolated location prevents the farmers to acquire necessary organic inputs required for a better crop yield.

***Marketing* :** In the organic-by default system nearly 60 per cent of the farm produce sold through middlemen/ traders (who came and collected the produce from the forest farm) for a very low price. It was also unknown that whether those produces were being sold with an organic produce label or not. However, the rest 40 per cent of the farm produce and wild collections like cardamom, and honey were sold through the Vanasree eco-shop of the Kerala forest department as natural forest products for a reasonable price. That helped the farm families to attain a little more income to sustain their livelihood. Farmers of the traditional homestead organic farms marketed their farm produce through the local retail shops and wholesale traders for the prevailed market price of the season. These farmers also didn't show much interest for exploiting the market opportunities of organic farm produce. Whereas, in the uncertified organic farming system the farm produce was directly sold to the consumers with a 'chemical free' label through weekly farmers' markets organised by the promoting NGO and farmers received slightly higher price for their produce than the market price. The major success factor of these kinds of direct marketing is the trust and mutual exchange between the producers and consumers as consumer knows the identity of the producer and the producer get a large share of the consumer rupee (Granovetter, 1985; Kirwan, 2004). The certified organic farmers found to be more organised in

the marketing aspects also and 95 per cent of their farm produce sold in the international markets as certified organic produce with fair trade mark (certified by Fair Trade International) through the Fair Trade Alliance Kerala (FTK), organisation of small holder farmers drawn from the hilly regions of the western Ghats of Kerala. The major international markets for their organic farm produce were Switzerland, Italy, France and the UK and these farmers received the best price. One of the studies on marketing of organic produce in India also noted that only large or organised organic producers exploited the domestic market opportunities for organic produce in India through super markets and farmers' markets. This kept the domestic sale of organic produce less than 10 per cent of the total organic production of India (Garibey and Jyoti, 2003).

Adoption of Organic Agricultural Technologies and Contribution to Sustainability

Technology adoption pattern: The study showed significant differences in the adoption pattern of selected organic farming technologies viz., Bio-pesticides (Technology 1), Bio-fertilizers (Technology 2), Organic/ farmyard manures (Technology 3), Compost/ vermicompost (Technology 4), Use of traditional seeds (Technology 5), Selective weeding (Technology 6), Inter cropping and crop rotation (Technology 7), Minimum tillage (Technology 8), and Mulching and cover crops (Technology 9) among the farmers of the four organic agricultural systems. Farmers adopted these technologies as technology bundles than individual technologies in each of the four organic agricultural systems. The most prominent combination of technology adoption pattern in organic-by-default system (93 per cent farmers) was a combination of bio-pesticides + traditional seeds + intercropping and crop rotation + minimum tillage + mulching and cover crops. In traditional organic homestead system majority of the farmers (80 per cent farmers) adopted bio-pesticides + compost + selective weeding + minimum tillage + mulching and cover crops. In uncertified organic agriculture system farmers mostly adopted a combination of bio-pesticides + Organic/farmyard manures + Compost/vermicompost + Use of traditional seeds + Inter cropping and crop rotation + Mulching and cover crops. Whereas in certified organic agriculture system majority of the farmers (90 per cent farmers) have adopted technologies except bio-fertilizers and traditional seeds. The results conveyed that irrespective of the efforts from the government to popularise biofertilizers in the country the technology still remain in the nascent stage in its adoption rate (Mazid and Khan, 2014). Perennial nature of the commercial crops grown in the four systems might be considered as one of the reasons behind the zero adoption as biofertilizers popularly use for annual crops as seed treatment. But, non-availability of biofertilizers, low awareness among the farmers, lack of proper efforts from the extension agencies, and farmers' illiteracy were also reported as some of the reasons of low adoption in India (Sundaravaradarajan *et al.,* 2006; Majumdar, 2015). Anand and Kaur (2018) also confirmed the low awareness of farmers about organic inputs even in an agrarian state like Punjab where annual crops grows in most farmlands. Further, minimum tillage was adopted by the farmers of only two organic agro-ecosystems i.e., organic-by-default system and certified organic system. However, only the certified organic farmers could be considered as the actual adopters of minimum tillage as a part of the recommendation organic agriculture because of two reasons. Firstly, the farmers of organic-by-default system (forest agro-ecosystem) were deprived of the implements and animal power for deep tillage activities. Secondly, the slopy agricultural lands were already under the threat of soil erosion and deep tillage practices enhance landslides during heavy monsoon season. The connection between the technology adoption and yield advantage in the organic farming systems was explicit from the results as the certified organic farming system that showed highest LER value adopted the maximum number of organic farming technologies. Also, the organic-by-default system that showed the lowest LER owned less number of technologies. This suggests that to improve the yield advantage from an organic farming system of the country farmers should be motivated to adopt more organic farming technologies in their farm field.

In order explore the possibilities of expanding the rate of adoption of organic farming technologies in the country it is necessary to understand the existing relationship of technology adoption rate with the socio-economic variables of various organic farming systems. For that a Spearman's rank correlation analysis was carried out and the results (Table 2) did not convey any common trend in the four systems studied. However, some of the correlations were really interesting and showed the uniqueness of each system. The strong negative correlations observed in the case of two variables like land under organic farming and experience in farming with the rate of technology adoption revealed that the small/marginal

Table 2: Correlation of rate of technology adoption with selected socio-economic variables

Variables	Spearman's rank correlation coefficient (r_s)			
	Organic-by-default	Traditional	Uncertified Organic	Certified Organic Agriculture
Age	0.028	-0.325	-0.362*	0.496*
Education	0.251	0.207	0.212	-0.132
Land under organic farming	0.642**	-0.85**	0.341	0.217
Farming Experience	0.025	-0.530*	0.689**	0.313
Organic farming Experience	0.025	0.2691	0.684**	0.971**
Number of crops grown	0.545**	0.317	0.254	0.721**
Irrigation Potential	0.03	-0.133	0.016	-0.096
On Farm Resources	0.910**	-0.004	0.021	0.562**
Off Farm Resource availability	0.083	-0.223	-0.226	-0.147
Information source utilization	0.268	0.162	0.491*	0.51**

*Significant at 5% level; **significant at 1% level

organic farmers who were relatively new to agriculture owned more number of organic farming technologies in the traditional homestead organic farming system. Whereas, land under organic farming showed a strong positive correlation with the rate of technology adoption in the organic-by-default system. The study of Khaledi *et al.* (2009) also confirmed the inclination of small holder farmers towards the complete adoption of organic farming practices. Age of the farmer and rate of technology adoption had a moderate negative correlation in the uncertified organic farming system but a strong positive correlation in the certified organic farming system. Hence, it could be assumed here that factors affecting the rate of technology adoption are highly locale specific and may not be same in all the organic agricultural systems. However, the strong positive correlations observed in the two variables viz., experience in organic farming and information source utilisation with rate of technology adoption in the uncertified as well as certified organic agriculture systems pointing to the possibilities of using information sources in the development of organic farming in the country. Because, farmers of those two systems were mostly organised for marketing the organic produce and one or the other member of the group had access to different information sources. Hence these farmers get more chance to know about innovative organic farming technologies. In fact, adoption always happens over a period of time and relatively slow process and association of the organic farmers with various information sources over a period of time definitely motivate the farmers to own the technology. Unfortunately, farmers of the organic-by-default and traditional homestead organic farmers lack this opportunity. Though some of the earlier researchers reported that education level of farmers influenced the adoption of organic farming technologies (Prashant and Reddy, 2012; Nyengere, 2015), in our study, education didn't show any correlation with rate of technology adoption in any of the four farming systems.

Sustainability Assessment: Assessing the contribution of individual technologies in sustaining the four organic agro-ecosystems was a tedious process as farmers adopted various organic farming technologies available/suitable for their family farms in bundles. Hence, contribution of those technology bundles adopted by farmers of each organic agro-ecosystem to the ecological, economic, and social dimensions of agro-ecosystem sustainability was assessed using K-W Test followed by a multiple pair-wise comparison of all the factors considered under the three sustainability dimensions (Table 3). The lower computed p-value ($\leq$0.05 per cent) in all the three sustainability dimensions showed that out of the four organic agro ecosystems at least one system benefited differently from the other three systems because of the adoption of organic farming. It is evident from the results (Table 3) that the certified organic farming system where farmers owned maximum number of technologies achieved more ecological sustainability (mean rank 95.37) followed by uncertified organic farming (mean rank 73.37). The multiple comparison results (grouping letters) also substantiate the same. However, the other two organic agro-ecosystems (organic-by default and traditional homestead organic farms), where the rate of technology adoption was less, had benefited ecologically more or less on the same scale.

Table 3: Contribution of Organic Farming to Sustainability Dimensions

Agricultural Systems	Ecological				Economic				Social			
	Mean Ranks	Groups			Mean Ranks	Groups			Mean Ranks	Groups		
Organic-by-default	35.70	A			60.28	A	B		93.92			C
Traditional	37.33	A			54.97	A	B		56.38		B	
Uncertified Organic	73.37		B		50.03	A			71.90		B	
Certified Organic	95.37			C	76.72		B		19.80	A		
K (Observed value)	*66.18*				*10.74*				*75.92*			
p-value	*< 0.0001*				*< 0.05*				*< 0.0001*			
	K (Critical): 7.815				*DF: 3*				*alpha: 0.05*			

Mean ranks having same grouping letter are not significantly different

Sustainability of any agro-ecosystem demands not only ecological benefits but economic benefits too. It demands that farmers continue to make a good living and population as a whole be supplied with an abundance of high quality food at reasonable cost. The adoption of appropriate technologies and the intelligent marketing strategies certified organic farming system ensured the system to be on the top in the economical sustainability (mean rank 76.72) also. Though mean ranks of organic-by default and traditional homestead organic agro-ecosystems were less than that of certified organic farming systems same grouping letters showed no significant difference between the three systems in the economic sustainability aspects. The results conveyed that with right management practices even the low input organic systems can produce a reasonable yield and income productivity (Liebman *et al.,* 2008, Posner *et al.,* 2008). Further, it was notable in the results that the economic sustainability of uncertified organic farming system found lowest though the farmers were innovative in the technology adoption. Though differences in the biophysical conditions, resource endowment, managerial skills and local market conditions/marketing strategies cause variability in economic performances among the farms that use similar technical and managerial production practices (National Research Council of USA, 2010) the possible reason behind the low economic performance of uncertified organic farming system might be their philosophy for practicing organic farming. Because, most of the farmers of the agro ecosystem were nature lovers and interested in the localisation of chemical free food materials to the society at affordable price than selling it on a premium price. Further, even though yield benefits were not promising organic farming contributed more to the social sustainability of the organic-by-default system (mean rank 93.92). Since the input cost was more or less negligible in this system compared to the rest three systems the selling price itself became the net income for the tribal organic farmers. Also, the low living cost of the farm family inside a forest eco-system compared to the other three systems acted as a positive component in ensuring an improved livelihood for the farm family.

Techno-economic Constraints: Results of the Friedman's test for the severity comparison of different factors of techno-economic constraints (Table 4) showed that there were significant differences between the different factors of technological and economic constraints of the four agricultural systems (p-value <0.05 and Friedman's test statistic Chi-Square > 7.815 at 3 degrees of freedom in all the cases). In the analysis of technological constraints organic-by-default system identified as the one severely affected with lack of technological backup particularly shortage of information (mean rank 3.00), organic inputs (mean rank 3.00), and a standardised package of practices for organic farming (mean rank 3.00). The traditional homestead organic system was also severity affected with lack of information (mean rank 3.42). However, shortage of disease free planting materials was the major constraint for the uncertified (mean rank 3.83) and certified (mean rank 3.17) agriculture systems. International Fund for Agricultural Development Report (IFAD, 2003) also mentioned that lack of proper technological backup, limited access to necessary planting materials and plant protection inputs, and other location specific agricultural problems constrained the small-scale organic farmers from achieving a good livelihood. In this regard the results conveyed a stagnation stage of organic farming development in the country. Because, even after a decade of agricultural development small scale organic farmers struggling with the same hurdles. However, it was also evident in the study that irrespective of all those constraints

Table 4: Techno-Economic Constraints in the Adoption of Organic Agriculture

Constraints	Mean Rank			
	Organic-by-default	Traditional	Uncertified Organic	Certified Organic
Technological Constraints				
Lack of information regarding organic farming technologies	3.00	3.42	1.20	1.62
Non availability of sufficient quantity of organic inputs	3.00	1.95	2.68	2.80
Lack of a reliable package of practices for organic farming	3.00	2.09	3.03	2.42
Shortage of disease free planting material/seeds	1.00	2.55	3.83	3.17
p-value	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Q (Observed)	*90.000*	*36.523*	*57.641*	*31.862*
Economic Constraints				
Initial yield losses	1.00	1.00	3.37	3.57
Inadequate financial support from the government promote organic farming	3.37	2.09	1.42	1.67
Higher cost involved with the development of sufficient on-farm resources	3.37	3.65	1.85	1.84
High cost of certification process and low price for produce without certification	2.27	3.27	3.37	2.98
p-value	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Q (Observed)	*83.561*	*85.412*	*73.705*	*62.307*
Q (Critical): 7.815	*DF: 3*	*alpha: 0.05*		

agencies promoting organic farming like non-governmental organisations (NGOs) and organic certification agencies made the farmers of certified and uncertified agriculture systems aware about the location specific organic farming technologies. On the other hand, the isolated location of the agro-ecosystem prevented the farmers of the organic-by default system from accessing these information sources. Further, the restriction from forest department for the domestication of livestock inside the forest made these farms in dearth of necessary organic manures. This made the system to struggle with shortage of technologies.

Analysis of economic constraints showed that initial yield loss was the severe constraint for the organic farmers of certified (mean rank 3.57) and uncertified (mean rank 3.37) agriculture systems as most of the organic farmers of these two systems were converted from conventional farming to organic farming in the last few years. Organic-by-default and traditional organic agro ecosystems were not affected by initial yield loss because of their eco-friendly farming from the beginning. However, inadequate financial support from government and cost involved with the development of on-farm resource (mean rank 3.37) were the severe constraints in the organic-by-default system. Traditional homestead organic system also found affected with the higher cost involved with the development of on-farm resource base (mean rank 3.65). However, development of on-farm resource base in the initial years itself is most important to make organic farming profitable as more dependence on off-farm organic inputs like bone meal and oil cakes leads to increase in cost of cultivation (Shanmugasundaram, 2015). For the uncertified organic farmers higher cost of certification and less price for their farm produce (mean rank 3.37) was also identified as another severe constraint. The results reaffirmed the earlier findings that constraints of organic farming greatly differ between localities based on the agro-ecological region, socio- economic status, availability of resource, and adoption of agricultural practices (FAO, 1998).

CONCLUSION

Organic agriculture has the potential to bring a positive outlook to the multiple cropped small family farming systems of India. The study revealed that intercropping yielded more in three out of the four organic agriculture system and the disadvantages associated with the location of organic-by default system affected on its yield performance. The contribution of organic agriculture towards ecological and economic sustainability of the agro-ecosystem found best in the certified organic farming system where farmers adopted most of the technologies and marketed the produce intelligently. However, even after two decades of organic movement the contribution of organic farming towards social sustainability and a feasible solution for major technological constraints are still ambiguous in India. Among the four organic farming

systems studied only the organic-by default system, where hardly 30-35 families reside, found highly sustainable to meet the food requirement of the society though the crop yield was not promising to give a high income sustainability to the farm family. In a country, where lion share of organic farmers mostly belong to the small and marginal category, it is obvious that farmers try to exploit the export market where they get a premium price to the produce. But this trend may eventually keep farmers away from growing food crops and this in turn creates serious impacts on the food security of the country. Hence, it is high time for the policy makers to think whether India's organic farming movement should emphasise on provision of safe food to the country's population or exploit the export market to improve the Indian economy.

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Impact of Dietary and Nutrition Education Intervention on Nutritional Knowledge of Moderately Anemic Adolescent Girls of Kangra District, Himachal Pradesh

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ABSTRACT

Lack of knowledge concerning nutrition is one of the most significant reason for nutritional problem and consequently inappropriate nutritional practices can lead to numerous complications. The present study was conducted on moderately anemic (Hb- 8-10.9 mg/dl) adolescent girls (10-18 yrs) divided into three groups (30 individuals per group) were interviewed by KAP (knowledge, attitude and practice) questionnaire to identify the level of knowledge, correct attitude and practices towards nutrition and health. Intervention was imparted to experimental groups i.e., group-I (received nutrition education and dietary intervention) and group-II (received only nutritional education) for four months and no nutrition intervention for control group. A significant improvement was recorded in group-I and group-II. Excellent improvement was seen at post intervention in experimental groups as 100 per cent of selected adolescent girls improve their KAP scores to more than 80 per cent. Nutrition intervention had positive impact on nutritional knowledge of adolescent girls.

Keywords: Anemia, Nutritional knowledge, Nutrition education, Dietary intervention, Garden cress

INTRODUCTION

Two billion people over 30 per cent of the world's population are anemic (WHO, 2011). The prevalence of anemia in India is 53.0 per cent. In Himachal Pradesh, the situation is on the troublesome front, wherein 53.5 per cent women, 20.1 per cent men and 53.7 per cent children were recorded to be suffering from anemia (NLHS-IV 2015-16).

Adolescents account for 20.9 per cent of Indian population; that means 253.2 million Indians are adolescents in the age group of 10 to 19 years. Further, the adolescent girl's population is found to be 18.64 per cent in Himachal (Census of India, 2011). In adolescent girls, there is expansion of the lean body mass, total blood volume and onset of menstruation that creates a greater risk of iron deficiency. Iron deficiency not only reduces work productivity but also accentuates the problem further during pregnancy because, they are just on threshold of marriage and motherhood. Thus, nutritional pattern in these years has special significance.

The major causative factor of iron deficiency and anemia is not only the low iron intake, but also low iron absorption which could be due to the consumption of insufficient absorbable iron from cereal based vegetarian diets coupled with excessive body needs among women (Savita *et al.*, 2013). Other possible causes are intestinal worm infestations, malaria and vitamin A deficiency. Iron depressed immune function and resistance to infection, diminished work capacity and increased risk of delivery of preterm and low birth weight infants. The nutrition deficiency disease may not essentially be due to lack of single nutrient. It may occur due to lack of more than one nutrient in the diet taken by the people for a specified duration of the year Nutrition deficiency is one of the major problems in the hilly region (Jethi *et al.*, 2018). Anand and Kumar (2015) also reported that women with poor health and nutrition are more likely to give birth to low weight infants. They are also less likely to be able to provide food and adequate care for their children. Finally, a woman's health affects the household economic well being, as a woman with poor health will be less productive in the

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labour force. Women everywhere work for longer hours, the plight of poor rural women in hills is rather worse.

A Knowledge, Attitude and Practices (KAP) questionnaire is a tool to identify, what a population already knows (knowledge), how they feel (attitude) and what they are doing (practices) regarding a particular issue. Nutrition education has been defined as educational measure for inducing desirable behavioral changes for the ultimate improvement in the nutritional status of all nutrition intervention programmes. Nutrition knowledge and nutrition education are also considered a long term approach to combat iron deficiency anemia. Nutrition education, which is practical and adopted to suit the socioeconomic conditions, food habits and local food resources, can tackle the problem to a great extent. So, with aforesaid review present study was focused to study the impact assessment of dietary and nutrition education interventions on nutrition knowledge of the moderately anemic adolescent girls.

MATERIALS AND METHODS

Locale and selection of subjects: The study was conducted in selected Government Senior Secondary Schools of three blocks of Kangra district viz Baijnath, Panchrukhi and Bhawarna. Total 300 adolescent girls in the age group of 12-18 years were screened for their hemoglobin. Based on hemoglobin level, these subjects were divided into different categories of anemia. From these anemic individuals, 90 moderately anemic (Hb- 8-10.9 gm/dl) adolescent girls were screened out and divided into three groups. Each group constituted 30 girls. Group-I received diet as well as nutrition counseling and group-II received only nutrition counseling. Group-III formed the control group i.e. no intervention of any type was provided to them. The study period was spread over for 120 days (Figure 1).

Knowledge, attitude and practice test schedule for nutrition and health: The schedule consisted of three parts: a) knowledge b) attitude c) practice test. Total fifteen

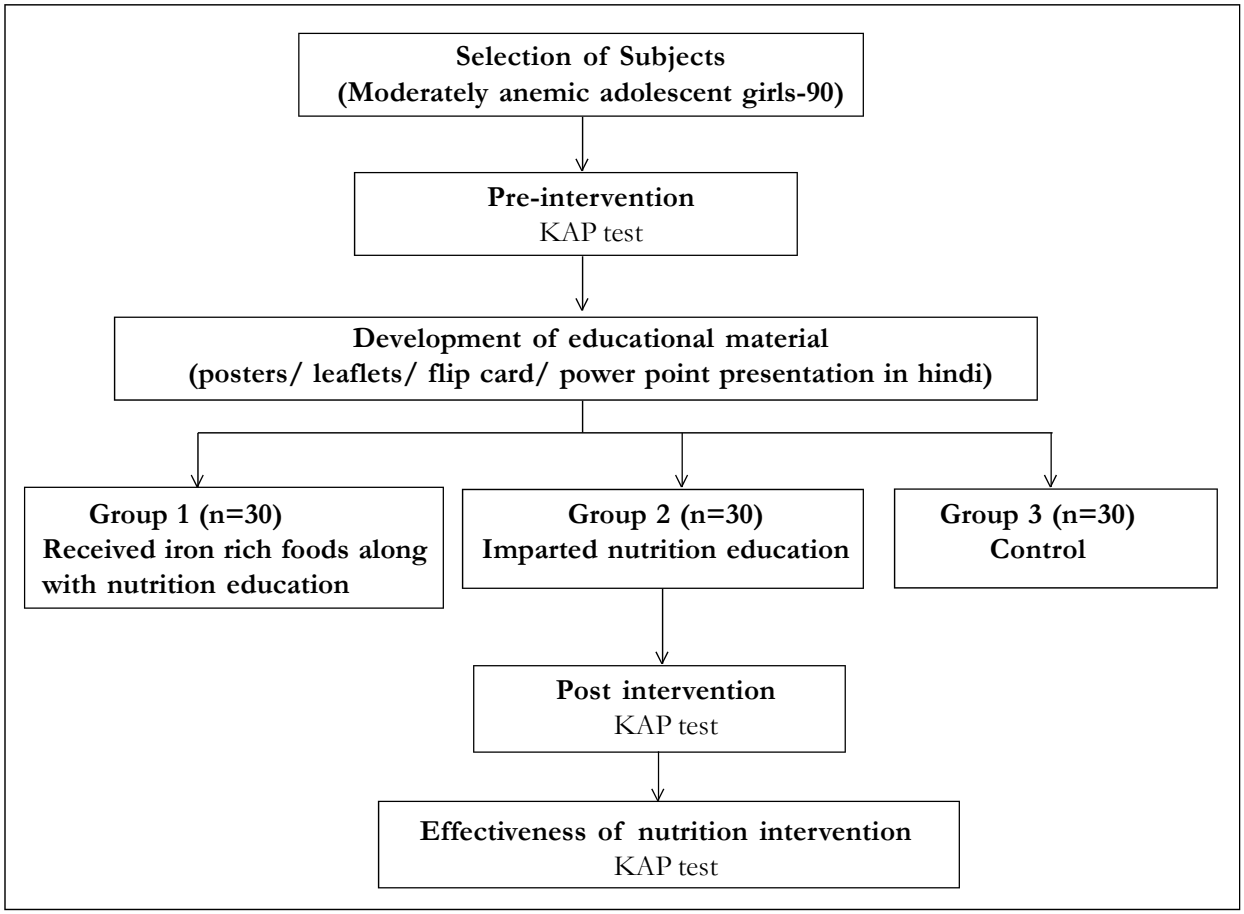

Figure 1: Schematic presentation of evaluating effectiveness of nutrition intervention

statements per part which were closed ended type questions were included in the inventory schedule for finding out attitude of the selected subjects and assessment of practices and knowledge regarding nutrition and health. For practice test, practices regarding nutrition and health were asked from the subjects. In attitude testing, subjects were asked about the extent of their agreement with the statement ranging from agree, disagree and don't know and in knowledge test, subjects were asked multiple choice questions and allowed to tick any one correct answer. Each question carried one mark and one mark was awarded for each correct answer. Maximum possible score of practice, attitude and knowledge was 45. Knowledge test of all the 90 subjects was measured before and after nutrition intervention. The developed questionnaire was pre-tested on 10 randomly selected respondents which were non-sampled subjects. Based on the response received during pre-testing, certain necessary changes were incorporated in the schedule. Hence, the pre-tested and reconstructed knowledge schedule was used for intervention program

Development of educational package: The information obtained from knowledge score of the subjects during pre-intervention was utilized for preparing the educational package. Combined package of audio-visual aids including posters/ leaflets/ flip card/ power point presentation in Hindi was prepared for conveying message and information regarding nutrition education to the selected respondents covering various aspects of food and nutrition science such as food and nutrients, balanced diet, nutrients preservation, right ways to cook food, anemia, iron rich foods, junk food, sanitation and hygiene.

Educational intervention: Subjects were imparted nutrition education through lectures-cum-discussion using audio-visual aids viz. posters/ leaflets/ flip card/ power point presentation. The lectures were delivered to (Group-1 and Group-2) for period of 120 days (4 months) at weekly interval on selected topics. The pamphlets or leaflets were distributed to the subjects.

Dietary intervention: Three iron enriched variants each of sweet and savoury recipes viz. *ladoo, mathri*, *shakkarpare* and biscuits were prepared. The first recipe of each product was control i.e. garden cress was not incorporated and was developed for comparison. Variant-1 was incorporated with un- processed (whole seed powder) garden cress seeds. Variant-2 was subjected to incorporation of processed (soaked + roasted + dried) garden cress seeds. Dietary intervention was carried out with one sweet *laddoo* (amaranth flour-10g wheat flour-10g jaggery-40g fat- 10g garden cress powder-10g sesame seeds-15g grated coconut-5g raisin-5g) and one savoury preparations *mathri* (refined flour-30g amaranth flour-20g garden cress powder -10g sesame-16g dry fenugreek leaves-2g fat -20g black pepper-2g salt-1.50g fat for frying) which were highly acceptable and had highest analysed iron content among developed recipes were used for dietary intervention to n=30 (Group-1) for period of 120 days 20g of each preparation per day provided 100per cent RDA for iron need of the adolescent girls (Table 1). So, weekly package of 4 days for *laddoo* and 3 days for *mathri* were provided to selected moderately anemic adolescent girls. The respondents were supervised for regular intake of dietary preparations. The composition of dietary preparations is as below.

Table 1: Composition of dietary preparations

Recipe	Daily Supplement (g)	RDA meet for iron (%)
Laddoo (variant-2)	20	100
Mathri (variant-2)	20	100

Impact assessment of nutrition intervention: To study the impact of nutrition intervention trial, the schools were revisited for follow-up of all the three represented groups after four months of intervention. For assessing the effectiveness of nutrition intervention, information on knowledge, attitude and practice was again collected for the same subjects. The pre and post intervention was done to evaluate the impact of intervention in terms of knowledge test scores. The scores of pre and post exposure stage were compared and impact of nutrition intervention was studied by using the following formula.

Gain in score= score of post test - score of pretest

Quantum of improvement = Post test score / Pretest score

Data analysis: After collection of field data, the information was coded on the master sheets and then tabulated into master tables. Paired-'t' test was used to compare pre and post exposure mean scores of experimental groups.

RESULTS AND DISCUSSIONS

Table 2 and Figure 2 & 3 clearly explains the impact of pre and post nutrition intervention on knowledge, practice,

Table 2: Impact of nutrition intervention on per cent scores of knowledge test of selected adolescents girls (n=90)

Parameters	Pre test	Post test	t-value	Gain in knowledge	Quantum of improvement (times)
Group-I (n=30)					
Knowledge	33.33±2.43	84.17±1.76	17.11^{S}	50.84	2.53
Attitude	61.11±2.91	80.33±2.82	4.85^{S}	19.22	1.31
Practice	73.33±2.05	83.67±3.05	2.86^{S}	10.34	1.14
Overall	56.63±1.60	82.89±1.80	10.88^{S}	26.26	1.46
Group-II (n=30)					
Knowledge	29.94±1.43	88.50±1.95	24.42^{S}	58.56	2.96
Attitude	58.89±2.76	82.22±2.35	6.44^{S}	23.33	1.40
Practice	73.94±2.77	86.50±3.20	2.91^{S}	12.56	1.17
Overall	54.17±1.45	85.57±1.73	13.89^{S}	31.40	1.58
Control (n=30)					
Knowledge	42.22±2.96	59.83±2.28	1.81^{NS}	17.61	1.42
Attitude	46.11±3.76	47.17±2.47	0.62^{NS}	1.06	1.02
Practice	69.67±2.60	69.69±2.96	0.31^{NS}	0.02	1.00
Overall	52.67±2.17	57.90±1.81	1.12^{NS}	5.23	1.10

Significant at 5% (t value at 28 degree of freedom 2.04)

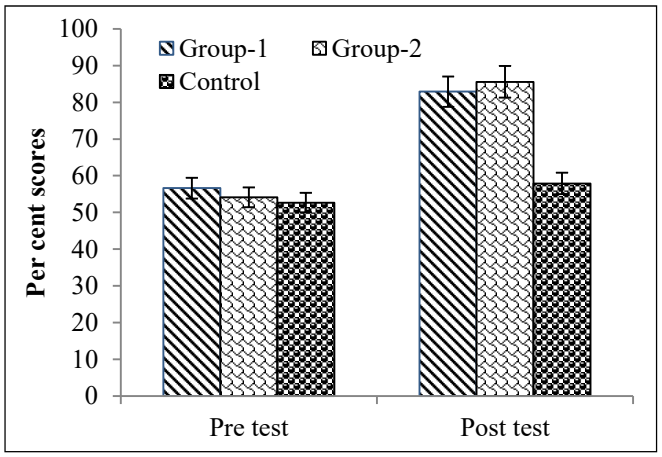

Figure 2: Impact of nutrition intervention on overall knowledge test scores of selected adolescents girls (n=90)

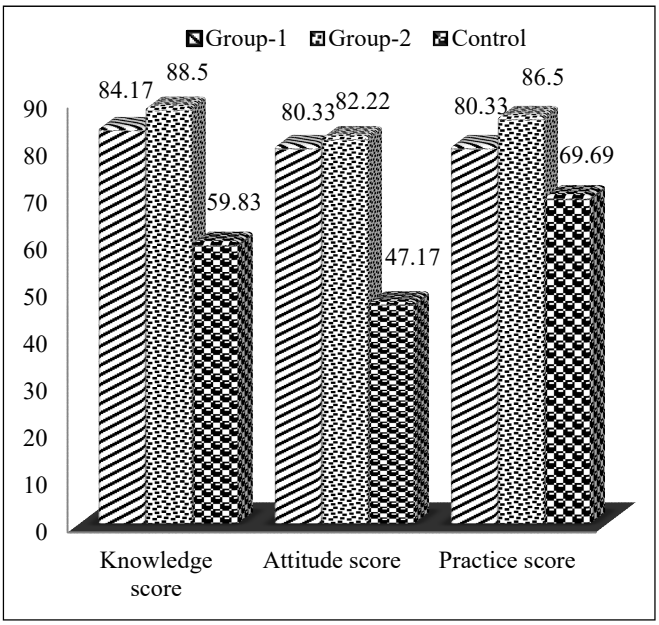

Figure 3: Comparison of per cent KAP test scores of control and experimental groups after intervention of selected adolescents girls (n=90)

attitude as well as overall impact on scores obtained by selected adolescent girls. The mean scores obtained in pre-test for knowledge, practice, attitude and overall impact on adolescent girls group were ranged 42.22±2.96 to 69.67±2.60 per cent for control, 33.33±2.43 to 73.33±2.05 per cent for experimental group-I and 29.94±1.43 to 73.94±2.77 per cent for group-II and corresponding mean scores in post-test were ranged 47.17±2.47 to 69.69±2.96 per cent for control, 80.33±2.82 to 84.17±1.76, per cent for group-I and 88.50±1.95 to 86.50±3.20 per cent for group-II respectively. A significant improvement was recorded in group-I and group-II thereby asserting that these respondents moved in a desirable direction. Group-II that received only nutritional education had maximum gain in percentage of knowledge varying from 12.56-58.56,

followed by group-I that received not only nutrition education but also dietary intervention and were recorded a change of 10.34-50.84 per cent of knowledge, attitude and practices related to nutrition and health intervention. Control group did not receive any type of nutrition intervention i.e. neither dietary intervention nor educational intervention therefore, the gain in knowledge was minimum ranging from 0.02- 17.61. The scores received were converted into percentages and distributed among different divisions for assessing the level of knowledge of the respondents in the initial and final session of the intervention.

Rao *et al.* (2007) conducted a study on adolescent girls (11-18 years) in schools of old city of Hyderabad. A significant improvement was found in the knowledge levels of both the experimental and control groups after the intervention. The improvement in the mean scores of the experimental group (3.09 ± 0.19) was significantly higher than the control group (1.65 ± 0.21). Singla *et al.* (2012) evaluated the impact of nutrition counseling on 60 adolescent girls aged 16-18 years. Nutrition counseling was imparted for a period of three months to assess the Knowledge, Attitudes and Practices (KAP) test before and after nutrition counseling. It was observed that the mean scores for nutrition knowledge improved significantly ($P<0.01$) in post test from 25.00 to 36.24 in experimental group E, while non-significant (21.80 to 22.13) control group C. Majority of the subjects had moved towards high score with gain in scores and quantum of improvement was 11.24 and 1.45 times in group E, respectively. An improvement was recorded in scores of knowledge, attitudes and practices in group E.

The data is presented in Table 3. The distribution of KAP level of the three different group showed that 66 and 63.66 per cent subjects of group-I and group-II had less than 34 per cent knowledge that has been rated poor. 26.66 and 36.33 per cent had average knowledge related to nutrients and health. After receiving nutrition education through different audio visual aids for a period spread over four months, 96.66 per cent girls in group-I and 100 per cent in group-II increased their knowledge scores to more than 80 per cent (rated as excellent). No such improvement in the level of control group was recorded after intervention. 66.66 and 36.33 per cent control subjects

Table 3: Impact of nutrition intervention on distribution rating of knowledge test per cent scores of selected adolescent girls (n=90)

Scores	Group-I (n=30)		Group-II (n=30)		Control (n=30)	
	Pre	Post	Pre	Post	Pre	Post
Knowledge						
<34 per cent (Poor)	20(66.66)	-	19(63.66)	-	20(66.66)	19(63.66)
34-50 per cent (Average)	8(26.66)	-	11(36.33)	-	11(36.33)	12(40.00)
51-80 per cent (Good)	3(10.00)	1(3.33)	-	-	-	-
>80 per cent (Excellent)	-	29(96.66)	-	30(100.00)	-	-
Attitude						
<30 per cent (Less)	17(56.66)	-	16(53.33)	-	27(90.00)	21(70.00)
31-60 per cent (Moderately)	13(43.33)	5(16.66)	14(46.66)	3(10.00)	3(10.00)	9(30.00)
>60 per cent (Highly)	-	25(83.33)	-	27(90)	-	-
Practice						
<40 per cent (Low)	22(73.33)	-	28(93.33)	-	21(70.00)	20(66.66)
41-80 per cent (Medium)	8(26.66)	-	2(6.66)	-	9(30.00)	10(33.33)
>80 per cent (High)	-	30(100.00)	-	30(100.00)	-	-
Overall						
<40 per cent (Poor)	21(70.00)	-	24(80.00)	-	23(76.66)	22(73.33)
41-75 per cent (Good)	9(30.00)	2(6.66)	6(20.00)	2(6.66)	7(23.33)	8(26.66)
>75 per cent (Very good)	-	28(93.33)	-	28(93.33)	-	-

#Figure in parentheses represents percentage

who had poor and average knowledge remained almost at same knowledge level. 56.66 and 43.33 per cent and 53.33 and 46.66 per cent of moderately anemic adolescent girls in group-I and group-II respectively had less and moderate attitude. After post intervention, only16.66 and 10.00 per cent remained at moderate level while 83.33 and 90 per cent rose to high attitude (>60%) for nutrition and health in the stated groups respectively. Control group again lagged behind and no such change was visible as compared to other groups. Overall scenario of KAP test explained that most of the adolescent girls in group I and –II who had poor to good knowledge substantiated their information and shifted into the category of "very good". So, the extent of improvement in mean scores of experimental group was higher than the control group indicating positive impact of intervention and supporting the fact that, nutrition education can significantly improve nutritional awareness of the beneficiaries. Positive impact of nutrition education was also reported by Sharma *et al.* (2009) on rural adolescent girls of 13 to 19 years of Rajasthan and intervention was given for nine months to girls through lecturers, discussions and demonstrations. The post test was done on the girls after the period of intervention and found that the knowledge of girls on health was improved. Rahimi *et al.* (2010) studied the effect of nutrition education on nutritional knowledge, attitude and practice among female employees and reported that 29.0, 62.2 and 8.95 per cent and 33.6, 59.3 and 7.1 per cent had good, moderate and poor nutritional attitude, respectively before and after nutrition counseling.

Impact of nutrition intervention on response of participants to different questions asked under knowledge, attitude and practice test is presented in Table 4. Most adolescent girls had poor knowledge regarding anemia, its causes, prevention and management. Knowledge test data showed that there was significant difference in pre and post intervention knowledge of experimental group (I and II) while non-significant difference remained in control group. When the participants in the current study were asked about their knowledge, only 23.33, 26.67 and 16.67 per cent respondents knew about nutrients required for growth and development, nutrients present in fruits and vegetables and deficiency of vitamin A in the pre-test. But after nutrition counseling, 100 per cent of the respondents had enhanced knowledge. Other enhanced

Table 4: Impact of nutrition intervention on per cent scores for knowledge, attitude and practice test (n=90)

Particulars	Group-I		Group-II		Control	
	Pre	Post	Pre	Post	Pre	Post
Knowledge Test n=30						
Nutrients in balanced diet	26.67	76.67	60.00	100.00	36.67	36.67
Nutrients for growth and development	23.33	100.00	86.00	96.00	43.33	33.33
Nutrients in fruits and vegetables	26.67	100.00	26.67	100.00	36.67	36.67
Mineral need for Hb formation	30.00	100.00	30.00	100.00	10.00	10.00
Food rich in Vitamin C	73.33	93.33	86.67	91.00	33.33	33.33
Deficiency of Vitamin A	16.67	100.00	13.33	100.00	10.00	10.00
Deficiency of iron	50.00	100.00	63.33	99.00	33.33	34.00
Signs of anemia in body	76.67	86.67	86.67	100.00	50.00	32.00
Iron absorption inhibitors	56.67	100.00	60.00	100.00	50.00	36.67
Rich source of iron	70.00	100.00	70.00	97.00	50.00	53.33
Causes of anemia in females	43.33	80.00	63.33	100.00	26.67	36.67
Facility by govt. to prevent anemia	40.00	90.00	76.67	98.00	43.33	10.00
Best method of cooking	26.67	90.00	46.67	90.00	33.33	30.00
Vitamin increase in fermentation	46.67	83.33	23.33	93.33	23.33	16.67
Vitamin loss during over cooking	26.67	100.00	16.67	100.00	20.00	30.00
Mean±SD	**42.22±5.04**	**93.33±5.90**	**53.96±6.73**	**97.62±6.98**	**33.33±3.42**	**29.29±8.26**
t value	**4.82^{S}**		**2.77^{S}**		**1.61^{NS}**	

Table 4 contd.....

Particulars	Group-I		Group-II		Control	
	Pre	Post	Pre	Post	Pre	Post
Attitude test n=30						
Good health need balanced diet	93.33	100.00	96.67	100.00	96.67	95.00
GLV should be eat in daily	86.67	96.67	80.00	100.00	96.67	96.00
Non-veg are good source of protein	30.00	93.33	26.67	100.00	56.67	60.00
Anemia affects our work capacity	23.33	100.00	20.00	83.33	40.00	40.33
GLV provides important nutrients	60.00	93.33	93.33	96.00	73.33	73.33
Tea should not be consume with meal	80.00	96.67	83.33	95.00	60.00	60.67
Iron utensils increase iron content	33.33	100.00	50.00	100.00	36.67	32.00
Iron is necessary for blood formation	26.67	80.00	60.00	83.33	20.00	22.33
Adolescents need balanced diet	70.00	100.00	60.00	100.00	70.00	70.33
Depletion of iron & folic acid in body cause anemia	30.00	66.67	33.33	100.00	33.33	40.67
Uncovered cooking leads to loss of nutrients	76.67	100.00	50.00	100.00	66.67	62.33
Non-veg food's iron is absorbed best	13.33	100.00	60.67	100.00	43.33	42.00
Balanced diet eradicating anemia	36.67	100.00	56.67	100.00	63.33	62.00
Deworming should be done time to time	76.67	80.00	83.33	90.00	86.67	85.00
Iron supplement course prevent anemia	63.33	93.33	80.00	96.67	86.67	87.00
Mean±SD	**52.00±7.30**	**93.33±3.84**	**58.67±7.16**	**96.28±5.24**	**62.00±6.14**	**61.93±5.36**
t value	**5.22[S]**		**2.51[S]**		**1.79[NS]**	
Practice test n=30						
Wash vegetables before cutting	63.00	100.00	93.33	100.00	90.00	90.87
Take citrus with meal	20.00	100.00	30.00	100.00	26.67	26.67
Use iron utensils	56.67	93.33	76.67	96.67	70.00	70.00
Eat green leafy vegetables	86.67	96.67	96.67	98.00	96.67	96.87
Take tea after meal	93.33	73.33	56.67	90.00	60.00	60.00
Don't eat sand/chalk	93.33	53.33	100.00	76.76	83.33	83.53
Take deworming tablet	73.33	100.00	50.00	100.00	66.67	66.67
Like to work with slipper	70.00	90.00	66.67	83.33	73.33	73.33
Eat food after hand wash	86.67	93.33	86.67	96.67	86.67	86.67
Check Hb in a year	56.67	100.00	70.00	100.00	70.00	70.00
Use lemon in salad	56.67	100.00	50.00	83.33	53.33	53.3
Do not like to eat vegetables without wash	100.00	100.00	96.67	100.00	86.67	86.47
Take bath daily in periods	66.67	100.00	73.33	90.00	73.33	73.33
Change sanitary pads 2-3 times in a day	90.00	93.33	70.00	100.00	90.00	90.00
Change undergarments daily	90.00	96.67	96.67	100.00	86.67	86.87
Mean±SD	**72.20±5.26**	**96.66±3.56**	**74.00±5.37**	**95.88±3.95**	**74.22±4.65**	**74.30±4.06**
t value	**3.67[S]**		**2.45[S]**		**1.34[NS]**	

Significant at 5% (t value at 28 degree of freedom 2.04)

scores ranged between 86-96 per cent. No change in knowledge was recorded in control group. In practice test, it was observed that only 20 and 30 per cent of the subjects in group-I and group-II took citrus fruits with meal, 63 per cent in group-I preferred washing vegetables before cutting and 56.67 and 70.69 per cent check their hemoglobin in a year and used lemon in salad too. Positive impact of nutrition counseling was observed as 100 per cent girls were practicing these.

Regarding sanitation and hygiene during menstrual periods, not much change in percentage was noted in group-I and group-II for changing their undergarments and sanitary pads but positive influence was noted for taking bath daily during periods which was 66.67 per cent in pre-test and 100 per cent in post-test. Group-II respondents were more aware of sanitary practices compared to the two groups. Further, scores of attitude test showed that there was significant improvement observed after intervention in group-I and group-II. Attitude scores regarding various questions like effect of anemia on work capacity, iron as necessary nutrient for blood formation, balanced diet for adolescents, loss of nutrients during uncovered cooking, non-vegetarian foods as best source of iron and eradication of anemia through balanced diet were achieved 100 per cent after intervention in group-I. Almost same scenario was observed for group II. The scores of control group remained same as pre intervention period. Similar scenario for group-I and group-II was also visible for practices performed by the subjects. Before nutrition intervention, 73.33 and 93.33per cent adolescent girls scored less than 40 per cent (low) and only 26.66 and 6.66 per cent scored between 41-80 per cent (medium) for correct practices. Excellent improvement was seen post intervention as 100 per cent of selected adolescent girls improve their nutrition practices scores to more than 80 per cent (high). Similar studies on awareness of anemia by Premalatha *et al.* (2012) reported that 80.75 per cent of the participants were unaware of anemia. Around 19.25 per cent of subjects were aware of what anemia is. There has been an increased awareness in private schools which may be a factor for the less prevalence of anemia in private schools. This emphasized the need to focus on awareness programs before implementing any interventions. Savita *et al.* (2013) conducted a study on impact of education intervention on nutritional knowledge of iron deficiency among post-adolescent girls. The percentage of correct response ranged from 39-69 per cent previously followed by 71 per cent to 96 per cent at immediately after education intervention and 70 per cent to 91 per cent at one month after education intervention. The response improved after education intervention that could help to combat micronutrient malnutrition. Sivapriya *et al.* (2014) showed that 70 per cent of the subjects were unaware about normal hemoglobin values while 50 per cent were ignorant about iron rich foods. All the participants were aware about the nutritional deficiency anaemia. After nutrition education, participants were able to tell out on iron rich foods more promptly. Also their knowledge on hemoglobin, and iron rich foods had improved.

CONCLUSION

Nutrition education is a key to promoting lifelong healthy eating habits and behaviours that starts from the early stages of life. Results of the study revealed that nutrition education intervention brings a significant increase in the knowledge level, which could be used as one of the long-term strategy to combat micronutrient malnutrition among adolescent girls. Nutrition education should be a part of education system to improve nutritional knowledge, attitudes and practices of adolescents, so that after marriage they can enter pregnancy with no serious iron-deficiency handicaps. Thus, increasing nutritional awareness and knowledge among adolescent girls improved nutritional knowledge level as well as help to reduce anemia in long run.

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Genetic Parameter of Early Genotypes Pigeonpea

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ABSTRACT

Efforts were made to study genetic variability in 13 early pigeonpea genotypes. In general PCV was higher than GCV indicating the effect of environment. The characters No. of pods per plant, secondary branches/plant, primary branches/plant, days to maturity showed higher genotypic and phenotypic coefficient of variation. High heritability recorded No. of pods/plant, days to 50% flowering, 100-seed weight and plant height. High genetic variance and high genetic advance as percent of mean shown by the characters No. of pods/plant, secondary branches/plant, 100-seed weight, days to 50% flowering, days to maturity. Heritability in broad sense was moderate indicating influence of moisture stress on these traits. However, high genetic advance as percent of mean indicating additive gene effects governing the traits providing ample scope of improvement.

Keyword: Early genotype, GCV & PCV, Genetic advance, Heritability, Pigeonpea, Variability

INTRODUCTION

Majority of the food proteins in India are derived from pulse that are invariably grown under risk-prone rainfed environment. Among the pulses, Pigeonpea (*Cajanus cajan*) occupies an important place in rainfed cropping systems with an estimated area of 4.04 million hectare (IIPR-2013). To enhance pigeonpea productivity multidisciplinary crop improvement projects were under taken at various research institutions. The adoption of new cultivars did help in enhancing the total cropped area and production (IIPR-2013) but its Productivity did not register any significant improvement and here the decades it has remained unacceptably low at around 700 kg/ha. This has been a matter of concern since the per capita protein availability in the country is declining steadily from 27.20 kg/year in 1950 to 10 kg/year in 2000. (www.commodityonline.com 2009. This is mainly due to ever growing population, stagnation of pulse production, and escalating prices. At present the national harvest accounts for about 2.50 million tones of pigeonpea grains. However the quantity is not sufficient to meet the domestic needs and about 5,00,000 tonnes of pigeonpea is imported annually. This situation is not likely to improve and considering 2% annual growth in population additional pulses will be required.

In India, majority of the pigeonpea comes from the states of Madhya Pradesh, Maharashtra, Gujarat, Karnataka, Andhra Pradesh and Uttar Pradesh. In these states medium and long duration pigeonpea cultivars are grown as inter-crop and it to unlikely that the cultivated pigeonpea areas will increase by any significant extent to meet the entire needs of the country. Hence new production riches with early maturity cultivars were explored. As a fallow-up pigeonpea-wheat rotation was successfully introduced in the state of Punjab, Haryana and Western Uttar Pradesh. The pigeonpea area in these states has also been stabilized over years. pigeonpea in cultivated as annual legumes crop under three maturity group i.e. early (130750 days), medium (150-200 days) and late (250-320 days).

MATERIALS AND METHODS

Early pigeon pea genotypes(13) were grown in random block design with three replications during *kharif* season 2014-15 at Instructional farm Krishi Vigyan Kendra P.G. College Ghazipur in single row (4 m) at row to row and plant to plant spacing of 60 cm and 20 cm respectively. The crop was grown under rainfed condition till maturity. Observations were recorded for 8 traits, days to 50% flowering, days to maturity, plant height, primary branches/plant, secondary branches/plant, number of pods/plant, 100-seed weight and yield. The analysis of variance for (RBD was carried out following Panse and Sukhatme (1967). The phenotypic and genotypic coefficient of variation were computed using the formula suggested by Burton and devane (1953). Heritability in brade sense and expected genetic advance as percent of mean were

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calculated according to the methods suggested by Hanson *et al.* (1956) and Johnson *et al.* (1955), respectively.

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences among genotypes for different traits indicating presence of considerable genetic variability among them. The range, general mean and parapets helpful in selection of two genotypes for a particular trait or groups of traits are present in Table 1 closer estimates of genotypic and phenotypic variances suggested negligible influence of environment in the expression of majority of the traits.

Table 1: ANOVA table

Source of variation	df	Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches/ plant	Secondary branches/ plants	No. of pods/ plant	Yield kg/ha	Test weight
Replication	2	36.51	65.87	13.025	0.18	9.423	411.18	0.025	0.041
Treatment	12	163.36*	108.36NS	193.70*	0.640NS	10.75*	15960.064*	0.143	5.671*
Error	24	3.41	766.22	12.05	0.596	0.965	179.013	0.016	0.208
SEM+		1.066	15.98	2.004	0.445	0.567	7.72	0.0730	0.263
CD		3.12	46.64	5.85	1.30	1.67	22.55	0.213	0.768
CV		1.996	19.73	2.40	36.42	16.30	6.632	5.23	3.966

Table 2: Analysis of genetic parameters

Characters	Range	Mean	62e	62q	62p	GCV	PCV	H_2(%)	Genetic advance	GA as Percentage of mean
Days to 50% flowering	88-110	92.64	3.41	53.32	56.73	7.88	8.13	93.98	14.58	15.7412
Days to Maturity	135.66-154.6	140.25	766.22	219.29	546.93	10.56	16.67	40.09	19.314	13.772
Plant height (cm)	136-165	144.49	12.05	60.55	72.60	5.39	5.89	83.40	14.64	10.13
Primary branches/plant	1.66-3.33	2.12	0.596	0.015	0.611	5.694	36.86	2.39	0.0384	1.816
Secondary branches/plants	4.0-9.0	6.025	0.970	3.26	4.23	29.97	34.12	53.56	2.270	54.25
No. of pods/plant	125.0-353.33	201.741	179.013	5260.350	5439.36	35.95	3.56	96.70	146.92	72.83
100-seed weight	10.13-14.73	11.50	0.208	1.821	2.029	11.73	12.39	89.71	2.633	22.89
Yield kg/ha	2.28-2.93	2.418	0.016	0.0423	0.0583	8.51	9.99	72.55	0.361	14.93

Table 3: Mean values of different character

Genotypes	Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches/ plant	Secondary branches/ plants	No. of pods/ plant	Yield kg/ha	100-seed weight (g)
CORG-2013-10	90.00	141.00	136.00	1.66	6.33	159.33	2.33	10.95
Pusa-2014-1	89.66	137.6	141.33	2.33	4.66	191.66	2.32	11.58
AH-08-36	89.66	139.00	139.66	2.00	5.00	138.33	2.52	10.70
Pusa-992(C0	90.00	135.6	145.00	2.00	4.33	153.33	2.31	10.13
Paras (LC)	90.66	137.66	141.33	2.00	5.00	125.00	2.32	10.55
AL-1758	88.33	137.66	136.00	1.66	8.33	200.00	2.28	10.85
AL-1933	89.33	139.00	141.00	2.00	7.00	208.33	2.30	10.75
RVSA-1014-2	108.33	152.00	155.66	3.33	9.00	359.33	2.85	14.73
AH-10-29	90.33	137.33	146.33	2.33	6.33	201.00	2.30	11.47
RVSA-2014-1	110.00	154.66	165.00	2.00	9.00	353.33	2.93	14.12
PAN-88 (LC)	90.00	136.33	141.66	2.00	4.00	126.66	2.32	11.25
Al-1932	88.00	138.33	141.66	2.66	4.33	171.66	2.34	11.03
Pu Sg. 2014-3	90.00	136.33	147.66	1.66	5.00	184.66	2.32	10.83

However, secondary branches/plant followed by primary branches/plant 100-seed weight and yield kg/ha were highly influenced by moisture stress as realized with the estimates of ECV (Environmental coefficient of variation). Therefore, selection of genotypes for these traits under moisture stress would be desired. The results were inconformity with the findings of Kumar *et al.* (2006); Bhadru (2011); Kumar *et al.* (2015). Broad sense heritability was highest for number of pods/plant followed by days to 50% flowering, 100 seed weight and plant height (cm) respectively indicating greater promotion of genetic components influencing their inheritance. Further, high heritability coupled high genetic advance as present of mean estimates for number of pods/plant followed by 100-seed weight, height (cm) and yield kg/ha revealed greater promotion of fixable genetic components (additive and additive x additive) which would be effective in selection of desirable transgressive segregants in early segregative generations also reported by Patel and Acharya (2011) and Sumitra *et al.* (2019). Rest of the traits such as primary branches/plant, plant height, yield kg/ha, Days to maturity which had high broad sense heritability as genetic advancement as percent of mean revealed that these traits were under the control of non-fixable (dominance x tristasis) type of genetic components, where heterosis could be exploded.

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Factors Encouraging Information and Communication Technologies (ICTs) Usage to KVKs Scientists of Madhya Pradesh and Chhattisgarh

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ABSTRACT

The agricultural production in India increased due to factors like bringing additional area under cultivation, extension of irrigation facilities, use of better quality seeds, advanced techniques like high yielding varieties, water management and plant protection practices. Now imagine a scene where every aspect of yielding crops, right from selection of quality seeds to threshing of crop is aided by updated and improved technology. All we need to do is exploit the resources of ICT and intertwine it with yield of crops thereby enhancing quality and quantity of crops in India. The mission is to make cost effective ICT based systems. These technologies besides improving the accessibility of the information for the farmers makes it possible for the providers of the extensional services to compete in a better and healthier environment. ICTs can be used to increase effectiveness and efficiency of extension system. Krishi Vigyan Kendra's (KVK) scientists are playing a proactive role in transferring new technology at field level with beneficial impacts. So, in this era of information revolution, the KVKs Scientists should be encouraged to use ICTs for different extension activities and field works. Hence, a research study was undertaken for 304 scientists working in different KVKs in Madhya Pradesh and Chhattisgarh, to find out the factors encouraging to KVKs Scientists for ICTs usage. The findings of the study indicate that among economic factors encouraging ICT usage, provision of grants to buy ICTs, with 3.58 MS, obtained first rank as it was perceived most important by 66.83 per cent of respondents, While in case of facilitating factors, availability of sufficient number of ICT tools, with 3.48 MS, was on first rank. Investments of the institution/ university on infrastructure for ICTs got second rank, with 3.39 MS and lastly among the social & psychological factors and technical factors, adequate familiarity and expertise in ICT and In-service training for using/producing ICTs, was on first rank respectively and perceived most important by KVKs scientists.

Keywords: Information and Communication Technologies (ICTs), Krishi Vigyan Kendras (KVKs), Factors encouraging ICTs usage, Accessibility

INTRODUCTION

India is predominantly an agriculture based country. The country was able to achieve record food production with the assuring of "green revolution" during later 60's. This was possible mainly due to the application of new technology and scientific methods of farming on farmer fields and introduction of high yielding varieties. Ever since the period of green revolution, there is a great demand for modern agricultural technology from the clientele side. The extension organizations all over the country are engaged in designing new methods of communication and information dissemination to reach the farmers at a faster rate. These ICT technologies are bringing people and decision makers together with unprecedented new tools for development. Use of ICT tools shown the worth for enhancing knowledge level of the rural farmers (Tiwari *et al.*, 2013). Nowadays agricultural extension is facing a large quantity of innovations, discoveries and information in different fields of science, skills and agricultural technology and has got the latest findings from the resources of producing information and make it accessible for the users and for being successful in this important matters, it is necessary to have a powerful and effective informing system (Bassak Harouni *et al.*, 2012).

ICTs improve adoption of agricultural technology by supporting farmer's learning, problem solving and

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accessibility to profitable markets for their crops (World Bank, 2011). ICT has an important role in connecting research, extension and the market toward expanding the professional and entrepreneurship abilities, capacities among the experts and the agricultural communities (Arkhi *et al.*, 2008). The advancements in ICT can be utilized for providing accurate, timely, relevant information and services to the farmers, thereby facilitating an environment for more remunerative agriculture.

The Krishi Vigyan Kendras (KVK) is of national importance which would help in accelerating the agricultural production and also in improving the socio-economic conditions of the farming community. They are continuously engaged in improving their professional knowledge and skills by keeping themselves abreast with latest information. The overall development of KVK's scientists largely depends on their capacity and willingness to seek and share relevant information with their colleagues and other members of organization.

The role of Information and Communication Technology (ICT) in the research institutions and universities is becoming increasingly prominent because of the potential value of such technologies. ICTs can be used to increase effectiveness and efficiency of extension system. So, in this era of information revolution, the KVKs Scientists should be encouraged to use ICTs for different extension activities and field works. The overall development of scientists largely depends on their capacity and willingness to seek and share relevant information (Bisht *et al.*, 2010). Keeping these things in mind, this research study was undertaken for 304 scientists working in different KVKs in Madhya Pradesh and Chhattisgarh, to find out the factors encouraging to KVKs Scientists for ICTs usage.

MATERIALS AND METHODS

The study was carried out in State Agricultural Universities of Madhya Pradesh and Chhattisgarh State. The study population included all scientists of KVKs of all SAUs, NGOs and ICAR Jurisdiction in both the States. A structured questionnaire was designed based on related literature and objectives of the study and variables and it was send to all scientists of KVKs comes under study area. Validity of the instrument was ensured through a panel of experts. Data was analyzed with using frequencies, percentages, mean and multiple correlation and regressions.

RESULTS AND DISCUSSION

The results presented in Table 1 revealed that among economic factors encouraging ICT usage, provision of grants to buy ICTs, with 3.58 MS, obtained first rank as it was perceived most important by 66.83 per cent of respondents, Financial inputs for training on ICT production and usage was on second rank with 3.54 MS, whereas, Economic support for software purchases obtained third rank with 3.46 MS. The fourth rank was occupied by Availability of exclusive budget for ICT projects, with 3.38 MS. Thus, it can be revealed that majority of the KVK Scientists were perceived encouragement for ICT usage through economic factors. This finding was in conformity with the findings of Khamoushi (2014).

According to the Table 2, among facilitating factors, availability of sufficient number of ICT tools, with 3.48 MS, was on first rank. Investments of the institution/ university on infrastructure for ICTs got second rank, with 3.39 MS. Whereas, Availability of software on third rank with 3.29 MS. 'Developing the policies and plans for usage of ICTs for dissemination of agricultural information', with 3.26 MS, obtained the fourth rank. Thus, it can be revealed that majority of the KVK Scientists were perceived encouragement for ICT usage through facilitating factors. This finding was in conformity with the findings of Khamoushi (2014).

According to the Table 3, among social and psychological factors, adequate familiarity and expertise in

Table 1: Distribution of the respondents based on their perception about economic factors encouraging ICT usage (n=202)

Items	Most Important	Important	Less Important	Not Important	Mean Score	Rank
Provision of grants to buy ICTs	135 (66.83)	50 (24.75)	17 (8.41)	0 (0)	3.58	I
Financial inputs for training on ICT production and usage	126 (62.38)	61 (30.20)	15 (7.42)	0 (0)	3.54	II
Economic support for software purchases	105 (51.99)	85 (42.07)	12 (5.94)	0 (0)	3.46	III
Availability of exclusive budget for ICT projects	96 (47.52)	92 (45.54)	9 (4.45)	5 (2.47)	3.38	IV

(Figures in parenthesis indicate percentage)

Table 2: Distribution of the respondents based on their perception about facilitating factors encouraging ICT usage (n=202)

Items	Most Important	Important	Less Important	Not Important	Mean Score	Rank
Availability of sufficient number of ICT tools	124 (61.39)	59 (29.21)	11 (5.44)	8 (3.96)	3.48	I
Investments of the institution/ university on infrastructure for ICTs	109 (53.96)	67 (33.17)	22 (10.89)	4 (1.98)	3.39	II
Availability of software	91 (10.89)	82 (40.59)	27 (13.37)	2 (0.99)	3.29	III
Developing the policies and plans for usage of ICTs for dissemination of agricultural information	86 (42.57)	87 (43.07)	25 (12.38)	4 (1.98)	3.26	IV

(Figures in parenthesis indicate percentage)

Table 3: Distribution of the respondents based on their perception about social and psychological factors encouraging ICT usage (n=202)

Items	Most Important	Important	Less Important	Not Important	Mean Score	Rank
Adequate familiarity and expertise in ICT	130 (64.36)	55 (27.22)	15 (7.42)	2 (0.99)	3.55	I
ICT improves self-efficacy	122 (60.40)	63 (31.19)	17 (8.41)	0 (0)	3.52	II
Felt need to use ICT	110 (54.45)	70 (34.65)	22 (10.89)	0 (0)	3.43	III
Rewarding the scientists using ICTs	92 (45.54)	75 (37.13)	27 (13.37)	8 (3.96)	3.24	IV

(Figures in parenthesis indicate percentage)

Table 4: Distribution of the respondents based on their perception about technical factors encouraging ICT usage (n=202)

Items	Most Important	Important	Less Important	Not Important	Mean Score	Rank
In-service training for using/producing ICTs	137 (67.82)	58 (28.71)	7 (3.46)	0 (0)	3.64	I
Easy access to expertise to solve technical difficulties	120 (59.40)	65 (32.18)	16 (7.92)	1 (0.49)	3.50	II
Investments of the institution/ university on the support services of ICTs	108 (53.46)	76 (37.62)	15 (7.42)	3 (1.48)	3.43	III
Availability of ICT tools acquiring scientists interest in ICT usage	89 (44.06)	87 (43.07)	22 (10.89)	4 (1.98)	3.29	IV

(Figures in parenthesis indicate percentage)

ICT, with 3.55 MS, was on first rank. ICT improves self-efficacy with 3.52 MS was on second rank. The third rank was occupied by felt need to use ICT, with 3.43 MS and rewarding the scientists using ICTs, with 3.24 MS was on fourth rank. Thus, it can be revealed that majority of the KVK Scientists were perceived encouragement for ICT usage through social and psychological factors. This finding was in conformity with the findings of Khamoushi (2014).

A close look at Table 4 indicated that in-service training for using/producing ICTs was on first rank and it was perceived by 137 scientists as most important technical factor. On the second rank easy access to expertise to solve technical difficulties was perceived as most important technical factor by 59.40 per cent scientists, followed by important (32.18%), less important (7.92%) and only one scientist perceived it as not important. Investments of the institution/ university on the support services of ICTs, was on third rank with 3.43 MS. The fourth rank was occupied by availability of ICT tools acquiring scientist's interest in ICT usage with 3.40 MS. Thus, it can be revealed that majority of the KVK Scientists were perceived encouragement for ICT usage through technical factors. This finding was in conformity with the findings of Khamoushi (2014).

CONCLUSION

It can be concluded that on the basis of these findings above all four encouraging factors i.e. Economical, Facilitating, Social & Psychological and Technical are

important for promoting and motivating the KVKs scientists for ICTs usage and there is a need to organize specialized training programs for KVK scientists for production of ICTs, enhanced budget allotments for ICT, and provision of supportive services as well as technical help to KVK scientists who are interested in production of ICTs.

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Constructing a Knowledge Test to Assess the Knowledge Level of Extension Functionaries and Devising Future Extension Strategies for Promotion of Organic Farming in India

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ABSTRACT

The ill effect of intensive chemical based agricultural system has drawn widespread criticism from different sections of society and the organic farming in the country has witnessed significant popularity in last few years. The growth has also been accompanied by technological developments in the organic sector, where new technologies such automatic milking systems, robot-based weed control systems, and the development of new organic fertilizers and plant breeding, are widely accepted across the globe. In this context the present study was conceptualized to assess the knowledge level of extension functionaries in organic farming, their future training need and documenting future extension strategies for promoting organic farming in the country with 30 extension officials from 7 states. The study develop a knowledge test of 20 items with difficulty index between 0.30 to 0.95, discrimination capacity (>0.30) and point bi-serial value (≥0.25) and reliability (0.71). It is found that the extension functionaries had more knowledge on applied aspect of organic farming than theoretical aspect. Majority of the respondents (43.33%) had high training need for bio-fertilizer preparation (X=3.07) followed by organic pest and disease management technologies/practices (X=2.77, 23.33%). The study revealed that the educating the farmers on organic farming and building their confidence on organic farming (X=3.57) was ranked as the most important strategy for promoting organic farming in the country. The findings of the study will be of immense help to the policy maker for successful implementation of any organic mission and policies.

Keywords: Organic farming, Knowledge test, Training need, Extension strategies

INTRODUCTION

The aura of green revolution in India has been disappeared and illusion of advance agricultural technologies specially heavy use of chemical fertilizer and pesticide was in question from different sections of the society. Despite the global awareness of environmental degradation and health hazards that could result from the continuous practice of inorganic farming, majority farmers in the country still practiced inorganic farming. The central government (National organic programme, 2000; Paramparagat Krishi Vikas Yojana, 2015) as well as different state government (Sikkim organic mission, Karnataka organic policy etc.) has adopted different policies to promote organic agriculture. Despite the considerable effort in organic farming, the organic sector remains stagnant in most of the states except Sikkim which officially has been declared as organic state. As per the report of APEDA, 2013-14 (http://apeda.gov.in), so far only 4.72 million hectare area was covered under organic farming out of 159.7 million ha arable land in the country. Over the past few decades, organic agriculture has undergone rapid growth, and it is now practiced in more than 150 countries globally with a global market value of more than US $60 billion (Willer and Lernoud, 2014). The growth has also been accompanied by technological developments in the organic sector, where new technologies such automatic milking systems, robot-based weed control systems, and the development of new organic fertilizers and plant breeding, are widely accepted across the globe.

It is highly important that the farmers in our country should adopt or update with these recent innovations in

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organic farming to tap this global market. The adoption of organic farming is driven by a variety of different reasons such as socio-economic, structural and institutional factors (Defrancesco *et al.*, 2008; Burton *et al.*, 2003). Among all these, knowledge is an important variable in determining the successful adoption of organic farming. Mahamud (2005) showed that knowledge is a major factor for successful organic rice cultivation. Food and Agriculture Organization, 1998 similarly highlighted the role of knowledge, attitude and skill of the farmers in adoption of organic vegetable cultivation. In this regard, extension agents played a vital role in knowledge building of farming communities in organic farming. However, the effectiveness of extension service delivery is critically dependent on the knowledge of extension officers on the various agricultural innovations they disseminate to farmers (Oladele and Tekena, 2010). Haleem (2018) similarly opined that successful dissemination of organic farming system required stakeholder's access to essential knowledge on organic technologies and practices in efficient ways. Hence, extension agents who are responsible for latest technological outreach to the farming communities should possess sound knowledge on organic agriculture. But very few studies so far has been conducted to know the knowledge level of extension official on organic farming in our country. Keeping this in mind the present study is conceptualized to study the extension agents' knowledge and, training need on organic farming. The study further aimed to document future extensions strategies for promoting organic farming.

MATERIALS AND METHODS

Knowledge test development: Here knowledge on organic farming has been conceptualized as the understanding about the basic history and principles of organic farming, the science behind organic farming, information on technologies and practices for sustainable soil health management, organic pest management, water management, crop management, post-harvest management, seed production, philosophy of traditional farming system, awareness on beneficial effect of organic farming in different system, information on certification procedure and marketing intelligence with textual as well applied knowledge. The different steps followed in knowledge test development are as follows-

Item collection: Fifty items on covering all the areas about organic farming were collected from relevant literature, experts, panel discussion, personal experience and pilot studies. Initially fifty items were selected covering almost all the areas related to organic farming.

Jury opinion: Total fifty items were sent to hundred experts to judge the relevancy of test items, their difficulty level and content validity. The relevancy of test items was judged on five point continuum from most relevant (5) to not at all relevant (0). Final selection of items was done based on the mean relevancy value i.e. items with relevancy value higher than 2.5 were retained for further analysis. Thus thirty four items were selected whose mean score was above 2.5.

Item analysis: Item analysis was performed to know the item difficulty and discrimination capacity of each item in the knowledge test. One pilot study was conducted with extension functionaries from government and private organizations in North Bengal for item analysis and 60 respondents were randomly selected for the study. The score obtained by 60 respondents were summed up and arranged in descending order to divide them in 6 equal groups with 10 respondents in each group and middle two groups were eliminated out of six groups for further analysis.

Item difficulty index: The item difficulty index was defined as the proportion of the farmers giving correct answer to that particular item. The difficulty level was calculated using the following formula- $Pi=n_i/N$;

Where, Pi= Difficulty index for i^{th} item, n_i= Number of respondents correctly answered the i^{th} item, N= Total number of respondents to which i^{th} item were administered.

Discrimination index ($E^{1/3}$): The following formula was used to calculate item discrimination index-

$$E^{1/3}= \frac{(S1+S2) - (S5+S6)}{N/3}$$

Where, S_1, S_2, S_5 and S_6 were the frequencies of correct answers in G_1, G_2, G_5 and G_6 groups respectively and N= Total number of farmers in the sample of the item analysis.

Reliability: Split-half method was employed to calculate the reliability coefficient value. In this method, all the 34 items were first randomly arranged and then divided into two equal halves one containing the odd items and other one containing the even items. Then, co-efficient of

correlation between two sets of scores was computed and the "r" value of 0.71 was found to be significant at 1% level of significance which indicates that the knowledge test was highly reliable.

Validity: Point bi-serial (r_{pbi}) correlation of every item was calculated to know the construct validity of the test.

Selection of final items: The items with difficulty score between 0.30 to 0.95 were selected for final test based on the recommendation of Althouse, L.A. The items with discrimination score more than 0.30 were kept for further analysis as per the recommendation of Score Pak and item with point bi-serial value of 0.25 or above was selected for further analysis. Finally, twenty items were selected based on the items' difficulty level, discriminatory power and point bi-serial correlation score (Table 1).

Administration of final knowledge test: Finally the standardized knowledge test was administered to 30 extension workers from 7 state of India. The data were collected during model training on "Capacity Building of Extension Personnel on Advance Organic Technologies & its Promotion through Innovative Extension Approaches" during 22.10.18-29.10.18 at Indian Agricultural Research Institute, Regional Station, Kalimpong. All the participants were working as extension professional either at block or district or state level on agriculture and rural development.

Measurement of training need: A schedule of twelve most potential training need areas was finalized based on experts' judgment. Training needs was measured on a 4-point Likert-type scale of highly needed (4), moderately needed (3), slightly needed (2), and not needed (1). Thereafter, weighted mean (W.M.) score was determined for each statement.

Devising extension strategies: Thirty most potential extensions strategies were selected through expert's judgment and put for ranking among the extension agents. The mean ranking score was calculated to prioritize the different extension strategies for promotion of organic farming.

RESULTS AND DISCUSSION

Knowledge level of extension functionaries: Knowledge is the cognitive behaviour of an individual. Once the knowledge is acquired, it produces changes in the thinking process of an individual, which would lead to further changes in attitude and helps the extension officials in making rational decisions. It is prerequisite for adoption of any agricultural innovation. With this view, an attempt has been made to determine the knowledge level of extension officials about organic farming. It is assumed that knowledge affects the extension functionaries' attitude which in turn affects their behavior. Therefore it becomes highly necessary to find out the current knowledge level of extension officials on organic farming for defining any promotional strategy. In this context, the findings of knowledge test will be of immense help to realize the current knowledge status of extension workers on organic farming, and to bridge the knowledge gap if any.

From the Table 2 it is clear that the knowledge level of extension professionals for most of the items on organic farming was quite low. Only 40 per cent extension agents knew about the father of organic farming and only one third extension agents (33.33%) had information on who coined the term organic farming. This indicates that the extension agents had limited knowledge on theoretical or textual history of organic farming. The low knowledge level of respondents on organic farming was also mentioned in the previous studies of Mondal (2014) and Marsh (2017). However, the present study found that majority of the extension professionals (90 percent) answered correctly for question "which are the trap crops cultivated in organic farming". More than three fourth extension functionaries (76.67%) had knowledge about the different insects used for biological pest control in organic farming. This indicates that the extension functionaries had more knowledge on applied aspect of organic farming. This may be due to their close association for promotion of organic farming under state organic farming prograrmme. Assis and Ismail (2011) in their study reported similar findings where majority respondents knew about basic applied aspect of organic farming like crop rotation, using kitchen, plant and animal wastes, pruning etc. Half of the respondents (50%) know about the time needed for treating a land for organic certification whereas less than half of the respondents (43.33%) had knowledge on scientific reason of adding super phosphate during composting. The study found that just more than half of the respondent had knowledge on organic hormone used in organic farming (66.67%) and why brown material is added in compost preparation (60%). But only 46.67 per cent extension agents knew correctly which group of earthworm is good for vermicomposting. Majority of the extension workers had good knowledge on different bio-fertilizer applied for supplying N to leguminous crop

Table 1: Score of difficulty index, discrimination index and point bi-serial correlation

SN	Items	P	$E^{1/3}$	r_{pbi}
1	Who is the father of organic farming?	0.43	0.62	0.58
2	Who coined the term organic farming?	0.52	0.65	0.47
3	Which are the trap crops?	0.80	0.45	0.32
4	Which is the decentralized organic certification system?	0.23(×)	0.35	0.13(×)
5	How many year a normal land needs to be treated for organic certification?	0.42	0.34	0.29
6	Which of the following insect is used for biological pest control?	0.53	0.55	0.52
7	Which of the following farming items are not eligible for organic certification?	0.25(×)	0.21(×)	0.14(×)
8	Why super phosphate is added in compost preparation?	0.53	0.30	0.35
9	When green manuring crops should be ploughed?	0.13(×)	0.05(×)	0.15(×)
10	Which of the following acts as organic hormone?	0.78	0.45	0.50
11	Why brown material is added in compost preparation?	0.48	0.68	0.37
12	What should be the depth of ploughing of green manure crops?	0.18(×)	0.49	0.14(×)
13	How much Cu application is allowed in organic farming?	0.46	0.32	0.23
14	How many years needed for organic certification?	0.58	0.55	0.54
15	Can genetically modified seed be used in organic farming?	0.78	0.64	0.58
16	Can one use veterinary medicine in organic farming?	0.81	0.69	0.42
17	In case of laying hens, what is the maximum permissible hour for artificial light in organic farming?	0.38	0.41	0.27
18	Why green material is added in composting?	0.98(×)	0.35	0.50
19	The minimum temperature needed for composting?	0.13(×)	0.29(×)	0.12(×)
20	What should be the P^h of final compost?	0.23(×)	0.40	0.13(×)
21	Which group of earthworm is good for vermicomposting?	0.57	0.40	0.37
22	Which is used as bio-fertilizer for supplying N to leguminous crop?	0.80	0.65	0.56
23	Which is used as bio-fertilizer for supplying N to non-leguminous crop?	0.98(×)	0.40	0.11(×)
24	What is used for organic seed treatment?	0.53	0.50	0.50
25	What is the conversion period for a farm to sell organic animal products?	0.38	0.60	0.69
26	Which is the apex organic accreditation certification body in India?	0.37	0.45	0.61
27	Which is the organic source of N in rice field and acted as fodder?	0.97(×)	0.42(×)	0.23
28	Which is the bacterial bio-control agent?	0.79	0.75	0.59
29	Which is the fungal bio-control agent?	0.97(×)	0.80	0.69
30	How much feed should be organic for livestock & poultry?	0.58	0.65	0.67
31	Which of the following can be used in place of cow dung in vermicomposting?	0.28(×)	0.40	0.12(×)
32	Which of the following organic technique used dead materials?	0.25(×)	0.29(×)	0.18(×)
33	What is the time gap to incorporate green manure crops and next crop?	0.19(×)	0.30	0.20(×)
34	Which of the following chemicals are allowed in organic farming?	0.38	0.26(×)	0.10(×)

(76.67%), numerous organic seed treatment techniques (80%), name of apex organic accreditation certification body in India (83.33%), different fungal bio-control agent (70%), type of green material added in composting (80%), diverse bacterial bio-control agent (70%) used in organic farming. It can be inferred from the above findings that extension workers had more knowledge on practical or applied aspect of organic farming. However, they had low knowledge on theoretical aspect of organic farming as very few respondents had correctly answered the items like "what is the conversion period for a farm to sell organic animal products (46.67)", "how much Cu application is

Table 2: knowledge level of extension functionaries on organic farming (n=30)

SN	Items	Frequency	Percentage
1	Who is father of organic farming?	12	40.00
2	Who coined the term organic farming?	10	33.33
3	Which are the trap crops?	27	90.00
4	How many year a normal land needs to be treated for organic certification?	15	50.00
5	Which of the following insect is used for biological pest control?	23	76.67
6	Why super phosphate is added in compost preparation?	13	43.33
7	Which of the following acted as organic hormone?	20	66.67
8	Why brown material is added in composting?	18	60.00
9	Which group of earthworm is good for vermicomposting?	14	46.67
10	Which is used as bio-fertilizer for supplying N to leguminous crop?	23	76.67
11	What is used for organic seed treatment?	24	80.00
12	How many month a farm should be under conversion to sell organic animal products?	14	46.67
13	Which is the apex organic accreditation certification body in India?	25	83.33
14	How much feed should be organic for livestock & poultry?	17	56.67
15	How much Cu application is allowed in organic farming?	10	33.33
16	How many years needed for organic certification?	17	56..67
17	Can genetically modified seed be used in organic farming?	18	60
18	Can one use veterinary medicine in organic farming?	17	56.67
19	In case of laying hens, what is the maximum permissible hour for artificial light in organic farming?	13	43.33
20	Which is the bacterial bio-control agent?	21	70

allowed in organic farming (33.335)", "in case of laying hens, what is the maximum permissible hour for artificial light in organic farming (43.33%)". Modest number of extension functionaries had knowledge on items like "how much feed should be organic for livestock & poultry (56.67)", "can genetically modified seed be used in organic farming (60%)", "which of the following organic technique used dead materials (63.33)", "can one use veterinary medicine in organic farming (56.67%)", "which of the following chemicals are allowed in organic farming (60%)", "what should be the P^h of final compost (66.67%)". The study revealed that extension officials had low knowledge on recent technological advances on organic farming and theoretical aspect of organic farming. Therefore, it is highly important to start well designed training and capacity building programme for different level extension functionaries through university, research institute or KVK to bridge the existing knowledge gap in organic farming.

Training need of extension officials on organic farming: Agricultural extension plays an important role in rural development; and the success of agricultural extension workers depends on their competency (knowledge & skills) in the respective subject or activities. As a result of the continuous change in the knowledge and skills, extension agents need to keep up with this change through training. Training in any form is intrinsic to organizational effectiveness. Organic farming is a new farming system which requires some specific knowledge and skill. During last decade, organic farming witnesses many technological development, and extension agents need to update their knowledge and skill with this change through training.

Therefore, the finding of the present study will help the policy makers to identify the specific areas of training need on organic farming for extension officials. The findings in Table 3 revealed that the mean score for training need on different compost preparation was quite low (X=1.83) and majority of the extension workers (43.33%) told that they did not need training on compost preparation. Similarly the training need for green manuring or green leaf manuring was also low (X =1.80) and majority (43.33%) expressed low training need as they already had

Table 3: Training need of extension officials (n=30)

Area of training need	High f (%)	Medium f (%)	Low f (%)	Not needed f (%)	Mean (X)
Different compost preparation	2(6.67)	4 (13.33)	11(36.67)	13 (43.33)	1.83
Liquid manure preparation like *panchyagavya, jeevamrit etc.*	4 (13.33)	5 (16.67)	13 (43.33)	8 (26.67)	2.17
Green manuring/green leaf manuring	0(0)	2 (6.67)	20(66.67)	8(26.67)	1.80
Crop rotation technique for different cropping system	3 (10.00)	8 (26.67)	12(40.00)	7 (23.33)	2.23
Bio-fertilizer preparation	13 (43.33)	9(30.00)	5(16.67)	3 (10.00)	3.07
Organic pest and disease management technologies/practices	9 (30.00)	7 (23.33)	8 (26.67)	6 (20.00)	2.63
Record keeping and collection standards for organic farming	6 (20.00)	7 (23.33)	13 (43.33)	4(13.33)	2.50
Grading/packing and marketing of organic produce	5 (16.67)	9(30.00)	10(33.33)	6 (20.00)	2.43
Organic soil fertility management technologies & practices	4 (13.33)	7 (23.33	9 (30.00)	10 (33.33)	2.17
Organic seed treatment	2 (6.67)	8 (26.67)	10 (33.33)	10 (33.33)	2.07
Integrated farming system	3 (10.00)	9 (30.00)	12 (40.00)	6 (20.00)	2.30
Organic livestock and poultry feed management	7 (23.33)	8 (26.67)	12 (40.00)	3 (10.00)	2.63

necessary skill on green manuring. Hence, it can be inferred that the extension workers were competent on basic compost preparation technique. Yadav (2013) similarly reported that majority of the respondents expressed low or no training need for composting (71%) and green manuring (54%). The mean training need score was comparatively higher for liquid manure preparation technique (X=2.17) and crop rotation technique for different cropping system (X=2.23). Majority of the respondents (43.33%) had high training need for bio-fertilizer preparation (X=3.07) followed by organic pest and disease management technologies/practices (X=2.77) by 23.33 per cent extension worker and organically animal health management (X=2.73) by 30 per cent extension officials. The other important areas of organic farming where mean training need score was quite high were biological method of pest control (X=2.63), organic livestock and poultry feed management (X=2.63), protected cultivation technologies (X=2.63), organic certification procedure (X=2.57), record keeping and collection standards for organic farming (X=2.50), grading/packing and marketing of organic produce (X=2.43). The findings of Yadav (2013) also highlighted the importance of record keeping and certification standards and majority of respondents in his study expressed a medium (40%) or high (24%) training need in this area. Paul (2015) also mentioned about the training need of extension officials on integrated pest management, water management, organic farming, integrated nutrient management, protected cultivation, integrated farming system, natural resource management and crop husbandry. Very few extension officials reported about training need on organic soil fertility management technologies and practices (X=2.17), organic seed treatment procedure (X=2.07) and integrated farming system (X=2.30). The study thus revealed the training need of extension officials not only on latest technological aspect of organic farming but also in management aspect and marketing aspect.

Extension strategies for promotion of organic farming: Even though India has vast potential in organic farming, its achievement on production, certification and export is low due to multiple factors. Lack of sufficient knowledge on organic farming, information on organic methods, no market facilities and intelligence support for interested farmers, lack of good consumer information on organic farming and organic food, high distribution cost, lack of effective demonstration of research results among farmers and advisors are few among them. To tackle these issues, suitable strategies have to be devised keeping current technological scenario and stakeholders' concern in mind. Therefore, the findings of the study will show the future path to the policy makers to decide the right path for promotion and implementation of any organic policies among the farming communities.

From the Table 4, it is found that the extension workers felt educating the farmers on organic farming and building their confidence on organic farming (X=3.57) as the most important strategy for promoting organic farming in the country. This shows two aspect - one is cognitive i.e.

Table 4: Extension strategies for promoting organic farming (n=30)

SN	Extension strategies for promotion of organic farming	Rank	Mean score
1	Educating the farmer on science of organic farming and building the their confidence in organic farming	I	3.57
2	Promotion of organic village in cluster approach	XIV	15.70
3	Increasing the awareness about different government programme on organic farming	IV	6.58
4	Linking organic farming with nutrition security, public health, well-being of children, aged and general public through organic food	XXV	27.76
5	Wider publicity of successful case study on organic farming	XXVI	28.12
6	Breaking the myth on organic farming that it is only based on cow and vermi-compost among the farming communities	V	7.24
7	Ensuring the availability of organic seed and trained the farmers in seed production of local crops	VI	8.30
8	Step-by-step implementation of organic farming policy in a phased manner instead of onetime efforts	XVIII	22.30
9	Adoption of compact area approach and community approach for successful promotion of organic farming	XXVII	28.30
10	Adoption of recommended modern organic technologies for a visible changes in yield and income	II	5.50
11	Organic soil and water conservation measures should be promoted	XV	16.38
12	Promote a mixed farming approach with special focus on organic poultry, fishery & livestock management	XVII	20.46
13	Conserve the local agro-biodiversity and traditional knowledge of farmers to promote organic farming	XIX	24.30
14	Intensive campaign and demonstration on organic farming for different crops and technologies	XVI	18.50
15	Ensuring availability of quality organic manure & bio-fertilizer	III	6.00
16	Ensure availability of quality bio-pesticide and different pheromone trap or light traps used in organic farming	III	6.00
17	Designing and promoting business models for entrepreneurship development in organic farming	XIII	14.10
18	Capacity Building of VLWs, block extension workers, input dealers and other stakeholders on organic farming	XI	11.76
19	Develop model organic farms using local crops for demonstration	XII	12.32
20	Incentivizing the private organization & NGOs who are practicing/promoting organic farming	XX	25.90
21	Promoting organic food processing & value addition technologies	VII	9.50
22	Develop special market separately for organic produce at each block	XXI	26.50
23	Develop a simple certification process at the block/district agricultural office	VIII	9.84
24	Encourage the use of renewable energy sources for irrigation and farming activities	XXII	27.00
25	Reorient participatory research and extension system specially for organic farming with release of new plant based pesticides, fertilizer, varieties resistant to pest and disease etc.	XXIII	27.18
26	The government should make laws to phase out chemical pesticides and fertilizers from the farming sector	X	10.65
27	Convergence of efforts of various departments who are working on similar line on organic farming	XXVIII	28.45
28	Establish farmers club, producer companies and cooperatives of organic farmers	XXIV	27.50
29	Creation of more organizational set-up for promotion of organic farming at different level	XXIX	28.60
30	Linking producers and consumers engaged in organic farming	IX	10.00

knowledge building of farmers on organic farming through education and second aspect is psychological that is building their confidence on organic farming in term of yield and income. The extension functionaries ranked "adoption of recommended organic technologies" as the second most important strategy (X=5.50) followed by "Ensure availability of quality organic manure & bio-fertilizer to the farmers", "Ensure availability of quality bio-pesticide and different pheromone trap or light traps used in organic farming" as third important policies jointly with mean score of six. This shows the need of creating a strong demand as well supply system for successful

adoption of viable organic farming in the country. Increasing awareness about government programme on organic farming (X=6.58) and breaking the myth on organic farming that it is only based on cow and vermi-compost among the farming communities (X=7.24) was ranked as fourth and fifth important strategies. The strategies like ensuring the availability of organic seed (X=8.30), promoting organic food processing & value addition concepts and technologies (X=9.50), developing a simple certification process at the block/district agricultural office (X=9.84), linking organic producers and consumers (X=10), making government laws to phase out chemical pesticides and fertilizers from the farming sector (X=10.65) was found place within ten most important strategies for promotion of organic farming. Devi (2018) also reported the following strategies- capacity building, supply of inputs in time and quantity, spread of awareness, increasing self-reliance, linking producers and consumers, wide publicity of success stories as extension strategies for promotion of organic farming. The strategies viz. capacity building of VLWs, block extension workers, input dealers and other stakeholders on organic farming (X=11.76), developing model organic farms at each block using local crops for demonstration (X=12.32), designing and promoting business models for entrepreneurship development in organic farming (X=14.10), promotion of organic village in cluster approach (X=15.70), organic soil and water conservation (X=16.38), intensive campaign and demonstration on organic farming (X=18.50), promoting a mixed farming approach with special focus on organic poultry, fishery and livestock management (X=20.46), step-by-step implementation of organic farming policy in a phased manner (X=22.30), conserving local agro-biodiversity and traditional knowledge of farmers (X=24.30) and incentivizing the private organization & NGOs who are practicing/promoting organic farming (X=25.90) as moderately important strategies as they were ranked between tenth to twenties strategies respectively. The extension agents ranked following strategies as last ten important strategies- developing special market separately for organic produce at each block (X=26.50), encouraging the use of renewable energy sources (X=27), reorienting participatory research and extension system specially for organic farming (X=27.18), establishing farmers club, producer companies and cooperatives of organic farmers (X=27.50), linking organic farming with nutrition security, public health, well-being of children, aged and general public through organic food (X=27.76), wider publicity of successful case study on organic farming (X=28.12), convergence of efforts of various departments who are working on similar line on organic farming (X=28.45), creating more organizational set-up for promotion of organic farming at different level (X=28.60) as the last nine important strategies respectively for promotion of organic farming. Murgan (2017) reported about similar strategies for promotion of organic farming.

CONCLUSION

India has the vast potential to become a major organic producing country given the international demand of our farm products, different agro-climatic regions of the country, the size of the domestic market and above all the rich traditional knowledge base of nature friendly farming and living. Therefore, a strong national organic policy to promote the updated technological know-how on organic farming is the main need to lead the global organic market. However, the present study revealed that extension officials in our country still had low knowledge on recent technological advances and theoretical aspect of organic farming. But they were knowledgeable on applied aspect of organic farming. The findings of training need analysis showed that the extension officials need training both on technological as well as managerial and marketing aspect of organic farming. Therefore, the policy makers should design different training curriculum and capacity building programme keeping the above findings in mind to bridge existing knowledge and skill gap in organic farming. The study further indicated that a single strategy is not enough for promoting organic farming. A multipronged strategy covering technological aspect, demand side, supply side, institutional factors, marketing aspects and managerial aspects of organic farming need to be taken up for successful implementation of any organic policies in the country.

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Effect of Climate Change on Agriculture in Tripura: A Qualitative Study

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ABSTRACT

The study captured the effect of climate change on agriculture in the state of Tripura located in North Eastern Himalaya of India. Farmers' perception was recorded through household survey and case studies using ethnographic mode. The study revealed that the temperature is raising and rainfall is declining in the state. The farmers reported that the water availability has decreased and pest and disease infestation has increased. The decline in rice productivity has lead to insufficiency in food in households. The lack of adaptation measure has the potential to aggravate the situation in case of extreme climatic variability; hence, the study recommends planned adaptation measure by the government agencies.

Keywords: Climate, Agriculture, Perception, Himalaya

INTRODUCTION

The effect of climate change is multi-dimensional and can be visible on all the biotic and abiotic elements. In India, various studies observed an increasing trend in temperature (Rupakumar *et al.*, 1994; Pant *et al.*, 1999; Singh and Sontakke, 2002). Studies also revealed regional as well as inter year variations in rainfall (Kripalani *et al.*, 1996; Mooley and Parthasarathy, 1984; Singh *et al.*, 2001). Climate change is considered to be one of the most important externalities to agriculture. Majority of the studies revealed that it will negatively affect the crop production (Kurukulasuriya and Rosenthal, 2003; Carraro and Sgobbi, 2008; Macchi *et al.*, 2011) but the overall impact of climate change on food security will differ across regions over time and will depend on the overall socio-economic status of the country (Schmidhuber and Tubiello, 2007). Some Indian studies argue that agricultural production has declined due to climate change (Aggarwal and Kalra, 1994; Dinar *et al.*, 1998; Kumar and Parikh, 2001a, 2001b; Kumar, 2009). If temperature rises by 4^0C, grain yield would fall by 25-40 percent, rice yields by 15-25 percent and wheat yields by 30-35 percent (Kumar and Parikh, 1998).

In the North-Eastern (NE) region, the number of rainy days is likely to decrease by 1–10 days and the intensity of rainfall in the region is likely to increase by 1–6 mm/day (INCCA, 2010). Studies revealed that the NE states also facing drought situations despite high rainfall (Ray *et al.*, 2012; Kusre and Laringliana, 2014; Laitonjam, 2015; Nongbri *et al.*, 2016). The projected increase in these events will result into greater instability (seasonal/annual fluctuations) in food production and threaten the livelihood of the farmers (Mall *et al.*, 2006). Macchi *et al.* (2011) reported that communities in Karbi Anglong of Assam and East Garo Hills of Meghalaya in India expressed concern about the change in precipitation patterns leading to a drying up of water sources for drinking and irrigation. Women's workload increased as they have to travel further to fetch water. Moreover, as the productivity of agriculture declines, men in search for wage labour opportunities, adding both to their workloads and to the workloads of their wives (Macchi *et al.*, 2011).

The impact of climate change is exacerbated in the hill production system which is already underdeveloped. In the absence of other occupations and planned adaptation measures in the hills, the livelihood of the people

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is expected to be adversely affected by changes in climatic change. Hence, this study was conducted in Tripura state in the NE Himalyan region of India with the objective to understand that how climate is changing as per farmers' perception; how it affects the farming and in turn the farm livelihood and how the farmers cope up or adapt to its effect.

MATERIALS AND METHODS

Primary data on socio-economic variables, climatic variables, crop yield, food, water *etc.* were collected from the farm households through interview with the help of structured pre-tested schedule during 2014-15. The data collected through household survey were analyzed and presented in tabular and graphical form. The household survey results were triangulated from the information generated by the case studies. FGDs were conducted in the appropriate site after due discussions with the villagers. After briefing the objectives of the study they were given opportunity to discuss among themselves and come to a consensus on different issues and write down their views on color chart papers. Then, in depth open ended discussions were held to unravel the underlying facts and learn through their experiences.

Multistage sampling technique was applied for primary data collection from farm households. West Tripura district was purposively selected as it was identified as vulnerable district by Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad. Then, Jirania and Mohanpur blocks were selected randomly from the district. In the next stage, from each of the selected blocks two clusters of villages consisting of two to four villages were selected randomly. From one block 60 farmers were selected randomly using probability proportional to size sampling. Hence, a sample of 120 farmers was selected for household survey.

RESULTS AND DISCUSSION

Majority of the respondents in West Tripura district perceived that the summer temperature has increased in last 10 years whereas in case of winter temperature the views were mixed (Table 1). Similarly, the farmers in Dhalai, Khowai and Jampui hill also felt that off-late temperature has risen.They recalled that they could not think of wearing half sleeve during the month of February alike in the year 2014 when they were young. Our discussion with the villagers in Jampui hills revealed that about 30-40 years back, the whole year used to be cold and, unlike now, no mosquito could be traced which they believed is due to the increase in temperature. In West Tripura district most of the farmers (84%) agreed that the monsoon rainfall has declined over the years and the onset became late (63.03%) but the winter rainfall has not seen much change (Table 1). Most of the respondents did not recall incidence of long unexpected dry spell within a rainy period (Table 2). Similar views were expressed by the respondents at Dhalaitoo. At Dhalai district the advent of monsoon has become late by about 10 days but in 2013 it was early by 7 days. Similarly, the rainfall has declined in Jampui hills and the advent of rainfall has been delayed. The respondents reported that the hills used to get rainfall starting from mid-April and it continued upto October-November but now the rainfall occurs during May-July only.

The respondents in West Tripura district reported that water availability for both, irrigation as well as drinking purpose reduced during the drought season but only about one tenth of the farmers informed about conflicts in the village for water in the last 5 years (Figure 1). The time

Table 2: Unexpected change encountered by the respondents in West Tripura (%)

Response	Long dry spell		Drought incidence	
	Monsoon	Winter	Monsoon	Winter
No	77.97	67.80	45.00	62.18
Yes	13.56	11.86	51.67	18.49
No change	7.63	10.17	3.33	13.45
Not sure	0.85	10.17	0.00	0.07

Table 1: Farmers' perception (%) about change in temperature and rainfall in West Tripura

Temperature			Timing of rainfall			Amount of rainfall	
Change	Summer	Winter	Change	Monsoon	Winter	Monsoon	Winter
Decrease	6.67	48.33	Late	63.03	4.20	84.03	19.33
Increase	85.83	44.17	Early	10.08	0.00	5.88	0.84
No change	6.67	4.17	No change	17.65	66.39	4.20	56.30
Not sure	0.83	3.33	Not sure	9.24	29.41	5.88	23.53

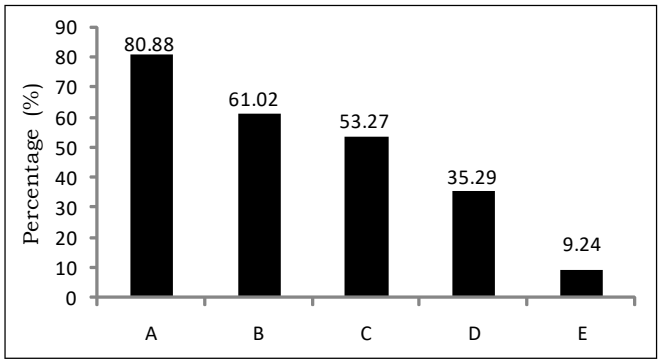

Figure 1: Effect of low rainfall on water availability in West Tripura district

Note: A = Decrease in irrigation water availability, B = Do you think your village's irrigation facility is becoming more and more inadequate? C = Decrease in drinking water availability, D = Do you think your village's drinking water facility is reducing?, E = During the past 5 years conflicts over water in the village

spent for fetching water increased in the drought years in comparison to normal years which is similar to the findings of Singh *et al.* (2012) and the extra burden was on female or both male and female members of the families (Figure 2).

At Dhalai, some farmers irrigated their land using the water from small streaks of Dhalai and Surmarivers. They used ring well, tube well and depended on water supply by Public Health and Engineering (PHE) Department. But in few villages during the summer both male and females had to shoulder higher burden (time and drudgery) to fetch water from distance. The drinking water facility has improved over the years in the villages due to government effort. The scanty rainfall in recent periods lowered the water level and shrank (in width) Khowai River and other small streams of it.

In Jampui hills, almost all the water sources i.e., Juririver and two ring wells in the village Purnoram Para, now a days, get dried up during the dry seasons which earlier used to be full of water for the whole year. Similar finding in Meghalaya was reported by Singh *et al.* (2012). The residents of these hill villages were facing drinking water scarcity and the females went down the slopes further to fetch drinking water from the down stream. Though the PHE water supply has reached to Purnoram Para but still tensions for water prevail as the lengths of dry periods have extended.

Any change in rainfall pattern *i.e.,* time and quantum of rainfall, affects the area under and yield of the crops. The respondents in West Tripura district reported decrease in area under rice in case of change in rainfall pattern but a considerable percentage of farmers did not change the crop area as rice is the staple food for the people in Tripura (Table 3). Golmohammadi (2012) studied the environmental and social impacts of drought in South Khorasan province, East of Iran and found that the average area under cultivation reduced by 1 per cent than the previous year. Nearly everyone agreed that yield has decreased during the low rainfall or late rainfall situations (Figure 3). In West Tripura and Dhalai districts, during the normal seasons they harvested about 4-4.5 MT/ha of rice. The farmers opined that during untimely or low rainfall period the rice productivity reduced from 36 percent (West Tripura) to 50 percent (Dhalai) in case of extreme climatic variability (ECV). Devisti and Moetamed (2012) reported

Table 3: Effect of rainfall variability on area under rice in West Tripura (%)

Response	Early/late	Drought/Low rainfall
Decrease in area	47.41	56.52
No change in area	51.24	42.39
Decrease in yield	83.54	94.44

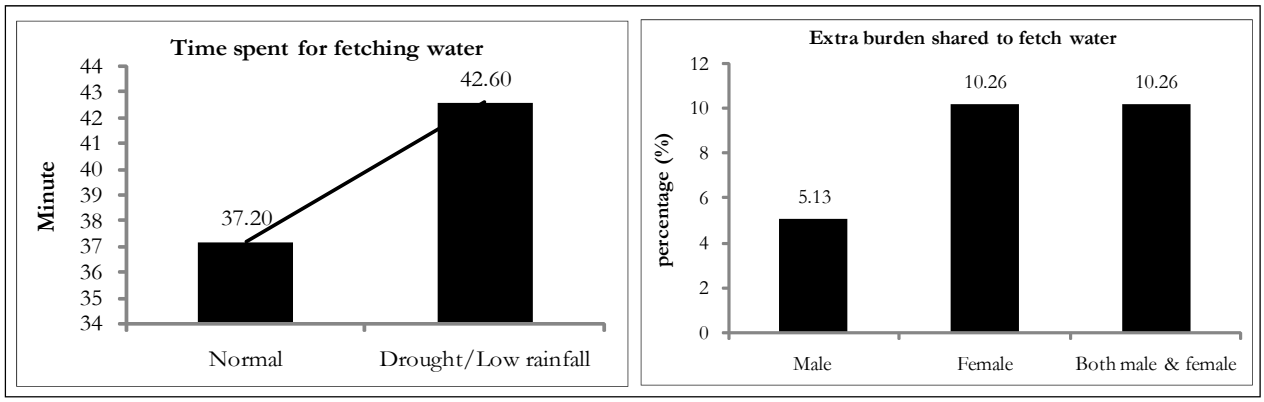

Figure 2: Effect of low rainfall on fetching drinking water in West Tripura district

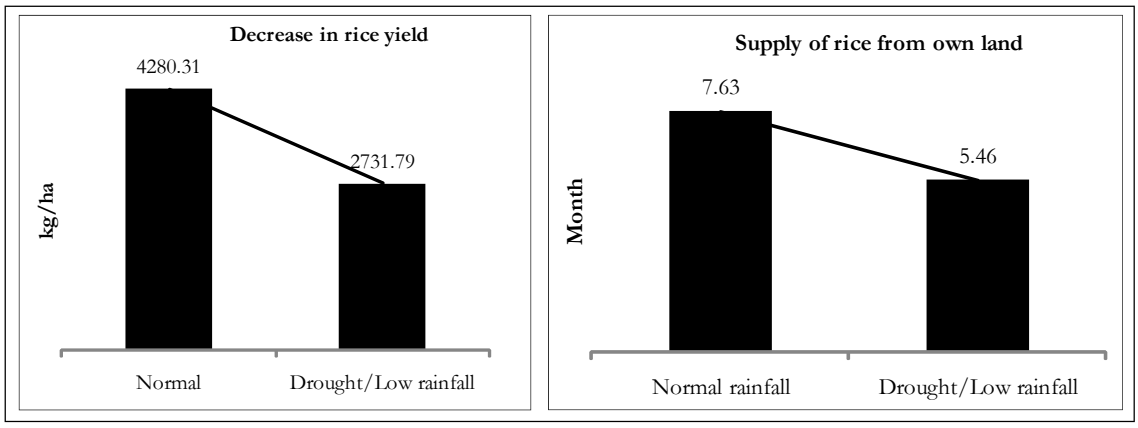

Figure 3: Effect of low rainfall on rice yield and household rice availability in West Tripura district

312 kg/ha drop in rice productivity in Iran during drought. The production of vegetables in Dhalai were not much affected as the farmers who have assured irrigation cultivated vegetables but the farmers were of the view that vegetables are sensitive to environmental extremes like high temperature and limited soil moisture which reduces the productivity.

Late rainfall and reduction in soil moisture during the cropping season is an issue of concern in *jhum* in Jampuii hills which led to reduction in crop production by 30 percent. Similarly, the vegetable crops in *rabi* (October-December) season also failed or production declined during the ECVs and negatively affected the household food and income security.

Nearly all of the farmers in West Tripura and Dhalai reported that the incidence of pest and disease attacks have increased in recent years and they felt that it might be due to change in climate (Table 4). The rice crop in the study areas was often infected by *khaira* disease. Curling of leaf and rotting of mid rib of leaf and roots were the major problems faced by the potato crop in Dhalai. They informed that the disease attack on potato crop was higher when the number of foggy days was more reducing the potato yield. The reang *jhumias* in Jampui hills revealed that the intermittent rain and hot weather increased the incidence of pest and disease in crops under *jhum*.

Table 4: Effect of change in climate on rice pest and disease in West Tripura (%)

Response	Disease	Pest	Crop damaged
Decrease	1.22	2.61	9.99
Increase	90.24	90.43	
No change	1.22	0.87	
Not sure	6.10	5.22	
New disease	0.00	0.00	

The climate change through its effect on agriculture in the study area has negatively impacted the household consumption from own farm produce (Figure 4). The rice produce from own farm lasted 2.17 months lesser during low rainfall period in caparison to normal years in West Tripura district. On an average the consumption of about two-third of the respondent farmers reported that availability of food has become insufficient during drought and about 31.09 percent of them found it difficult to purchase food from the market due to insufficiency of money; but majority of them said all the family members got food and no gender discrimination was observed (Figure 4). The supply of food grains through public distribution system (PDS) at very low price was one of the important reasons for this.The production from *jhum* cultivation lasted for 3-4 months for home consumption but during severe drought it lasted for only 1-2 months only. Similarly insufficiency of food was reported by Orong tribe of Sundargarh in Odisha during drought (Mishra, 2007). Another study by Warner *et al.* (2012) revealed food and livelihood insecurity in Vietnam, India, Bangladesh, Ghana, Guatemala, Tanzania, Peru and Thailand during climatic variability.

Adaptation strategies to cope up with the climatic change were more of autonomous nature in West Tripura district. Changing the time of sowing and harvesting were the two major decisions that the farmers took in case of late rainfall. Some of them changed the cultivars or cropping sequence due to change in climate. During drought, most of the farmers cultivated in smaller area of land as compared to normal years. A few farmers also changed the land race in case of change in time of rainfall (Table 5). It was found that quite a large number of sample farmers did not adopt any measure which is a matter of concern; which makes the planned adaptation strategy imperative.

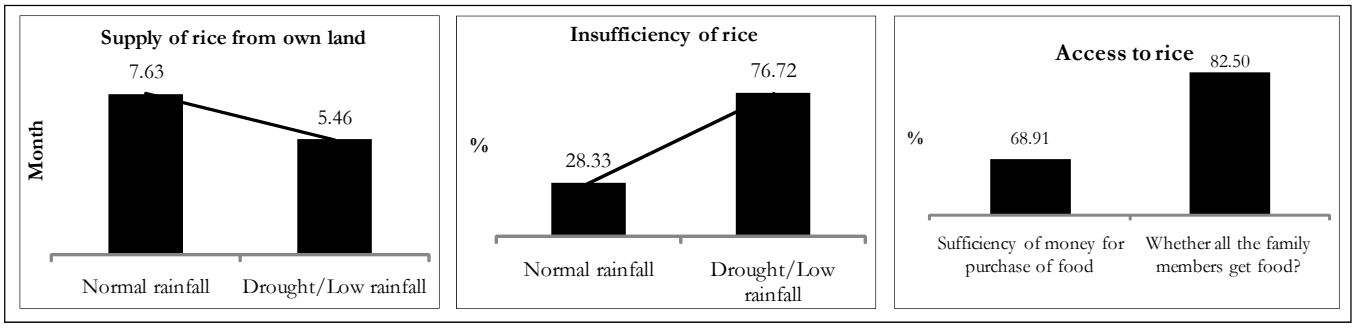

Figure 4: Effect of low rainfall on household rice consumption in West Tripura district

Table 5: Adaptation strategy followed in agriculture in West Tripura (%)

Strategy	Late rainfall	Early rainfall	Drought/Low rainfall
Leave complete fallow	0.00	0.00	13.33
Grow dry fodder crops	1.49	0.00	1.09
Change in cropping sequence	7.69	0.00	5.62
Change in crop cultivar/ landrace	4.69	12.50	2.20
Change in sowing/harvesting time	54.55	25.00	12.77
Change in harvesting time	50.00	25.00	11.70
Shift from crops to livestock	1.52	0.00	1.10
Grow more cash crops	0.00	0.00	1.10
No change	41.79	85.71	47.00

The respondent farmers in West Tripura district reported that *Swarna Mahsuri, Paijam, Malati, Ranjit* and *Shatabdi* were the varieties resistant to water stress. In Jampui hills, the jhum farmers stopped growing some local rice varieties *viz. Bhaidaya, Maisanyha* and *Maibrain* but they still continue to cultivate *Galong Beeti* since, it can withheld stress and the productivity is higher. In Dhalai lentil has been introduced by the State Agricultural Department through KVK in last 4 years. In Jampui hills in order to supplement the income of the farmers, coffee has been introduced as an alternative crop during 1966 by the Coffee Board. Arecanut plantations have also come up in Jampui hills.

Working as wage laborer was the best alternative the respondents had in case of ECVs, as 100 days of employment opportunity was available in the villages under Mahatma Gandhi National Rural Employment Gurantee Act (MGNREGA) (Figure 5). About 12 per cent of the households interviewed in West Tripura district reported migration during climatic variability periods. Majority of

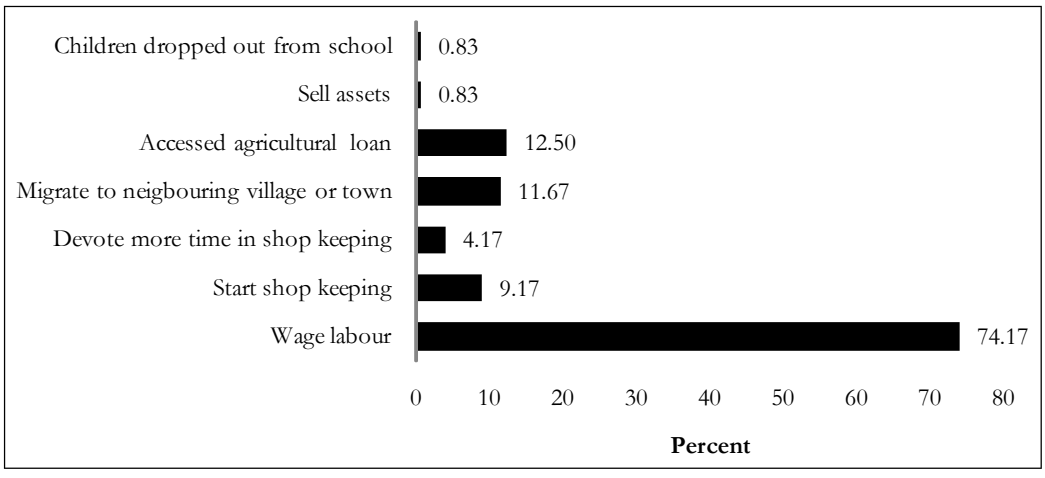

Figure 5: Farmers' response to negative variability for sustaining livelihood in West Tripura district

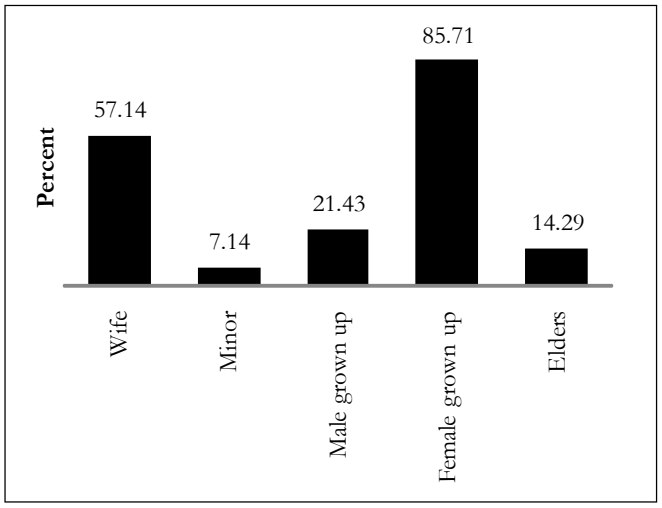

Figure 6: Family members left at home during migration in West Tripura

them migrated to the neighboring villages/towns; and mostly the wives and female grown up were left at home (Figure 6). Some of the farmers resorted to shop keeping during the lean periods.

CONCLUSION

The study was conducted in Tripura state of NE Himalyan region of India to understand the effect of climate change on farming and farm livelihood through household survey and case studies. The results showed that the sample farmers perceived that the monsoon rainfall has been in decline and has often been delayed. Summer months were perceived to be hotter now-a-days. The farmers cultivated lesser area during the period of late or low rainfall. The reduction in area under cultivation coupled with decline in yield has affected the household consumption from own produce. Even *jhum* production also suffered in the hill district of the state. Availability of job as wage labourers, especially under MGNREGA in the village was the alternative source of income which enabled them to purchase food from PDS as well as from nearby village markets. The irrigation facility was minimal and further shrunk during the low rainfall period. Farmers delayed the timing of sowing or transplanting in case of late rainfall in the study areas. Despite government efforts the drinking water scarcity was a problem in the hilly areas. They also have changed the varieties they grew to maintain the yield stability. Hardly farmers have availed any loan or heard about crop insurance in the study areas. The study recommends that research effort may be directed towards development of varieties suitable for late sowing, which should perform better in condition of water stress and increased temperature. Focus should be put on conserving and upgrading the existing landraces considered to be suitable for climate change situation and making available the suitable varieties at the time of need. For combating drought government should invest on irrigation structures suitable to the terrain of the region. Water may be stored in watersheds, such as *jalkunds,* to be utilized in the lean periods. Financial sector also can play a constructive role by extending the crop insurance schemes in the state of Tripura.

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Constraints and Mitigation Strategies for Smooth Implementation of Integrated Watershed Management Programme: A Lesson from Wokha, Nagaland

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ABSTRACT

Integrated Watershed Management Programme (IWMP) is highly prioritized flagship programme of Government of India for all-round development and poverty alleviation of rural people on a watershed basis. Accordingly, it was introduced in Nagaland. This paper is an attempt to explore the constraints involved in the implementation of IWMP and measures for mitigation of constraints. Accordingly, Wokha district of Nagaland was purposively selected for the study. Total of 120 beneficiaries was purposively selected from 12 villages (10 beneficiaries from each village). To assess the constraints, a list containing 24 constraints was prepared after thorough research from literature and assuming the local condition of the study area. The constraints were ranked based on the frequencies of response against each constraint. Among the constraints, 'Lack of post-harvest technologies', 'Technology being capital and labour intensive', 'Lack of transport facilities', 'Lack of skilled labour', 'Lack of technical knowledge', 'Non availability of good quality equipment and implements to construct conservation structures' were some of the most commonly faced constraints. Further, provision of providing rubber roller, provision of proper market linkage for the produces, the inclusion of a greater number of beneficiaries under different livelihood activities and provision of training on tapping of rubber emerged as remedial measures as provided by the beneficiaries.

Keywords: Beneficiaries, Constraints, IWMP, Ranking, Suggestions

INTRODUCTION

Rain-fed agriculture in India is characterized by low productivity, high risk and uncertainty, low level of technological change and vulnerability to degradation of natural resources (Joshi *et al*., 2004). In order to improve agricultural production and alleviate poverty in rainfed regions, Watershed Development (WSD) in India has been a part of the national approach since the 1970s (Gray and Srinidhi, 2013). Watershed Development programs focus on rainfed regions because these areas represent 65 per cent of arable land in India and 55 per cent of the country's agricultural output, and provide food that supports 40 per cent of the nation's population (Ahmad *et al.,* 2011; Planning Commission, 2012).

In the wake of depleting water, soil and other natural resources, India had been implementing a large number of the watershed programme as a means to achieve agricultural development and is considered as the engine of growth and sustainable development in the rainfed and drought-prone areas. One such initiative of the Government of India had been the implementation of Integrated Watershed Management Programme (IWMP) by the Department of Land Resources, Ministry of Rural Development from February 2009, principally for the development of rainfed portions of net cultivated area and culturable wastelands. IWMP is an initiative for all-round development, poverty alleviation and upliftment of rural community to abolish social exclusion and emphasis on social inclusion as well as conservation of natural resources (Ao and Patra, 2018). Accordingly, IWMP has emphasized all the issues for well-uniform distribution of social equity. Even though the majority (63%) of the beneficiaries had benefitted moderately, around 14 per cent had least benefitted from the scheme in respect of social inclusion (Ao and Patra, 2018). These are indicating the evidence of the influence of some hinderances or constraints in the implementation process. Considering all

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the issues, this is an initiative to explore the constraints involved in the implementation process of IWMP.

MATERIALS AND METHODS

The study was conducted in Wokha district of Nagaland. IWMP was implemented in the district since 2009. For the study, the first batch of the project under Wokha district, which consisted of IWMP-I and IWMP-II were selected, since these phases had already completed implementation. Selection of villages was done in consultation with the watershed development teams (WDT) of the project area. Twelve villages were selected, i.e. five villages from IWMP-I and seven villages from IWMP-II. From each selected village, ten beneficiaries were selected. Thus, a total of 120 beneficiaries were interviewed for the study.

In this study, an attempt was made to identify the constraints faced by the beneficiaries of IWMP in the adoption of various components of IWMP, as well as to extract suggestions from the beneficiaries. Constraint is any factor that prevents or limits an individual or group from adopting an intervention or restrains them from tapping the intended virtues of an intervention (Aiswarya *et al.,* 2019). The constraint is a limiting factor which restricts to achieve the potential with reference to a goal (Kumar *et al.*, 2017). In this study, constraint referred to the problems, hindrances or barriers which come in the way of acceptance and adoption of components under IWMP. Based on the reliable sources of literature as well as views from the experienced people of IWMP, a list of constraints was prepared. The constraints were further reviewed and reconsidered to finalize as recognized constraint for the study. Altogether, 24 constraints were included in the study and presented with a four-point continuum of 'not agree', 'partially agree', 'agree', and 'strongly agree' with scores of 0, 1, 2 and 3 respectively. Beneficiaries were asked to mention the constraints faced by them under IWMP with a certain degree. The response of beneficiaries against each constraint with different degrees was also taken into account and expressed as frequency and percentage. The response of each beneficiary against every constraint with score value was summed up to get the total score. Based on the total score, the ranking was done.

Further, to understand the degree of constraint at an individual beneficiary level, the total score of the individual beneficiary against all the selected constraints were calculated. Based on the total score of an individual, respondents were categorized into low, medium and high constraint group. Also, to improve the performance of IWMP and smooth implementation of the programme, the beneficiaries were asked to mention suggestions for smooth implementation of IWMP. Accordingly, beneficiaries provided large numbers of suggestions. Based on the number of beneficiaries highlighting the same suggestion, it was ranked and presented accordingly.

RESULTS AND DISCUSSION

Constraints as perceived by the beneficiaries: The study aimed to identify the constraints faced by the beneficiaries in the adoption of watershed management approaches under IWMP. Under this, perceptions of the beneficiaries were taken into account. The result obtained on the constraints as perceived by the beneficiaries is presented in Table1.

From Table 1, it could be observed that lack of post-harvest technologies was the most common constraint faced by the beneficiaries and had been ranked first with a total score of 331. Regarding this constraint, a total of 76 per cent responded to 'strongly agree' and 24 per cent responded to 'agree'. Technology as being capital and labour intensive was perceived as another important constraint and had been ranked as second with a score of 325. The majority (76%) of the beneficiaries 'strongly agreed' to this constraint, 19 per cent responded to 'agree' and 5 per cent partially agreed.

Lack of transport facilities was another important constraint faced by the beneficiaries with a score of 319 and had been ranked third. Here, a total of 66 per cent 'strongly agreed' to this constraint, and 34 per cent responded to 'agree' in facing this constraint. Lack of skilled labour was ranked fourth among the constraints with a total score of 314. It was observed that 62.5 per cent of the beneficiaries responded to 'strongly agree', 36.7 per cent responded to 'agree' and 0.8 per cent responded to 'partially agree'. Lack of technical knowledge was adjudged to be the fifth constraint by the beneficiaries with a score of 312. Regarding this constraint, 60.8 per cent 'strongly agreed' to it as an important constraint, 38.3 per cent responded to 'agree' and 0.8 per cent 'partially agreed'.

Non-availability of good quality equipment and implements at the local level to construct conservation structures was another constraint much faced by the beneficiaries with a score of 309 and had been ranked sixth among the constraints. A total of 67 per cent responded to 'strongly agree', 24 per cent responded to

Table 1: Constraints perceived by the beneficiaries in the adoption of activities under IWMP

S. No.	Nature of constraints	NA		PA		A		SA		Total score	Rank
		F	%	F	%	F	%	F	%		
1.	Lack of post-harvest technologies	0	0	0	0	29	24	91	76	331	I
2.	Technology is capital and labour intensive	0	0	6	5	23	19	91	76	325	II
3.	Lack of transport facilities	0	0	0	0	41	34	79	66	319	III
4.	Lack of skilled labour	0	0	1	0.8	44	36.7	75	62.5	314	IV
5.	Lack of technical knowledge	0	0	1	0.8	46	38.3	73	60.8	312	V
6.	Non-availability of good quality equipment and implements at the local level to construct conservation structures	0	0	11	9	29	24	80	67	309	VI
7.	Adoption of the new crop is difficult and risky	0	0	17	14	45	38	58	48	281	VII
8.	Low prices of produce	0	0	9	8	64	53	47	39	278	VIII
9.	Lack of training	0	0	9	8	65	54	46	38	277	IX
10.	Lack of knowledge about proper application and recommended dose of fertilizers	4	3	16	13	43	36	57	48	274	X
11.	Weak advisory and extension services	0	0	19	16	63	52	38	32	259	XI
12.	Slow returns from fruits and forest plants	0	0	22	18	59	49	39	33	257	XII
13.	Lack of input at proper time	0	0	20	17	79	66	21	17	241	XIII
14.	Lack of sufficient fund for different activities	0	0	23	19	73	61	24	20	241	XIII
15.	Labor rates are high	0	0	21	17	81	68	18	15	237	XIV
16.	Perishable nature of produce	0	0	27	22	73	61	20	17	233	XV
17	Distant training centre	0	0	34	28	71	59	15	13	220	XVI
18	Lack of timely availability of plant protection measures	5	4	36	30	66	55	13	11	207	XVII
19.	Lack of provision for repair and maintenance of soil and water conservation structures	16	13	33	28	43	36	28	23	203	XVIII
20.	Lack of irrigation facilities	16	13	35	29	55	46	14	12	187	XIX
21.	Stray/wild animal menace	14	12	79	66	24	20	3	2	136	XX
22.	Poor quality of structures created under the project	32	26	54	46	20	16	14	12	136	XX
23.	Poor execution of work by watershed committee	61	51	34	28	14	12	11	9	95	XXI
24.	Fragmented land holding	62	52	58	48	0	0	0	0	58	XXII

*NA=not agree, PA=partially agree, A=agree, SA=strongly agree

'agree' and 9 per cent 'partially agreed'. The seventh most commonly faced constraint among the beneficiaries was the risk and difficulty involved in the adoption of a new crop, with a score of 281. A total of 48 per cent of the beneficiaries 'strongly agreed', 38 per cent responded to 'agree' and 14 per cent 'partially agreed' about risk and difficulty involved in the adoption of a new crop.

Similarly, the low price of produce was ranked eight among the constraints with a score of 278. Among the beneficiaries, 53 per cent responded to 'agree', 39 per cent 'strongly agreed' and 8 per cent 'partially agreed' to the low price of produce. Lack of training with a total score of 277 was ranked ninth. Regarding this constraint, the majority of the beneficiaries, i.e., 54 per cent responded to 'agree', 38 per cent responded to 'strongly agree', and 8 per cent 'partially agreed' about lack of training.

The beneficiaries also felt that the lack of knowledge about the proper application of fertilizers with recommended dose was another serious constraint faced by them which scored a total of 274 and had been ranked as tenth. Regarding this constraint, 48 per cent of the beneficiaries 'strongly agreed' to have faced this constraint,

36 per cent responded to 'agree', 13 per cent 'partially agreed' and 3 per cent did not agree on lack of knowledge about the proper application of fertilizers with the recommended dose.

'Weak advisory and extension service' was perceived as an important constraint among the beneficiaries with a score of 259 and had been ranked eleventh. Regarding the response of the beneficiaries, it was observed that 52 per cent responded to 'agree', 32 per cent 'strongly agreed' and 16 per cent 'partially agreed' about weak advisory and extension services and this finding are well aligned with the findings of Patra *et al.* (2018). Further, the beneficiaries mentioned that the slow return from fruits and forest plants was another constraint. It was ranked twelfth with a score of 257. In this regard, 49 per cent responded to 'agree', 33 per cent 'strongly agreed' and 18 per cent 'partially agreed'.

'Lack of input availability at the proper time' as well as 'lack of sufficient fund for different activities' seemed to be important constraints with a score of 241 each and had been ranked thirteenth. In case of lack of input facilities at the proper time, a total of 66 per cent beneficiaries responded to 'agree', 17 per cent 'partially agree' and remaining, 17 per cent 'strongly agree'. Regarding lack of sufficient fund for different activities, 61 per cent responded to 'agree', 20 per cent responded to 'strongly agree', and remaining 19 per cent responded to 'partially agree'.

On the other hand, the high labour rates was another concern for the beneficiaries and had been ranked as the fourteenth constraint with a score of 237. The number of beneficiaries who responded to 'agree' was 68 per cent, followed by 'partially agree' with 17 per cent and the remaining 15 per cent 'strongly agreed'. The similar constraint was also reported among jute growers in west Bengal (Kumar *et al.,* 2017).

According to the beneficiaries, perishable nature of the produce being an important constraint was ranked fifteenth with a score of 233. The response of the beneficiaries showed that 61 per cent responded to 'agree', 22 per cent responded to 'partially agree' and 17 per cent 'strongly agreed'. Distant training centre as a constraint was ranked sixteenth with a score of 220. The response of the beneficiaries on this constraint showed that 59 per cent 'agree', 28 per cent responded to 'partially agree' and 13 per cent 'strongly agreed'. Another major constraint faced by the beneficiaries was lack of timely availability of plant protection measures which ranked seventeenth with a score of 207. Regarding this constraint, 55 per cent of the beneficiaries responded to 'agree', 30 per cent 'partially agreed' and 11 per cent 'strongly agreed' and remaining 4 per cent did not seem to agree.

Lack of provision for repair and maintenance of soil and water conservation structures was identified by the beneficiaries as a constraint and had been ranked eighteenth with a score of 203. Around 36 per cent responded that they 'agree', 28 per cent responded that they 'partially agree', 23 per cent felt that they seriously face this constraint and 'strongly agreed' whereas 13 per cent did 'not agree' to this as a constraint. The beneficiaries mentioned that lack of irrigation facilities was another constraint which ranked nineteenth with a score of 187. As many as 46 per cent responded to 'agree', 29 per cent 'partially agreed', 13 per cent did 'not agree' and 12 per cent 'strongly agreed' to this constraint.

'Stray or wild animal menace' along with 'the poor quality of structures created under the project' scored 136 each and had been ranked twentieth. Regarding stray or wild animal menace as a constraint, majority of the beneficiaries (66%) 'Partially agreed', 20 per cent responded to 'agree', only 2 per cent 'strongly agree', whereas 12 per cent did 'not agree'. In case of poor quality of structures created under the project, it was found that 12 per cent of the beneficiaries 'strongly agreed' to it, and another 16 per cent responded to 'agree', 46 per cent 'partially agreed' whereas, 26 per cent did 'not agree' to this as a constraint.

Some of the beneficiaries also felt that poor execution of work by the watershed committee was a constraint with a score of 95 and ranked twenty-first. In this regard, 28 per cent 'partially agreed' to this constraint, 12 per cent responded to 'agree' and only 9 per cent 'strongly agreed', whereas, 51 per cent did 'not agree' to this as a constraint. Fragmented land holding had been ranked twenty-seconds with a score of 58. The majority (52%) of the beneficiaries did 'not agree' to this as a constraint and remaining 48 per cent responded to 'partially agree' with this constraint.

Distribution of beneficiaries according to the degree of constraint encountered in the adoption of activities under IWMP: To get an overview of the level of constraint, the beneficiaries were categorized into three based on the calculated mean and standard deviation of the total score obtained by each beneficiary for the stated constraints. Further, based on their total score of response,

the beneficiaries were placed under the categories of the low level of constraint (up to 45 scores), medium level of constraint (46-53 score), and high level of constraint (> 53) the result is presented in Table 2.

Table 2: Distribution of beneficiaries based on the degree of constraint faced

Level of constraint	Frequency	Percentage
Low (up to 45)	15	13
Medium (46-53)	87	72
High (above 53)	18	15
Total	120	100

It is observed (Table 2) that majority of the beneficiaries (72%) were in the medium category of constraint level, followed by high level (15%) and low level (13%), respectively. From the study on constraints, it can be concluded that the beneficiaries had been encountering various problems in the adoption of the IWMP approach. Further, it can also be concluded that around 15 per cent of the beneficiaries were facing a high degree of constraint in the implementation of the IWMP approach.

Suggestions provided by the beneficiaries of IWMP: To make IWMP more effective and beneficial, the beneficiaries were asked to propose to suggestive measures from their experience and wisdom to mitigate the constraints as well as to accelerate the implementation of different components of IWMP. The suggestions put forward by the beneficiaries were collected and analyzed. The findings are presented in Table 3.

From Table 3, it can be seen that 48 per cent of the beneficiaries suggested providing rubber roller, and this had occupied the 1st rank and the most common suggestion. The 2nd most important suggestion was the provision of proper market linkage for the produces where 44 per cent of the beneficiaries highlighted this suggestion. The 3rd most common suggestion was to involve a greater number of beneficiaries under different livelihood activities. This suggestion was highlighted by 37 per cent of the beneficiaries. The suggestion to provide training on tapping of rubber occupied the 4th rank where 35 per cent of the beneficiaries came forward with this suggestion. The 5th rank was occupied by the suggestion to provide sufficient and quality planting materials on time. A total of 33 per cent of beneficiaries provided this suggestion. The 6th most provided suggestion was the introduction of diversified cash crops under IWMP. This was suggested by a total of 32 per cent of beneficiaries.

Table 3: Suggestions of the beneficiaries for future improvement of the programme

S.No.	Suggestions	Number of beneficiaries	Percentage	Rank
1.	To provide rubber roller	57	48	I
2.	Agri link road to the fields for transportation	35	29	VII
3.	Introduction of diversified cash crops	38	32	VI
4.	Training on tapping of rubber	42	35	IV
5.	Construction of resting shed at a strategic location	18	15	XIV
6.	Supply of Sufficient and quality planting materials on time	40	33	V
7.	More emphasis on livestock-based livelihood	28	23	XI
8.	Financial assistance for maintenance of watershed	25	21	XII
9.	Strong technical support for rubber cultivation	31	26	VIII
10.	Construction of more number of WHS for common use	25	21	XII
11.	Promotion of fishery	18	15	XIV
12.	Proper market linkage for the produces	53	44	II
13.	Inter cropping with rubber to enhance their income	24	20	XIII
14.	Equal distribution of inputs and activities to all beneficiaries	29	24	X
15.	Support more income-generating activities	28	23	XI
16.	Equal distribution of funds to the beneficiaries	30	25	IX
17.	Involvement of more number of beneficiaries under different livelihood activities	44	37	III

Construction of agri-link road to the fields for transportation had been ranked 7th, where a total of 29 per cent beneficiaries provided this suggestion.

Another important suggestion offered was to provide strong technical support for rubber cultivation which occupied the 8th rank. Altogether, 26 per cent beneficiaries highlighted this suggestion. Equal distribution of funds to the beneficiaries was ranked 9th, where 25 per cent beneficiaries expressed the suggestion. Unequal and bias distribution/selection of beneficiaries for different activities was an important problem under IWMP. Equal and unbias distribution of various inputs and activities for better livelihood among the beneficiaries under IWMP had been suggested by 24 per cent of beneficiaries and ranked 10th. Suggestions like 'more emphasis on livestock-based livelihood' and 'to support more income-generating activities' each had occupied the 11th rank. For both the suggestion, an equal number of beneficiaries, i.e., 23 % suggested the same. The suggestion to 'provide financial assistance for maintenance of watershed' as well as to 'construct number of WHS for common use' occupied the 12th rank with an equal number of beneficiaries, i.e., 21 per cent each for the more effective functioning of IWMP. Around 20 per cent of beneficiaries also suggested promoting inter cropping with rubber to enhance their income. This suggestion occupied the 13th rank. Suggestions like 'Construction of resting shed at strategic location' and 'promotion of fishery' under IWMP were suggested by 15 per cent each of the beneficiaries and had occupied the 14th rank.

CONCLUSION

The success of any developmental programme depends on the response of the beneficiaries to accept and adopt the activities without much difficulty, and within their social and economic ability. The constraints identified in this study highlights various financial, institutional, market-linkage and technology-related constraints which the beneficiaries had faced and continues to face. The study indicated that 'Lack of post-harvest technology' was the most severe constraint as perceived by the beneficiaries in the study area, followed by 'Technology as capital and labour intensive', 'Lack of transport facilities', 'Lack of skilled labour' and so on. The suggestions provided also brought to light the needs of the beneficiaries based on their own experience from IWMP over the years since implementation. The 'Provision of rubber roller' to the beneficiaries was the most common suggestion, followed by agri-link roads to the fields, diversification of cash crops, training on rubber etc. It can be concluded that there should be regular monitoring of the programme, and the implementing agencies, as well as the committees at the village level, should timely review such discrepancies associated with the programme and bring it to the notice of the higher authorities. This would facilitate the remediation of constraints and incorporation of valuable suggestions for the improved performance and sustenance of the programme.

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Techno-economic Evaluation of Solar Photovoltaic Operated Drip Irrigation System

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ABSTRACT

Irrigation is one of the major consumers of electricity that is supplied mostly from conventional electricity sources across the globe. However, these sources of electricity generation are depleting fast and causing environmental pollution. Renewable energy sources are sustainable and eco- friendly alternatives, and solar photovoltaic (PV) is the most attractive among them. To get the wider acceptance of solar power in the field of agriculture, the scientific information regarding the technical performance and economical viability of solar photovoltaic (SPV) operated irrigation system has great importance. In this study, the techno-economic evaluation of SPV operated submersible pump and drip irrigation system is investigated. The experiment has been conducted during Rabi season for varying solar irradiance and temperature conditions at IIT Kharagpur, West Bengal, India. The effect of solar irradiance on drip irrigation was analyzed and found that maximum emission uniformity for the system is achieved during 11:00 AM to 2:00 PM of about 94 per cent. The LCC analysis shows that the SPV system is preferable than DG set. The payback period for SPV and DG set is found as 2.5 years and 4.5 years respectively.

Keywords: Drip irrigation, Life cycle cost, Solar PV pumping, Uniformity coefficient

INTRODUCTION

Irrigation is one of the most important operations in agriculture and most of the time due to non-availability of the energy there is a delay in irrigation which ultimately affects the crop yield. To meet the demand for energy especially in agriculture use in rural and remote places, solar energy is emerging as one of the best renewable energy alternative (Kumar *et al.,* 2015). Solar energy is abundantly available in most parts of the world. India has potential of solar power of about 750 GW (MNRE). However, application of solar power is limited and the major constraint in adopting this technology is higher cost and climate dependant nature of power generation. The development performed in semiconductor technology leads to achieve significant price reduction per Watt of a solar cell in the last two decades. This falling cost of the solar panel is mainstreaming solar pumps from research stations to farmers' field. Increased affordability of the PV technology encouraged Governments and International agencies to promote solar pumps across the world. The Government of India have taken several steps to promote the use of solar powered pumps, The Kusum (Kisan Urja Suraksha evam Utthaan Mahabhiyan) scheme announced recently during the union budget 2018-19 is one of them. The adequacy of drip irrigation system with solar PV power generation is not reported substantially in the literature. Therefore, to get the wider acceptance of solar PV operated drip irrigation, the intensive field performance evaluation studies are needed. Therefore considering this fact, this paper presents the experimental evaluation of effect of climatic parameters (solar radiation and temperature) on the power generation of PV system, the effect of varying power generation on the pump flow rate and effect of varying pump flow rate on the drip irrigation system performance.

MATERIALS AND METHODS

The present investigation was carried out at research farm of Department of Agricultural and Food Engineering, IIT Kharagpur. The climate of the Kharagpur region is sub-humid, with average annual rainfall of about 1200-1500 mm. The minimum temperature varies from 9.6°C to 27°C and maximum temperature ranges from 27.2°C to 41.8°C for the winter and summer season respectively. The maximum and minimum relative humidity varies from 79 to 99 per cent and 19 to 78 per cent throughout the

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year. The soil is sandy loam. The database on solar irradiance and module temperature of the Kharagpur region was collected on hourly, daily and monthly basis for the year 2015-2017 which is monitored at the Department of Electrical Engineering, IIT Kharagpur. The average annual solar insolation for the irrigation period (Rabi and summer) was estimated and found as 4.7 kWh/m^2/day. The climatic data of maximum and minimum temperature, relative humidity and daily sunshine hours were collected from the precision farming development centre (PFDC), IIT Kharagpur for last 10 years (2007 to 2017). The solar insolation level in different months at Kharagpur is shown in Figure 1 and the reference evapotranspiration estimated using equation 1 is presented in Figure 2. The experimental set up consists of SPV system, submersible pump and drip irrigation system is depicted in Figure 3. The detailed specification of solar PV pumping system is presented in Table 1. Performance of the designed PV system was measured in terms of electrical parameters and their variation with the solar irradiance during the day hours. In order to get a fair estimate of electrical parameters the average value was considered obtained from the number of data recorded corresponding to the solar irradiance. These parameters obtained for the different value of solar irradiance are the performance indicators of the system. To estimate the actual cost associated with all the system, the life cycle cost (LCC) analysis was performed for pumping system operated with diesel generator set, grid supply and solar photovoltaic. During LCC analysis, initial cost of system, escalation of fuel price, routine maintenance of diesel generator set, electricity charges escalation and routine maintenance of SPV system was considered.

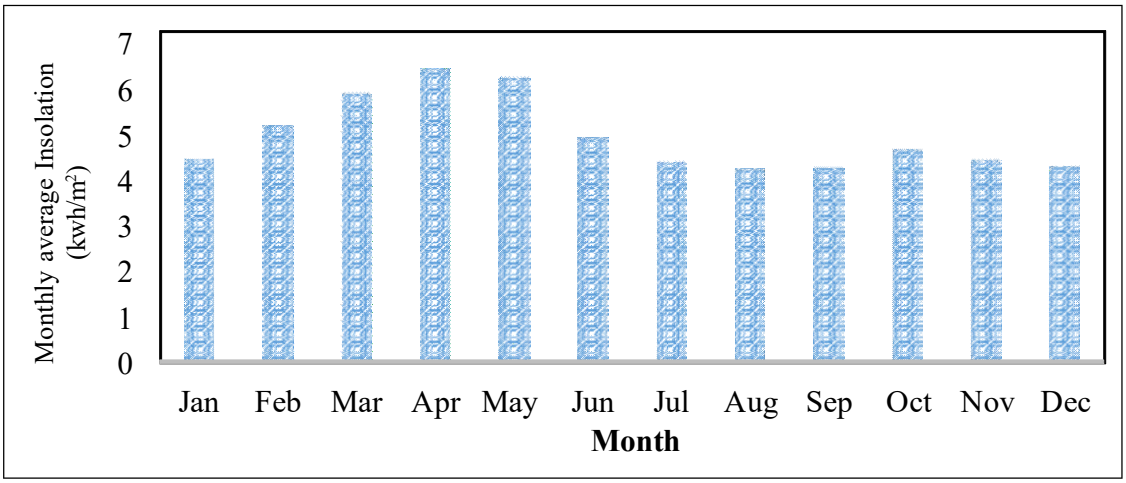


Figure 1: Solar insolation level is different months at Kharagpur

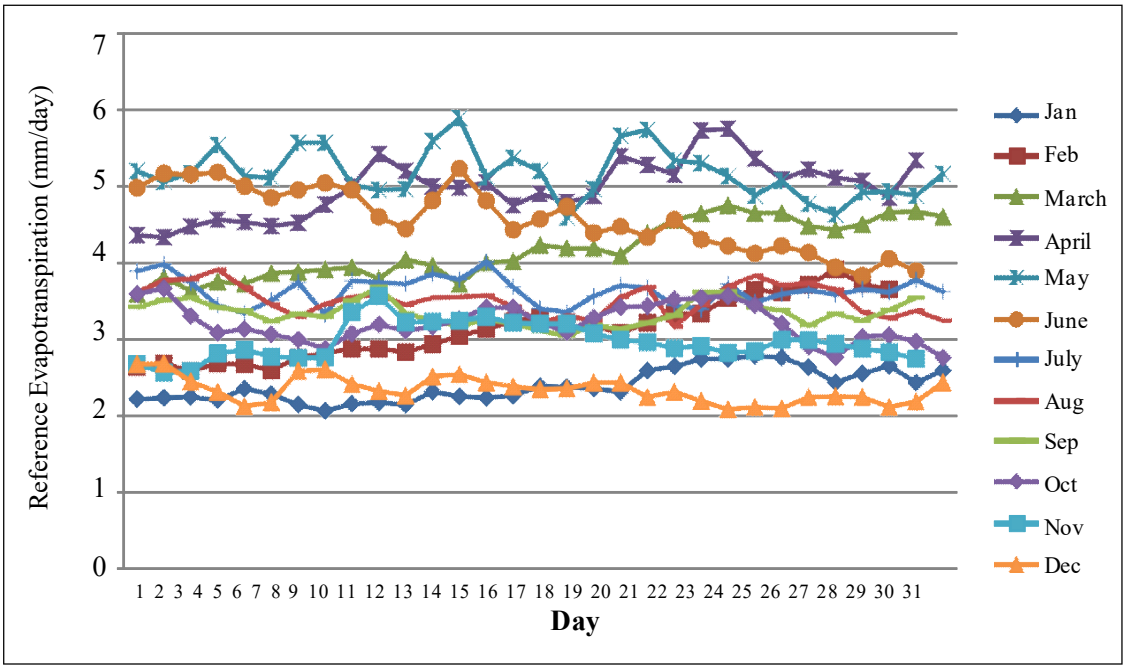


Figure 2: Estimated daily reference crop evapotranspiration

Figure 3: Installed solar PV Pumping System at IIT Kharagpur

Table 1: Specification of the installed SPV Pumping System

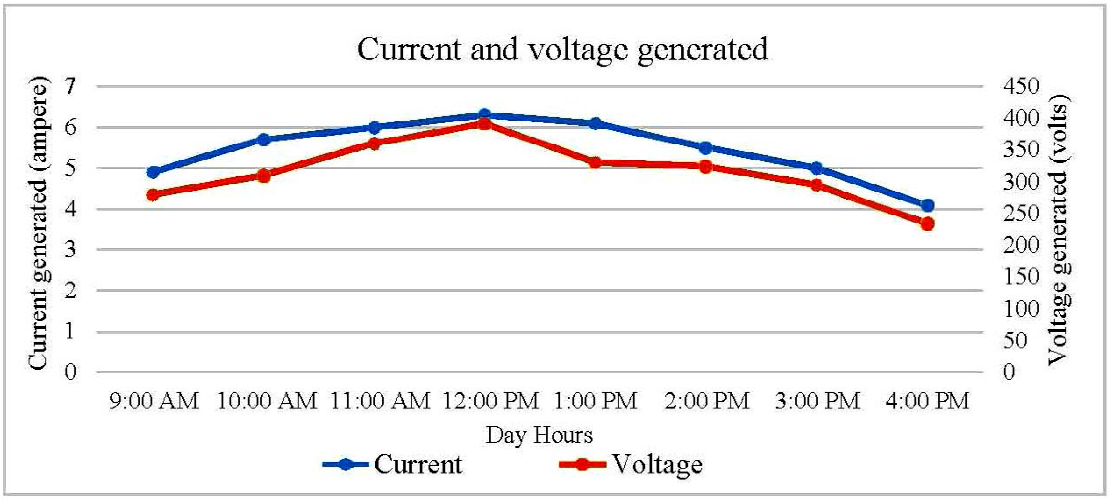
Parameter	Specifications
Open circuit voltage (Voc)	45.01 V
Optimum operatingvoltage (Vmp)	36.56 V
Short circuit current (Isc)	9.11 A
Optimum operatingcurrent (Imp)	8.76 A
Power at STC (Pmax)	320 W
No. of the module inseries	16
No. of module inparallel	1
Solar panelcapacity	5.12 kWp
Pump (AC-Submersible)	5 hp
Controller	VFD based inverter with MPPT

During LCC analysis the useful life of all the three system considered as 20 years with all regular maintenance. Future value of all the cost associated was calculated and then the net present worth was estimated. By considering the Life cycle cost, per unit cost of power generation was estimated for all the three system. Payback period for DG set, SPV system and Grid power supply was estimated to evaluate the relative profit among the systems studied. For estimating payback period net profit that can be obtained from the 2 ha area by growing the crops were considered.

RESULTS AND DISCUSSION

The power generated by the SPV system was measured for 4 months of Rabi season and the maximum power that could be generated by the system was calculated using solar irradiance data of the respected months and considered system parameters. The comparative analysis was performed between the actual power generated and the potential of power generation. The pump performance is measured in terms of pump speed and flow rate against time and corresponding irradiation. Electrical parameters are measured corresponding to varying solar irradiance during the day hours as presented in the Figure 4. The voltage and current responded to varying solar irradiance in the same pattern but the effect is more on voltage as compared to current. The maximum current and voltage was obtained during the period in which solar irradiance is maximum. Pump speed and flow rate were measured for different solar irradiance during the day hours and their variations are presented in Figure 5 and it can be concluded that the pump is running at maximum speed during the peak hours of solar irradiance, thus the maximum flow rate generated during these hours. Figure 5 shows that during 11:00 AM to 2:00 PM maximum water would be available for irrigation. Therefore, operational time of the irrigation system must include these peak hours for efficient irrigation. Variation of pump pressure with solar irradiance measured is shown in Figure 6. Emission uniformity of the emitters was measured for the varying solar irradiance during the different hours of the day and shown in Figure 7. The emission uniformity of the drip irrigation system

Figure 4: Current and voltage variation during day hours



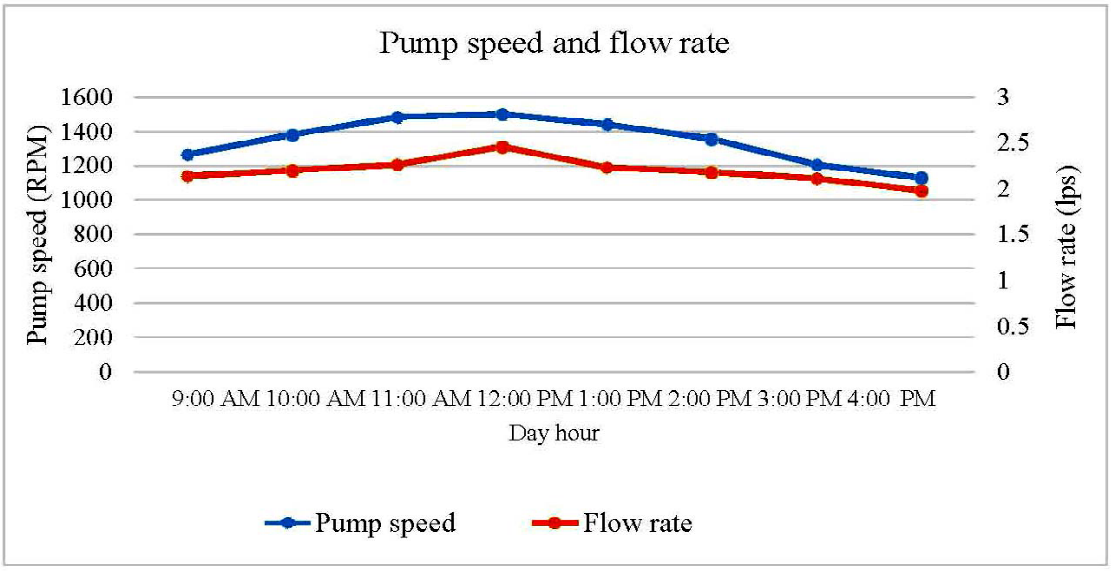


Figure 5: Pump Speed and Flow rate variation during day hours

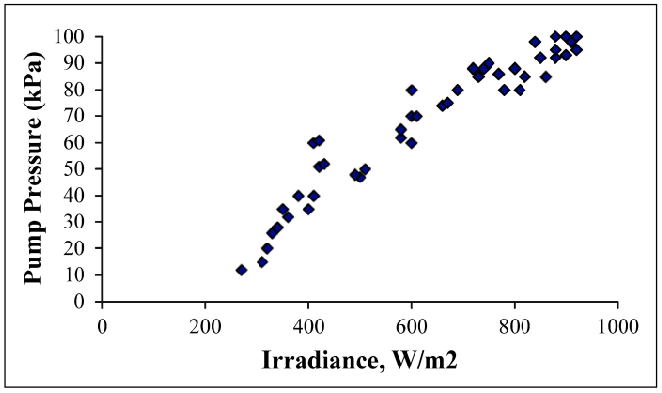


Figure 6: Irradiance vs. pump pressure

varies from 85 to 94 per cent and follows the same pattern as of the solar irradiance during the day hours. When the solar irradiance increases the power generated by the system also increases and it increase the emission uniformity. It became maximum between 12:00 PM to 2:00 PM and again starts decreasing. At peak hours, the higher emission uniformity was observed.

Effect of varying temperature on power generation presented in Figure 8. It shows that with an increase in temperature by 1°C above the standard test condition (STC) the power generation decreased by 0.32 to 0.43 per cent. The Decrease in the power is more at a higher temperature compared to lower temperature. Life cycle cost analysis was carried out for the three power generation system namely diesel generator (DG) set, Solar photovoltaic (SPV) and grid supply system, comparative analysis of LCC for the three is shown in the Table 2. The initial investment of the SPV system was highest which is approximately 2.5 times of the initial cost of diesel generator set but the operational cost of the SPV system is lesser than DG set and grid supply set except in the case of replacement of equipment. On the other hand DG set which is most

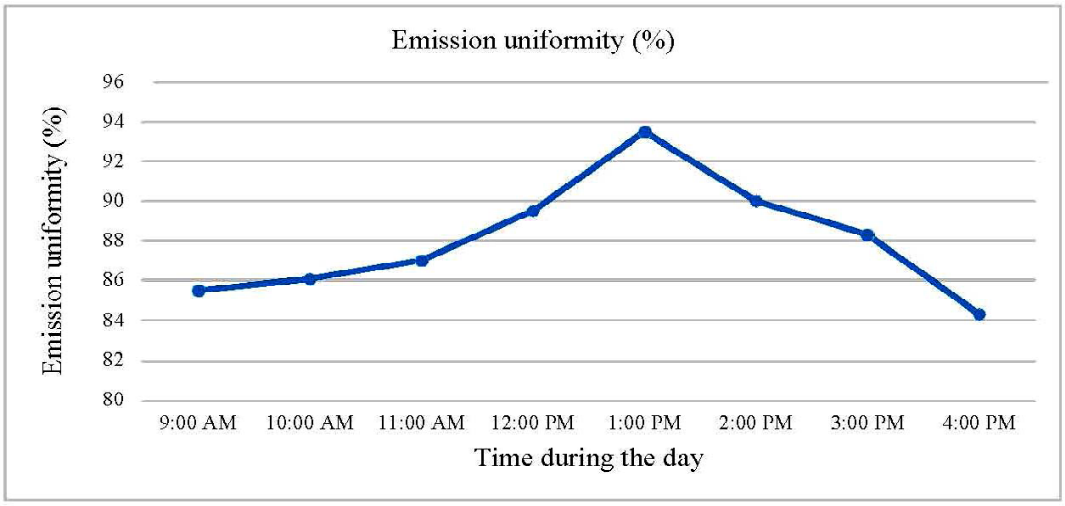


Figure 7: Emission uniformity variation during day hours

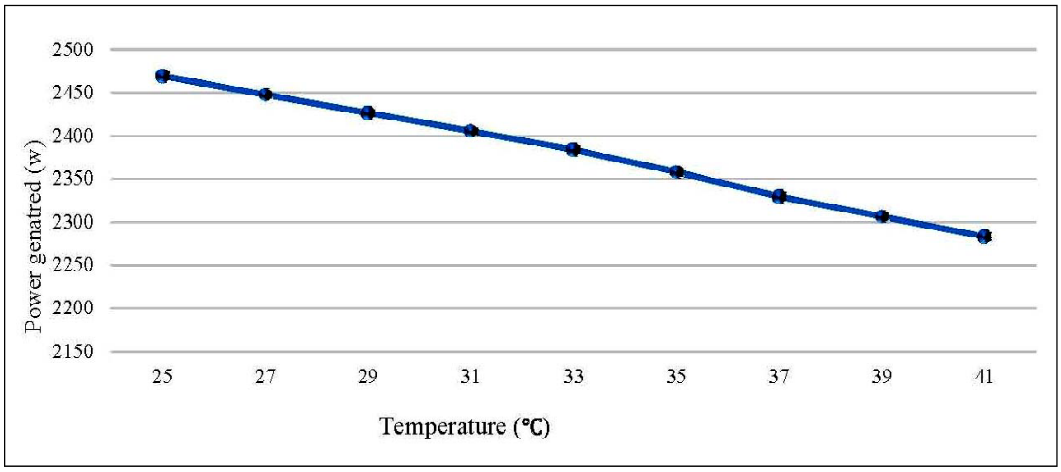


Figure 8: Effect of temperature on power generation

Table 2: LCC analysis of different power sources

Year	Cost (Rs) ×10³		
	DG set	SPV	Grid
1	175.0	454.00	11.60
2	65.4	5.00	8.6535
3	68.7	7.0005	8.99964
4	87.2	5.001	9.3504
5	75.8	7.0021	9.71602
6	80.0	5.0015	10.09476
7	100.9	107.0428	10.48788
8	75.8	5.002	10.89504
9	101.9	17.0034	11.33
10	116.9	5.002	11.78236
11	102.2	7.0035	12.252744
12	106.6	5.0025	12.7426
13	135.4	107.0535	13.2516
14	117.5	5.0025	13.7808
15	123.3	7.0042	14.3316
16	157.3	5.003	14.904
17	150.4	17.0051	15.49935
18	142.8	105.003	16.119
19	181.4	7.0042	16.76295

commonly used for power generation for pumping in remote areas of India have low initial investment compared to SPV system but have high operational and maintenance cost, moreover the facility of maintenance of DG set is the main constraint. On the basis of the net profit that can be earned from the fields irrigated by using the different source of power generation for pumping, the payback period of the systems is calculated. It can be seen in Fig. 9 that grid supply system is the cheapest source of power

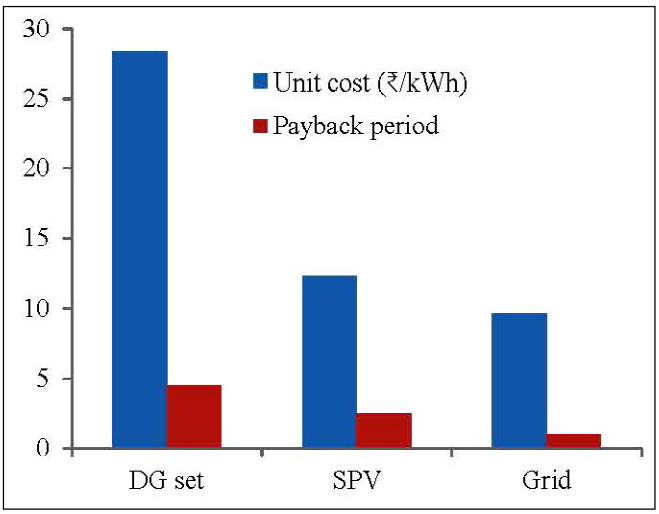


Figure 9: Payback period and Unit cost of power generation

supply and all the investment which the farmer made to on the system during the operation and maintenance of the system for the whole life span of the system (considered 20 year) will be paid back by running the system 6 months. Similarly, for SPV system and DG set payback period is 2.5 years and 4.5 years respectively. SPV system have initial cost 2-4 times more than DG set but the payback period is 3 times more for DG set as compared to SPV system.

CONCLUSION

The performance of commercially available Solar Photovoltaic pumping system for drip irrigation was analyzed. The analysis revealed that variable climatic conditions affect the performance of the pumping system and drip irrigation significantly. Based on the results obtained, the following salient conclusion can be drawn.

1. The actual power generation is always less than estimated because the field conditions affect the

conversion efficiency of solar cells.

2. The current, voltage and power generated during the day depend on the solar irradiance and follow the same pattern as of solar irradiance. The Maximum power generation, pump speed and flow rate observed during 11:00 PM to 2:00 PM.
3. Emission uniformity (EU) for the drippers is maximum during the peak solar irradiance in the day and it varies from 85 to 94 per cent. Therefore, the drip irrigation system should be operated within this time period for efficient utilization of generated power.
4. The cost economics shows that SPV system is preferable than DG set and SPV payback period of 2.5 years.

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Farmers' Perspective of Krishi Vigyan Kendra (KVK) Activities in Uttarakhand, India

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ABSTRACT

Ever since introduction of Krishi Vigyan Kendra (KVK) as grassroots vocational training centre, it has emerged as a focal point of technology transfer through its diverse activities like OFT, FLD, capacity building, updating knowledge & skills of extension personnel and farmers. As the number of KVKs continues to grow, the quality of performance becomes the prime concern to understand factors which contribute to the success or failure of KVKs, Thus, in view of the above, A purposive and simple random sampling technique was used to select 168 respondents (160 farmers and 8 scientists) from the two division of the state- KVK Dhakrani (Dehradun) representing the plains region of Garhwal division and Bageshwar KVK representing the hill region of Kumaon division.Finding of the study revealed that majority of the beneficiaries had favourable perceptions towards training programmes, teaching & subject matter/ quality of scientists, physical facilities and advisory services & supplies. However, they had unfavourable perceptions towards front line demonstration (FLD) and on farm trail (OFTs). His study throws light on the importance of variables such as gender, education, caste, family type, occupation, mass media exposure, information seeking behavior and social participation in determining farmer's perceptions about effectiveness of KVKs. Performance of training programmes and FLDs of KVK Bageshwar was found to be better as compared to KVK Dhakrani, whereas performance in respect of OFTs and other extension activities of KVK Dhakrani was found to be better as compared to KVK Bageshwar.

Keywords: Performance, Evaluation, Perception, Effectiveness, Krishi Vigyan Kendras (KVKs), Uttarakhand

INTRODUCTION

Agriculture is the main engine of economic growth in India as more than half of the population of the nation depends on it. Poverty and unemployment are the major areas of concern for the rural society. The unemployed rate in between age group 15-29 has been increased since 2009-2010. According to the Global Employment Trends 2014 the unemployment rate has raised to 3.8 per cent. The International Labour Organisation (ILO) has said in the recent report that India has shown rise in the unemployment in the last two years. The government and non-government agencies have started numerous programmes for motivation and training of farmers, farmwomen and rural youth. Indian Council of Agricultural Research (ICAR)'s introduction of Krishi Vigyan Kendras (KVKs) as grassroots vocational training centre has emerged focal point of technology transfer through its diverse activities like OFT (On farm trail), FLD (Front line demonstration), capacity building, updating knowledge and skills of extension personnel and farmers. "KVKs are grassroots level organizations meant for application of technology through assessment, refinement and demonstration of proven technologies under different 'micro-farming' situations in a district" (Das, 2007). Since the establishment of the first KVK at Pondicherry in 1974, the number of KVKs has grown to 641 plus**.** To ameliorate the poor socio-economic conditions of the farmers, farm women and rural youths in rural India by raising the level of farm productivity, income and employment with application of agricultural innovation generated at research station, an innovative extension education institutions i.e. Krishi Vigyan Kendra (KVKs) was introduced by Indian Council of Agricultural Research (Dubey *et al.,* 2008). Studies have indicated limited success of KVKs in terms of impact. The Indian Parliamentary Standing Committee

on Agriculture (1995) reported that no realistic, technical and economic analysis was ever conducted to evaluate the implementation and adoption technology transferred by the KVKs. It suggested that performance evaluation of the trainings organized by the KVKs should be conducted to identify the constraints and impacts (Anonymous, 2002). Further, it was observed that there is shortfall in training courses conducted for practicing farmer/rural youth and extension personnel. Vocational training courses for rural youth, ex-trainees meetings, impact assessment of training courses which is necessary to assess the relevance of training courses and for further modifications. The objective of testing developed technologies, identifying constraints and formulating recommendations by conducting on farm trail (OFTs) were not being achieved fully by KVKs. Consequently, there is no mechanism in Indian Council of Agricultural Research (ICAR) to ensure that the information on latest crop varieties released and technologies developed by ICAR and other organizations were disseminated to KVKs for conducting FLDs (Performance Audit of Agricultural Extension Activities in ICAR, Report No. PA 2 of 2008). As the number of KVKs continues to grow, the quality of performance becomes the prime concern to understand factors which contribute to the success or failure of KVKs, Thus, in view of the above, the present study was undertaken to evaluate the performance of selected KVKs and find out farmers' perceptions about effectiveness of KVKs as an instrument of technology transfer.

MATERIAL AND METHODS

The study was conducted in the state of Uttarakhand. Two KVKs - KVK Dhakrani of Dehradun district (Garhwali division) and KVK Sinduri Baskhola of Bageshwar district (Kumaon division), Uttarakhand were selected purposively for the present study because performance evaluation of only those KVKs can be done which have been in existence for a reasonable period of time (5 years for the present study). Eight villages were selected from 80 villages adopted by KVKs - four villages within the radius of 5 km and the other four beyond radius of 05km for each KVK. Only those villages were selected where the farmers have had intensive/ continuing involvement with KVK programmes /activities within the specified period i.e. from 2009 to 2014. Ten respondents were randomly selected from each of the selected villages. Eight villages (10% of the total population) Thus, 80 respondents were selected from each KVK, with an aggregate of 168 respondents (160 farmers & 8 KVK scientists) from two KVKs. Structured pre-tested interview schedule prepared which was personally administered on respondents were used to collect primary data for the study. Primary data for the present study was collected by following methods, observation, interview schedule (For KVK scientists and beneficiaries), in-depth Interviews. Secondary data for the present study were collected from the following sources available at the selected Kendras, viz. action plan, annual report, literature, publication and public report, etc.

Objectives such as socio-economic, communication and psychological characteristics of KVK's scientists and beneficiaries, perceptions about effectiveness of KVKs were analyzed using descriptive statistics – mean, frequency, percentage, range, standard deviation. A 5-point Likert-scale was used to determine the perception of effectiveness of KVKs (captured with a scale thus: strongly agree = 4; agree = 3; undecided = 2; disagree = 1 and strongly disagree = 0). To assesses the association between various socio-economic independent variables and dependent variables such as effectiveness of KVKs multiple regression analysis was used to realize above objective.

RESULTS AND DISCUSSION

The socio-economic, communication and psychological profile of the beneficiaries and scientists of the KVKs was analyzed taking various independent variables. The result obtained is presented in Table 1.

Table 2 indicates that majority of the beneficiaries were

Table 1: Socio-economic, communication and psychological profile of KVKs beneficiaries (N-160)

Variable	Beneficiaries (%)
Age	
Young (up to 30 year)	15
Middle (31 to 50 years)	55
Old (above 50 years)	29
Gender	
Male	63
Female	37
Education	
Illiterate	13
Can read and write	01
Primary Education	10
Secondary Education	15
Higher Secondary Education	49

Table 1 contd.....

Variable	Beneficiaries (%)
Diploma	01
Graduate and above	10
Caste	
General	45
OBC	27
SC	15
ST	12
Family type	
Nuclear	30
Joint	69
Family size	
Small Family (up to 4)	23
Medium Family (5-8)	40
Large Family (above 8)	36
Annual income	
Above poverty line (APL) Income more than Rs. 27,000 per annum	71
Below poverty line (BPL) (Income less than Rs. 27,000 per annum	29
Size of land holding	
Upto 1 ha (Marginal)	54
1-2 ha (Small)	30
2-4 ha (Semi-medium)	07
4-10 ha (Medium)	04
>10 ha (Large)	00
Occupation of head of the household/Family	
Labour	15
Caste occupation	04
Business	22
Skill profession	04
Cultivation/Farming	38
Service	16
Media Ownership (using various media for a variety of purposes including education, information seeking and entertainment)	
Low (upto 2)	45
Medium (2-4)	50
High (above 4)	05
Mass media exposure	
Low (upto 11)	14
Medium (11-21)	77
High (above 21)	37

Table 1 contd.....

Variable	Beneficiaries (%)
Extension agency contact	
Low (upto 12)	20
Medium (12-21)	68
High (above 21)	12
Information seeking behavior	
Low (upto 23)	26
Medium (23-30)	65
High (above 30)	08
Social participation	
Low (upto 6)	59
Medium (6-10)	26
High (above 10)	14

male (63%), middle aged (55%), had educational qualification up to higher secondary (49%), belonged to medium size family (40%). Majority of the beneficiaries were from joint family (69%) and belonged to general caste (45%). Beneficiaries mainly relied on farming for livelihood (38%), had land up to one acre (54%). Majority of the beneficiaries were from above poverty line (APL) family (71%). It was also found that majority of beneficiaries had medium level of media ownership (50%), mass media exposure (77%), extension agency contact (68%) and information seeking behavior (65%). It was also found that majority of the beneficiaries had low level of social participation (59%). The findings of this study in the case of education are similar with Goswami *et al.* (2008), Singh and Kumar (2012) and Mandve *et al.* (2013), in the case of gender with Ahmad (1998), in the case of caste, and family size with Singh and Kumar (2012), in the case of family type and occupation of head of the household/ family with Saini *et al.* (2010), in the case of family income, size of land holding and mass media exposure with Gangwar (2014), in the case of media ownership with Yadav (1986), in the case of extension agency contact, information seeking behavior, social participation with Gangwar (2014) and Tomar (2014).

It is evident from Table 2 that the majority of the scientists were male (87%), middle aged (100%), had educational qualification up to Ph.D. (62%) belonged to general caste (75%). Majority of the scientists were from medium size family (50%), joint family (62%). Most of the scientists were with 6-10 years of experience of their service and medium levels of professional activeness. The

Table 2: Socio-economic, communication and psychological profile of KVKs scientists (N=8)

Variable	Scientists (%)
Age	
Young (up to 30 year)	00
Middle (31 to 50 years)	100
Old (above 50 years)	00
Gender	
Male	87
Female	12
Education	
Post graduate	37
Ph.D.	62
Caste	
General	75
OBC	12
SC	12
ST	00
Family type	
Nuclear	37
Joint	62
Family size	
Small Family (up to 4)	12
Medium Family (5-8)	50
Large Family (above 8)	37
Annual income	
Up to Rs. 40,000	12
Rs. 40,001 to 80,000	62
Above Rs. 80,001	25
Professional activeness	
Low (upto 122)	37
Medium (122-311)	50
High (above 311)	12
Professional experience	
Up to 5 yr.	12
6-10	50
11-15	25
Above 15 yr.	12
Communication Skill	
Communication ability	25
Low (upto 10)	75
Medium (10-15)	00
High (above 15)	00
Communication quality	12
Low (upto 28)	87
Medium (28-36)	00
High (above 36)	00
Expertise in the preparation of A.V. aids	00
Low (upto 9)	25
Medium (9-20)	75
High (above 20)	00
Overall communication skill	00
Low (upto 48)	25
Medium (48-68)	75
High (above 68	00
Achievement motivation	
Low (upto 5)	25
Medium (5-9)	62
High (above 9)	12
Training need level of scientists	
Low (upto 6)	00
Medium (6-12)	87
High (above 12)	12

most of the scientists were having medium level of communication ability where as 87 percent of scientists were having medium communication quality. In case of expertise in preparation and use of training material, the scientists were having medium. Over all communication skills of trainers in KVKs was found medium level. The findings of this study are similar in the case of age group with Mahindra (2004) and Suominen (2010), education with Rajput (2011), professional experience with Kiran (2007) and Rajput (2011), overall communication skill with Mahindra (2004) and Singh & Kumar (2012), achievement motivation with Gangwar (2014).

An attempt has been made here under to describe the perception of farmers about effectiveness of KVK indicates the awareness about activities undertaken by a KVK in its catchment area. It was categorized into seven parameters. This was measured with the help of a questionnaire containing statements which were rated on a five point continuum, namely "Strongly agree", "Agree", "Undecided", "Disagree" and "Strongly disagree " with a score of 4, 3, 2, 1 and 0, respectively as per the opinion of the experts. Based on the score assigned to the respondents, the mean and standard deviation were calculated. It was categorized into three categories as given Table 3.

Table 3: Farmers' perceptions about effectiveness of KVKs (N=160)

Perceptional Factor	Degrees of perception of beneficiaries (%)
1. Farmer's perceptions towards training programmes	
Low (Below 43)	34
Medium (43-55)	50
High (Above 55)	15
Mean=48.63, S.D. =6.36, Max=67, Min=35	
2. Farmer's perceptions towards front line demonstration	
Low (Below 8)	49
Medium (8-14)	42
High (Above 14)	09
Mean=10.38, S.D. =3.13, Max=23,Min=3	
3. Farmer's perceptions towards on-farm trials	
Low (Below 6)	59
Medium (6-14)	24
High (Above 14)	17
Mean=9.95, S.D. =4.13, Max=18, Min=3	
4. Farmer's perceptions towards teaching and subject matter/ quality of scientist	
Low (Below 17)	34
Medium (17-23)	47
High (Above 23)	19
Mean=19.52, S.D. =2.67, Max=31, Min=12	
5. Farmer's perceptions towards physical facilities	
Low (Below 26)	19
Medium (26-35)	52
High (Above 35)	28
Mean=30.1, S.D. =4.41, Max=40, Min=19	
6. Farmer's perceptions towards advisory services and supplies	
Low (Below 20)	22
Medium (20-28)	45
High (Above 28)	32
Mean=23.48, S.D. =3.783, Max=33, Min=12	
7. Farmer's perceptions towards other supporting activities	
Low (Below 13)	40
Medium (13-21)	48
High (Above 21	10
Mean=16.438, S.D. =3.816, Max=28, Min=8	
8. Over all farmer's perceptions towards effectiveness of KVKs	
Low effectiveness (Below 133)	36
Medium effectiveness (133-178)	47
High effectiveness (Above 178)	17
Mean=158.156, S.D. =19.32, Max=198, Min=114	

It is clear from Table 3 that majority of the KVK beneficiaries had favourable perceptions toward straining programmes, teaching and subject matter/ quality of scientists, physical facilities, advisory services and supplies (improved seed, planting material and insecticide, etc.) and other supporting activities. However, beneficiaries displayed unfavourable perceptions towards front line demonstration and on-farm trials. It can thus be concluded that farmers had unfavourable perception towards FLD and OFTs. FLDs' techno effectiveness was least favourable due to not demonstrate production potential of newly released varieties and proven technologies of agriculture and allied sectors from KVKs in the farmers' fields. Many farmers even did not know what is OFT and even the knowledge and experience of the scientists conducting OFTs was doubted. Thus, due importance needs to be given to find out farmer's interests and needs, and then accordingly conduct the trials. With seeking participation of farmers in conducting OFTs may enhance the learning outcomes besides increasing adoption of the latest technology.

It is evident from the Table 4 that the value of 'F' statistic 7.81 (Training programme), 5.65 (OFTs) were significant at 5% probability level where as the value of 'F' statistic 1.4321 (FLDs), was not significant. This indicates that selected independent characteristics were the factors influencing the farmer's perception towards KVK trainings, OFTs and FLDs. However, the value of Coefficient of Determination (R^2) was 0.43, 0.12 and 0.35 which means that characteristics included in the study collectively contributed to the extent of 43.01, 12.14 and 35.30 per cent only. The remaining unexplained variation could be due to other variable/factors not included in the sample. It is clear from the Table 4 & 5 the 'F' statistic 4.13 (Teaching and subject matter/ quality of scientist), 5.07 (Physical facilities) and 3.76 (Advisory services and supplies) were significant. This indicates that selected independent characteristics were the factors influencing the farmer's perception towards teaching and subject matter/ quality of scientist, physical facilities and advisory services and supplies. However, the value of Coefficient of Determination (R^2) was 0.28, 0.32 and 0.26 which means that characteristics included in the study collectively contributed to the extent of 28.52, 32.88 and 26.65 per cent only. The remaining unexplained variation could be due to other variable/factors not included in the sample. On the basis of findings from the Table 5, the value of 'F' statistic 6.12 (other supporting activities) and 6.98 (overall effectiveness of KVKs) was significant. This indicates that

Table 4: Multiple regression analysis of socio-personal variables on different dependent variables

Variables	Training programmes			Front line demonstration (FLDs)			On-farm trials (OFTs)			Teaching and subject matter/ quality of scientist		
	Coeff. (β)	Std. Err.	"t" stat.	Coeff. (β)	Std. Err.	"t" stat.	Coeff. (β)	Std. Err.	"t" stat.	Coeff. (β)	Std. Err.	"t" stat.
Age	0.054	0.032	1.652 NS	0.004	0.020	0.206 NS	0.022	0.022	0.987 NS	0.006	0.015	0.444NS
Gender	6.877	1.077	6.383**	-0.367	0.659	-0.557 NS	1.855	0.746	2.486*	2.014	0.506	3.977**
Education	-0.073	1.009	-0.072 NS	-0.036	0.618	-0.059 NS	0.769	0.699	1.100 NS	1.264	0.474	2.665**
Caste	0.271	0.844	0.320 NS	1.181	0.517	2.284*	-0.638	0.584	-1.091 NS	-0.428	0.397	-1.078NS
Family type	1.942	0.968	2.005*	-0.155	0.593	-0.262 NS	0.931	0.670	1.388NS	-0.422	0.455	-0.928NS
Family size	0.156	0.152	1.031 NS	-0.154	0.093	-1.663 NS	-0.028	0.105	-0.270 NS	0.073	0.071	1.034NS
Annual income	-6.8E-0	8.1E-0	-0.836 NS	-7.2E-0	4.96E-0	-1.461 NS	3.61E-0	5.61E-0	0.644 NS	4.82E	3.81E	1.266NS
Occupation	-1.234	0.621	-1.985*	-0.643	0.380	-1.690 NS	-0.431	0.430	-1.002 NS	0.197	0.292	0.676NS
Size of land holding	-0.321	0.210	-1.527 NS	0.191	0.129	1.482 NS	0.059	0.145	0.407NS	0.153	0.099	1.547NS
Media ownership	1.100	0.560	1.964*	-0.325	0.343	-0.948 NS	-0.543	0.388	-1.399 NS	-0.082	0.263	-0.312NS
Mass media exposure	-0.497	0.134	-3.694**	0.095	0.082	1.160 NS	-0.178	0.093	-1.918*	-0.083	0.063	-1.321NS
Extension agency contact	0.191	0.119	1.602 NS	-0.094	0.073	-1.289 NS	0.084	0.082	1.017 NS	0.094	0.056	1.683NS
Information seeking behaviour	0.275	0.129	2.124*	0.165	0.079	2.088*	0.217	0.089	2.421*	0.019	0.060	0.324NS
Social participation	-0.399	0.197	-2.016*	0.091	0.121	0.756 NS	-0.424	0.137	-3.097*	-0.318	0.093	-3.428**

β_o = 40.362, R^2 = 0.430, β_o = 7.144, R^2 = 0.121, β_o = 7.959, R^2 = 0.353, β_o = 18.777, R^2 = 0.285

F stat = 7.816*, F stat = 1.432, F stat = 5.652*, F stat = 4.133*

df= Regression (14)+ Residual (149)=159

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

Table 5: Multiple regression analysis of socio-personal variables on different dependent variables

	Physical facilities			Advisory services and supplies			Other supporting activities,			Overall effectiveness of KVKs		
Variables	**Coeff. (β)**	**Std. Err.**	**"t" stat.**	**Coeff. (β)**	**Std. Err.**	**"t" stat.**	**Coeff. (β)**	**Std. Err.**	**"t" stat.**	**Coeff. (β)**	**Std. Err.**	**"t" stat.**
Age	0.050	0.024	2.018*	0.018	0.022	0.814NS	-0.001	0.020	-0.083NS	0.155	0.102	1.518NS
Gender	0.894	0.809	1.104NS	1.834	0.726	2.524*	1.688	0.678	2.488*	14.074	3.348	4.202**
Education	0.696	0.758	0.918NS	-1.300	0.680	-1.910*	-0.289	0.635	-0.456NS	0.828	3.137	0.264NS
Caste	-1.360	0.634	-2.143*	-0.936	0.569	-1.643 NS	-0.680	0.532	-1.278NS	-2.731	2.625	-1.040NS
Family type	-0.164	0.727	-0.226NS	0.799	0.653	1.224 NS	2.293	0.609	3.759**	4.624	3.010	1.536NS
Family size	-0.187	0.114	-1.636NS	-0.053	0.102	-0.520NS	0.156	0.095	1.632NS	0.033	0.472	0.070NS
Annual income	9.86E	6.08E	1.621NS	0.000	5.46E	2.251*	5.94E	5.1E-0	1.164NS	0.000	0.000	0.971NS
Occupation	0.625	0.467	1.338NS	1.169	0.419	2.790**	-0.145	0.391	-0.372NS	-0.004	1.932	-0.002NS
Size of land holding	0.325	0.158	2.053*	-0.208	0.142	-1.465 NS	-0.067	0.132	-0.511NS	0.232	0.655	0.354NS
Media ownership	0.782	0.421	1.857*	-0.099	0.378	-0.264 NS	-0.556	0.352	-1.575NS	0.515	1.742	0.295NS
Mass media exposure	-0.207	0.101	-2.056*	-0.086	0.090	-0.947 NS	-0.161	0.084	-1.910*	-1.110	0.418	-2.654**
Extension agency contact	-0.057	0.089	-0.644NS	0.098	0.080	1.220NS	0.084	0.075	1.125NS	0.331	0.370	0.894NS
Information seeking behaviour	0.090	0.097	0.925NS	0.149	0.087	1.707 NS	0.224	0.081	2.752**	1.119	0.402	2.781**
Social participation	-0.528	0.148	-3.550**	-0.129	0.133	-0.970 NS	0.064	0.124	0.517NA	-1.588	0.615	-2.582*

β_o = 31.207, R^2 = 0.328, β_o = 19.233, R^2 = 0.266, β_o = 9.924, R^2 = 0.371, β_o =134.514, R^2 = 0.402

F stat = 5.075*, F stat =3.764*, F stat = 6.120, F stat = 6.988*

df= Regression (14)+ Residual (149)=159

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

selected independent characteristics were the factors influencing the farmer's perception towards other supporting activities and overall effectiveness of KVKs. However, the value of Coefficient of Determination (R^2) was 0.37 and 0.40 which means that characteristics included in the study collectively contributed to the extent of 37.14 and 40.29 only. The remaining unexplained variation could be due to other variable/factors not included in the sample. Multiple regression analysis revealed that out of 14 variables, only gender, education, caste, family type, occupation, mass media exposure, information seeking behavior and social participation had significant effect on farmer's perceptions about effectiveness of KVKs training programmes. This study reiterated the importance of variables such as gender, education, caste, family type, occupation, mass media exposure, information seeking behavior and social participation in determining the farmer's perceptions about effectiveness of KVKs.

A careful perusal reveals that performance of KVK, Dhakrani in respect of training programmes organized against the targets was satisfactory as its achievement was 82% during the period under study, i.e. 2009-2014. On the other hand, performance of KVK Bageshwar was 90% So, performance of KVK Bageshwar was better as compared to KVK Dhakrani. Frontline demonstrations (FLDs)' achievement against the targets set by the KVK Dhakrani was found less as compared to corresponding achievement by the KVK Bageshwar. Out of 91 frontline demonstrations planned, KVK Bageshwar achieved 93 per cent during 2009-2014. Therefore, performance of KVK Bageshwar in respected of FLDs was found to be better as compared to KVK Dhakrani. Regarding On Farm Testing (OFTs) achieved against the set target, performance of KVK Dhakrani was better (93%) as compared to KVK, Bageshwar (80%). Out of 31 OFTs planned, KVK Dhakrani conducted only 29. However, KVK Bageshwar conducted 28 OFTs against the set target of 35. Thus, the performance of KVK Dhakrani was found to be better in terms of OFTs as compared to KVK Bageshwar. It may be concluded that through secondary data and supplemented by in-depth interview/observation from the two KVKs, the achievements of KVK in respect of training programmes, FLDs and OFTs varied year to year. It may be due to differences in local training needs, availability of infrastructure, availability of fund, vehicles, staff, etc. Upon a close observation, the researcher noted that different types of demonstration units have not yet been completed even after 11 years of establishment of

Table 6: Performance of Training and Developmental Activities of KVKs from 2009-2014

Year	Training Programme						Front Line Demonstrations (FLDs)						On Farm Trials (OFTs)					
	KVK Dhakrani			KVK Bageshwar			KVK Dhakrani			KVK Bageshwar			KVK Dhakrani			KVK Bageshwar		
	Target	Achieved	%	Target	Achieved	%	Target	Achieved	%	Target	Achieved	%	Target	Achieved	%	Target	Achieved	%
April 2009-March 2010	135	98	72.6	100	88	80	135	98	72.6	100	88	80	10	10	100	10	5	50
April 2010-March 2011	121	121	100	101	93	92.1	121	121	100	101	93	92.1	7	7	100	5	5	100
April 2011-March 2012	50	60	120	101	88	87.1	50	60	120	101	88	87.1	4	4	100	7	7	100
April 2012-March 2013	95	45	47.4	64	70	109	95	45	47.4	64	70	109	4	2	50	5	4	80
April 2013-March 2014	85	78	91.8	95	79	83.1	85	78	91.8	95	79	83.1	6	6	100	8	7	87
Total (Overall Achievement)	486	402	82.71	461	418	90.67	486	402	82.71	461	418	90.67	31	29	93.54	35	28	80

(***Source***: Action plan and Annual reports of KVK from 2009-2014)

KVK Dhakrani but in KVK Bageshwar multiple numbers of demonstrations units were existing. Another reason could be the lack of clear guidance regarding short and long term training as it creates lots of confusion among the trainers of KVKs. The major objective of the KVK is to organize vocational training programmes according to the local needs. However, most of the trainings in KVKs were non vocational in nature and also there is no mechanism in ICAR to ensure that the information on latest crop varieties released, technology developed by ICAR and other organizations were disseminated to KVKs for conducting FLDs. The major objective of frontline demonstrations is to generate awareness about new crop varieties and technologies, which were the first essential step towards their adoption. So, there is a need to organize different types of vocational trainings and demonstrate the potential of newly released varieties/technology over traditional practices by KVKs with adequate facilities.

CONCLUSION

The KVK network has increased in number as well as coverage and became the focal point of TOT activities through its diverse and varied profile of activities in meeting the expectations of the farming community. KVKs are mandated to promote agriculture and rural development through its diverse activities like OFT, FLD, capacity building, updating knowledge & skills of extension personnel and farmers. The conclusion drawn from the present study was majority of the beneficiaries were male, middle aged, medium family size, joint family, relied on farming for livelihood, marginal, medium level of media ownership, mass media exposure, extension agency contact, information seeking behaviour and low level of social participation. Overall farmers' perceptions towards effectiveness of KVKs was medium. Performance of both KVKs was good in respect of training programmes organized while performance of KVK Bageshwar in respect of FLDs was found to be better as compared to KVK Dhakrani.

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Content Analysis of Training Module for Entrepreneurship Training Programmes in Rural Development and Self Employment Training Institutes (RUDSETI)

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ABSTRACT

While training for human resource development is imperative, it is equally vital to consider the content and quality of the training. The study was designed to analyze the content of the training modules used in RUDSETI Institutes for entrepreneurship training. Thirty-four training modules were purposively selected for the content analysis and one module was randomly selected for readability analysis. Results show that there were 19 major topics covered in entrepreneurship training programmes. Majority of the training programmes lasted for 30 days (one month). Flesch's Reading Ease Score of training module was 48.6 which fall within a fairly difficult range. It is recommended that some improvement should be made to increase the ease of reading for trainees.

Keywords: Entrepreneurship, Module, Rural development, Success, Training

INTRODUCTION

Globally, the ratio of youth to adult unemployment rates has changed very little in recent years, serving to illustrate the particularly disadvantaged situation of young people in the labour market. In 2009, global youth unemployment was a crisis reaching 76.7 million (ILO, 2017). Furthermore, youth are three times as likely as adults to be unemployed. This calls for special attention for Governments to initiate and implement programmes that cater exclusively for youth skills training and employment. The establishment of RUDSETI (Rural Development and Self Employment Training Institutes) was a timely intervention to salvage the youth unemployment crisis. Since its inception, a huge number of youths have been trained and are involved in self-employment activities achieving a settlement rate of 70 percent of its trainees (MoRD, 2013). In India, over 30 percent of youth, aged between 15 to 29 are not in employment, education or training (NEETs). This is more than double the OECD average and almost three times that of China.

Even though researches have shown that training has potential benefits, there are several factors if not given due consideration will make training fall short of its full potentials. For an institution to claim that it provides entrepreneurship training is not enough, the content of what is provided, analysis of potential entrepreneurs and the expertise of trainers also play an important role (Watson *et al.,* 2002). They further emphasized that high-quality training interventions are earmarked by reduced failure rates, increased profits, and growth of SMEs.

It is believed that content analysis help brings out salient points on, what to be included in training modules, how training is structured, the sequence of topics, number of topics covered, time to be allocated to different topics and how the training modules could be improved for better performance. In the past, many research work have focused on assessing the impact of training without paying due attention to analyzing the content of the training module. It is believed that if the content of the training module is good, there is a likelihood of training achieving its intended benefits of objectives. Botha *et al.* (2016) stated that access to education is important but limited access is not the only aspect of the educational system that could be contributing to lower levels of entrepreneurship. It is necessary to consider the content and quality of education.

Content analysis is a method of studying and analysing communications in a systematic, objective, and quantitative manner to measure variables (Kerlinger, 1986). Busch *et al.*

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(1994) define Content analysis as "a research tool used to determine the presence of certain words or concepts within texts or sets of texts. Researchers quantify and analyze the presence, meanings and relationships of such words and concepts, then make inferences about the messages within the texts, the writer(s), the audience, and even the culture and time of which these are a part". Garavan and O'Cinneide (1994) summarized the content of five different entrepreneurship programmes and found that the focus of the programmes varied from idea generation and business planning to the identification of products, market research and business formation. Brown (2000) viewed that entrepreneurial education should teach the skills and characteristics that will enable the participants to develop new and innovative plans. He recommends the essential curricular components that can be applied in any setting where entrepreneurship education; Learn to develop ideas, prepare to start a business, build a viable business. In this backdrop, it is essential to analyse the content of entrepreneurship training programmes conducted by RUDSET Institutes.

MATERIALS AND METHODS

RUDSET Institute Ghaziabad, Uttar Pradesh has played a pivotal role in Youth training and self-employment since its establishment in 1986. For achievement of objectives, both primary and secondary data were obtained. Thirty-four training modules which are used for RUDSETI entrepreneurship training programme were purposively selected for content analysis. Out of those modules selected, one was randomly selected for readability analysis. To validate the information provided, forty-one post-training reports were review as well as personal interview with trainers. Data were analyzed using descriptive statistics. Readability analysis was done to determine how easy or difficult training module was. Methods used by both Flesch and Gunning fog index were used as given below:

Flesch Reading Ease score is:

Score = 2068.835 - (1.015 x ASL) – (84.6 x ASW)

Where, Score = Position on a scale of 0 (difficult) to 100 (easy), with 30 = very difficult and 70 = suitable for adult audiences.

ASL = average sentence length (the number of words divided by the number of sentences).

ASW = average number of syllables per word (the number of syllables divided by the number of words).

Gunning fog index

0.4 x [(words/sentence) + 100 (complex/words)]

Texts that are designed for a wide audience generally require an index of less than 12

Texts that require a close-to-universal understanding generally require an index of less than 8

Anything over 17, called "17- plus," meaning above the level of a college graduate.

RESULTS AND DISCUSSIONS

Results in Table 1 shows that the entire entrepreneurship training programmes conducted by RUDSET institute are divided into three categories. These are, General EDP's, (Rural Entrepreneurship Development Programme and Prime Minister Employment Generation Programme); Agricultural EDP's (Diary farming, Sericulture, Poultry, Beekeeping, Mushroom cultivation etc.) and Process EDP's (Electric Motor Rewinding, Refrigeration and Air Conditioning, Mobile Repairs, Dress Making, Beauty Parlor etc.). All the EDP's cover three training aspects such as Behavioural aspects, Enterprise launching aspects and Managerial aspects. Similar results were reported by Singh *et al.* (2016) whereas the need for training in four areas-group management skills, marketing skills, enterprise management skills and production technical skills was expressed by women farmers. In addition to that, the Agricultural and Process EDP's cover skill acquisition and technical information in their training programmes. Useful categories of training as opined by Watson *et al.* (2012) might include motivational, business, and entrepreneurial skills training.

It can be seen from Table 2 that there are a total of 19 different topics covered in entrepreneurship training programmes at RUDSETI training institute. However, results show that major topics covered in the training are; Entrepreneurship Development Programmes for PMEGP (23.8%), Refrigerator and Air Conditioning (14.3%), EDP for Micro Enterprise (14.3%), Women Tailoring (7.1%), Beauty Parlor (4.8%), Electric Motor Rewinding and Pump Maintenance (4.8%). All other training programmes were conducted only once, accounting for 2.4 percent of the entire training programme. This may be due to the fact that the courses with low frequencies were not in high demand as compared to other courses. Hazeltine and Falk (1999: 2) reported that there are 19 common topics, emphasizing varying aspects of content for each topic.

Table 1: Components of RUDSETI Entrepreneurship Training Programmes

	Name of the Module	No. of Sessions
General EDP		
Module I	Behavioral aspects	13
Module II	Enterprise launching aspects	20
Module III	Managerial aspects	13
Agricultural EDP		
Module I	Behavioral aspects	12
Module II	Skill acquisition/Technical information	As per programme
Module III	Enterprise launching aspects	8
Module IV	Managerial aspects	5
Process EDP		
Module I	Behavioral aspects	13
Module II	Skill acquisition/Technical information	As per programme
Module III	Enterprise launching aspects	15
Module IV	Managerial aspects	7

Compiled from Course Module for Entrepreneurship Development Training Programmes (2010)

Table 2: Topics Covered in RUDSETI Training Programmes

Topic	Frequency	Percentage
Refrigerator and air Conditioning	6	14.3
EDP for Micro Enterprise	6	14.3
Women Tailoring	3	7.1
LMV Owners	1	2.4
EDP for PMEGP	10	23.8
Mushroom Cultivation	1	2.4
Beauty Parlour	2	4.8
Krishi Udayami	1	2.4
Desktop Publishing	1	2.4
Sales promotion and Retail Management	1	2.4
UPS & Battery Making and Servicing	1	2.4
Two Wheel Mechanic	1	2.4
Electric Motor rewinding and Pump Maintenance	2	4.8
Soft Toy making and Selling	1	2.4
General EDP	1	2.4
Paper Cover Envelope and File making	1	2.4
Prime Minister's Employment Generation Entrepreneurship Development Programme	1	2.4
Cell Phone Repairs	1	2.4
Computerized Accounting	1	2.4
Total	**42**	**100.00**

Compiled from Post-Training report (2019)

These topics include the major business functional areas, and strategy formulation and business planning, acquisitions and start-ups, and international business and ethics. The main topics seem to include marketing, financial and operations planning and human resource issues.

Results from Table 3 reveals that the majority of the training programme lasted for 30 days (one month) and that accounts for 71.5 percent of all the training programmes conducted at the RUDSET Institute. Next to this was 13 days training programme which was conducted 8 times and accounts for 12.4 percent of training programmes. This was followed by 10 days training programme. It was conducted 9 times and accounts for about 10.7 percent of the entire training programme. Training of 6 days duration was conducted 5 times and

Table 3: Duration of RUDSETI Training Programmes

No. of days (x)	Frequency (f)	f (x)	Percentage
6	5	30	3.6
10	9	90	10.7
13	8	104	12.4
15	1	15	1.8
30	20	600	71.5
Total	**43**	**839**	**100.00**

Compiled from Post-Training report (2019)

that accounts for 3.6 percent whereas training of 15 days duration was conducted only one time and accounts for 1.8 percent of the training programme. The 30 days training programme was highest due to the fact that lots of skills are required to be able to set up and run a profitable enterprise. That means, more content, more practical sessions, more networking with successful entrepreneurs is required which cannot be done in a short duration.

Table 4: Training Module (RUDSETI)

Aspects	Dimension
Number of pages (average)	117
No. of pictures/Diagrams (average)	40
Number of Pages with Pictures/ Diagrams (average)	28
Average length of picture/diagrams	5.4 cm
Average width of picture/diagrams	4.6 cm
Average area of picture/diagrams	25.6 cm^2
Nature of picture/diagrams	Black and white
Total area covered by pictures (average)	1022.2 cm^2 (3 pages)
Total area covered by Text (average)	58894 cm^2 (175 pages)
Average Ratio of area covered by text to picture	58:1

It can be observed from Table 4 that total number of pages for all training module is 117. There are 40 pictures in the entire training module and were found on only 28 pages having average length of 5.4 cm, average breadth of 4.6 cm and average area of 25.6 cm. All pictures were in black and white and did relate to specific subject matter. There were no coloured pictures in the entire training module which affected the attractiveness and eye catching negatively. Memory retention studies as stated by Patil (2012) supports that a word or phrase printed in color is 78 percent more likely to be remembered than in black and white. Na Ree Lee (2002) as cited by Patil (2012) states that colors improve efficiency of the message and make them appear real as they form a visual concord of the elements projected in the advertisements. Total area covered by picture was 1022.2 cm^2 whereas area covered by text was 58894 cm^2. Ratio of area covered by text to picture is 58:1. This shows that text occupied more space in the RUDSETI training module than pictures. Nain *et al.* (2018) while studying the content of ETIPs observed that the attractiveness of the illustrations and the size of illustrations need to be looked into to make it more effective. Similarly, Nain and Trikha (2001) reported that the space provided to illustrations in farm magazine was below the satisfaction level. The assumptions based on the convergence model of communication (1979) 'person', 'process' and 'product', that per son is important entity having certain characteristics like attitude, perceptions, motivations and background which determine his behaviour and training is that educational process which aims to change the skill, attitude knowledge and understanding of the person. So, the appropriate content of the training can improve process as well as product. In this context Nain and Trikha (2009) highlighted training need in various areas of farm journalism like layout and designing of farm periodicals, analysis of target audience, editing, and proof reading of manuscripts in order to make them user friendly.

Readability of Training Module

Readability of training module was assessed using both Rudolph Flesch reading Ease formula and Gunning fog index.

Data:

ASL = 17.62 and ASW = 1.66

Score = 2068.835 - (1.015 x 17.62) – (84.6 x 1.66)

Score = 48.60

According to Flesch's Reading Ease Score, 48.6 fall within the fairly difficult range. It is therefore concluded that the training module used for entrepreneurship training is fairly difficult to read. Efforts should be made to make it easier for trainees to read. Evans *et al.* (2016) reported a mean Flesch Reading Ease score of 47.8 whereas Aliu *et al.* (2010) found that all analyzed documents on the ASPS and ASAPS Web sites targeted to the consumers were rated to be more difficult than the recommended reading grade level.

Gunning fog index

0.4 x [(words/sentence) + 100 (complex/words)]

Words = 100 Sentence = 7 Complex words = 21

Gunning fog index = 0.4 x [(100/7) + 100 (21/100)] = 14.114

= 14

A Gunning fog index of 14 is above 12 and below 17. We can, therefore, say that the training module has an average difficulty in reading. We recommend that some improvement is made to make it easy to read by trainees.

CONCLUSION

From the study and review of training reports it is quite clear that RUDSETI has done remarkably well in enhancing youth skills and making them employable through various training programmes. However, quality training should be maintained at all times and a constant drive for excellence so that the purpose of establishing the institute should be achieved. To achieve that, it is recommended that content should be always reviewed as it was reviewed only during 2010 (nine years ago). This is to ensure that module is designed according to the changing needs of the beneficiaries and quality trainers sought to deliver the training. Training reports revealed that feedback had not been sought from trainees regarding quality of content and usefulness. This should be a regular feature to help make improvement in subsequent training programmes. Content of the training should be made simple to be read by both trainers and trainees and training module should contain more pictures and illustrations to provide breathing space to readers as well as increased retention rate.

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Evaluating Impact of Training on Backyard Poultry Farming Among Landless and Small Farmers of Koderma District

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ABSTRACT

An investigation was carried out with the objective of evaluating impact of training on backyard poultry farming among landless and small farmers of Koderma district of Jharkhand. On the basis of findings, it may be concluded that training on management of chicks is most important area where training is highly required followed by improved breeding and feeding management. The findings also showed that education, socio-economic status, scientific orientation, land holding, social participation and marketing intelligence having the positive correlation with knowledge gained by participant. The knowledge gained during the three days training was calculated as 107 per cent. All these interventions resulted in increases of 30-35 per cent additional income. Therefore, if the component used properly, it will surely help in improving the livelihood, reduce migration rate, generating employment and improving quality of life (QOL) of the rural youth in the region.

Keywords: Backyard poultry, Entrepreneurship, Farming system, Marketing intelligence

INTRODUCTION

The Farm Science Centre known as Krishi Vigyan Kendra (KVKs) are functional in various districts of our country having the objectives to solve the problem of un-employment in the rural areas of their respective district by providing vocational training and advisory services and to strengthen the allied enterprises other then crop production in the area as a source of subsidiary business or main source of income for diversification of agriculture and increase of farmers income per unit area. The KVK being an educational institution of the farmers offers a very real opportunity by organizing trainings to work closely with trainees in developing a more skilled and educated work force. Through network of 680 KVKs, 6.5 lakh farmers and farm women, every year, trained in agriculture and allied fields such as crop production, livestock production, plant protection, horticulture, home science, soil and water management and farm machinery etc. The training programmes of KVK are multipurpose one to cover not only the various needs of farmers but also the entire needs of village and community (Chaudhary, 1999 and Sharma *et al*., 2013). Training refers to the "acquisition of knowledge, skills, and competencies as a result of the teaching of vocational or practical skills and knowledge that relates to specific useful skills" (Wikipedia, 2006 and FAO 1993). Training is extending and developing individual's capabilities for better performance in their work. It involves the transfer of new knowledge, skills, behaviour and attitude to develop and maintain trainees' competencies to perform specific roles at their work place". Seventy percent of the world's rural poor depend on livestock as a component of their livelihoods (FAO, 2002), and a vast majority of those keep poultry (Epprecht *et al.,* 2007). Rural poultry production, known as backyard extensive poultry production, is a common phenomenon in many developing countries. The demand of eggs and meat of rural areas to be met by backyard poultry rearing (Gayathri *et al.,* 1998, Nandi *et al.,* 2007; Panda *et al*., 2008). In fact, among the rural poor, poultry is found to be a crucial livelihood asset for the poorest segments, such as those households that are in the first income quintile (Roland-Holst *et al.,* 2007). In fact National Agricultural Innovations Project lists poultry as one of the new income earning activities in which rural youth are increasingly being involved. Hence there is ample scope for development of backyard poultry in rural areas. In this context the study

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was undertaken to investigate the extent of gain in knowledge immediately after conducting three on and off-campus training programme on backyard poultry and the impact of characteristics of participants toward knowledge gained about backyard poultry among rural youth farmers, which may be the most important component of for employment generation, income enhancement and family diet enrichment. In the present study, an attempt is made to evaluate training programmes on "Backyard Poultry for an Entrepreneurship Development among Rural Youth" in terms of knowledge gained about backyard poultry by rural youth farmers in district Koderma, Jharkhand.

MATERIAL AND METHODS

The analysis presented under this study is based on three on and off-campus training programme on back yard poultry organized during November, 2016 at KVK, Koderma (KVK-K), Jharkhand. In this training programme, 25 landless farmers from Santh village, Jainagar block of Koderma district were participated. Santh villages having maximum number of poultry population from Jainagar block were purposively selected. The training methodologies adopted included, lectures followed by questions and answers, grouped discussion, demonstration, practice and instruction through audio-visual aids. In order to measure the knowledge level of the farmers no specific knowledge test was used. However, some precautions were taken care during preparation of a questionnaire within the syllabus of training. A questionnaire with 20 questions was prepared with the help of subject matter specialists and veterinary officers of line department. For each correct and incorrect answer 1 and 0 score was given, the maximum and minimum obtainable score was 10 and 0 respectively, for individual participant. During the training pre and post knowledge score of the trainees was calculated. The gain in overall knowledge was further calculated as the difference of post and pre knowledge score. In the present study, entire analysis is based on change in knowledge. Subramanian (1976) defined knowledge as a body of understandable information possessed by an individual or by culture. Knowledge is one of the essential measurements of individual's behaviour, since the product of learning process is the body of knowledge. The variables related to personal orientation of the trainees were operationalised in the study. Regarding training needs, trainees were asked to write down their training requirements related to backyard poultry based on priority and analyses. As per the priority and obtained scores, training areas were ranked.

RESULTS AND DISCUSSION

It was observed that majority (56%) of participants were in the age group between 25 to 40 years. Among these participants, 40 per cent were educated up to the primary standard, followed by 32 per cent participants who can sign only, 16 per cent were illiterate and only 12 per cent participants were having secondary level of education. Of them 44 per cent of participants were having the experience of rearing backyard poultry more than 21 years, and 88 per cent participants attended 1 to 2 trainings prior to these trainings and only 12 per cent participants were attended more than two training programmes organized by different agencies of the district (Table 1). Total obtained score and mean score relating to before exposure, after exposure and knowledge gained by all the participants in the training programme revealed that before exposure, score ranged from 0 to 5 and total knowledge obtained score was 98 and after exposure score range was 4 to 9 and obtained score was 205, the score added was 107 and

Table 1: Profile of Trainees participated in on and off-campus training programme on back yard poultry organized by KVK-Koderma

Parameter	No.	Percentage
Age group (year)		
Below 25	9	36
25-40	14	56
>40	2	8
Total	25	100
Level of education		
Illiterate	4	16
Literate who can sign	8	32
Primary	10	40
Matriculate	3	12
Total	25	100
Experience of rearing of backyard poultry		
Up to 10 yrs	2	8
11-20	7	28
21-40	11	44
>40	5	20
Total	25	100
Training attended		
1-2	22	88
>2	3	12
Total	25	100

the knowledge increment was 107 per cent (Table 2). The attempt was made to ascertain the effectiveness of independent variables on knowledge gained in training programme. It was found that age of the participants was negatively and non-significantly correlated with knowledge gained (Table 3). It shows that young participants gained more knowledge than older one. Sadamate and Sinha (1976) reported in their study that age influences the amount of knowledge gained. Education of the participants was positively and significantly correlated with knowledge gained. It indicates that the qualified participants gained more knowledge than less/non-qualified one. Similar findings were also reported by Mishra and Sinha (1981) and Sharma *et al.* (2006). Experience in agriculture, family background and training programmes attended by the participants did not show any relationship with knowledge gained. Socio-economic status, scientific orientation level holding social participation and marketing intelligence also having positive correlation towards knowledge gained. The findings also revealed that all 25 trainees required training needs on all the aspect of backyard poultry production technology as perceived by the participants, that the most important area of the training has been found to be management in chicks ranked first (Table 4). This is understood by the point of view, that management of chick needs a lot of skills to handle it. This is followed by improved breeds for backyard poultry. Feeding management and taking care is another important area identified in training needs; it also required a sharp management skill for success as entrepreneur, such findings were highlighted by Rao (2009) suggesting that management skill is relatively important component to all other dimensions of any occupation that may be utilized in entrepreneurship development.

Table 2: Impact of rearing of backyard poultry

Particulars	Before training	After training	Knowledge gained
Score range	0-5	4-9	4-8
Total score	98	205	107
Mean score	3.4	7.9	4.5

Table 3: Zero order correlation co-efficient of independent variables with knowledge gained.

Independent variables	'r' value
Education	0.453*
Experience	0.323
Age	-0.726**
Marketing intelligence	0.630**
Number of trainings attended	0.022
Scientific orientation	0.372*
Land holding	0.321*
Family background	0.034
Social participation	0.368*
Socio-economic status	0.695**

* P=0.05, ** P=0.01

Table 4: Training needs of participants

Particulars	Score	Rank
Management of chicks	19	I
Improved breeds for backyard poultry	18	II
Feed preparation and Watering	11	IV
Feeding management and take care	15	III
Marketing intelligence	9	VI
Housing	10	V

CONCLUSION

It can be concluded from the study that young and qualified trainees gained more knowledge than old and illiterate participants. The major training needs of the participants were management of chicks and improved breeds for backyard poultry. Taylor (1961) rightly said that training mean to bring about the continuous improvement in the quality of work performed by the staff and the individuals. Thereby, training should be provided time to time to an individual to update them from the new technologies so that they can perform well in their field.

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Constraints in Implementation of Natural Resource Management activities by Women Groups

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ABSTRACT

In an effort to sustain Natural Resource Management (NRM) in united Andhra Pradesh, there has been a major thrust on implementation of various technologies under integrated natural resource management program by the state. The program was implemented in all the three regions of united Andhra Pradesh viz., Telangana, Rayalaseema and Andhra Pradesh. Considering the importance of implementation of NRM for the sustainable livelihood of women groups, this research study was taken up in one district per region with the objective to identify the major constraints elicited by the women groups in implementation of NRM activities. The results indicated that majority of the constraints perceived by the women groups were lack of marketing knowledge, difficulty in selecting the entrepreneurship activity, lack of proper transport facilities, lack of education, knowledge and managerial skills, lack of credit availability at low rates of interest and financial support. The results also indicated that the suggestions given by majority of the women groups to address the constraints perceived by them. The suggestions are to strengthen the forward and backward linkages, loan to the individual members rather than to the entire group, increase in the loan amount to start the enterprise, providing transport facilities, and increase in the frequency of loans, reduction of rate of interest on loans in the order of importance. Hence, there is a need for creation of awareness on importance of NRM activities for enhancing the efficiency, skills and knowledge through organizing more number of capacity building programs for women groups. This will enable the women groups to undertake entrepreneurial activity in the villages.

Keywords: Constraints and livelihood, Natural resource management, Women groups

INTRODUCTION

Natural Resource Management (NRM) plays an important role for an inclusive and sustainable development in India. It is largely accepted that management of natural resources should aim to benefit all resource users as equitably as possible, within constraint of environmental sustainability, financial sustainability and institutional sustainability. The reduction in per capita natural resources leads to intensive land use which results degradation of environment drastically. Such multi-objective management approaches have been termed Integrated Natural Resource Management (INRM) approaches (Batchelor, 1995). Since few last years, programmes for women have been receiving particular attention under community and rural development programmes (Mishra and Badodiya, 2015). In India, women groups are part of the community participation concept which stresses the active participation of members for their own welfare (Kalra *et al.,* 2013). Women groups represents a unique approach to financial intermediation (Sahu and Ghosh, 2015). Bhati and Upadhyay (2019) concluded that providing good sources of income, and income in hand to women groups could be led better use of income and resource management. Hence, development of management strategies in INRM will be based on the understanding of the constraints in implementation of NRM activities and provide suggestions for development. It is important, therefore the challenges in sustainable NRM is urgently to be addressed by involving participation of communities who are living in close association with these natural resources.

Many approaches were evolved to have women in the planning, implementation, execution and monitoring of natural resources. Many researches have been initiated to implement and enhance this participatory process management in NRM activities. In Indian Economy women groups are major contributor to the survival of

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family in rural areas and constituting one-third of the national labour force. Policy makers and planners have formulated many programmes to provide credit facilities for women groups in rural areas for improving the women participation in Natural Resource Management (Tyagi, 2015). The Government organizations and Non-Government organizations have provided skill on women's participation, is a very important and new addition into the sustainable livelihood development. The importance of natural resources, comprising land, water and vegetation, is higher than ever before for the need to ensure sustainability due to change in climate, increased biotic pressure and declining resource productivity (Lenka *et al.,* 2015).

Further, natural resource management and poverty alleviation are being considered as two-sides of the same coin. Conserving the natural resource results to improved agricultural productivity and which is a key driver for poverty reduction in rural areas. Agricultural growth generates the income and livelihood for the poorest people. The experiences gained in watershed management programmes proved that the livelihood of the rural people depends on agriculture which links with watersheds and natural resources importance. This calls for identifying the constraints perceived by the different stakeholders and their suggestions for enhancing NRM activities in rural areas.

MATERIALS AND METHODS

Research design: Research design is developed to enable the researchers to answer research questions as validly, objectively, accurately and as economically as possible. Ex post facto research is a systematic enquiry in which the researcher does not have direct control on the independent variables because their manifestations have already occurred or because they are inherently not manipulable, (Kerlinger, 1973). In this study since the manifestations of the variables had already occurred and there was no scope for manipulation of any variable, Ex-post facto research design was adopted to conduct the study.

Area specific study: The state of Andhra Pradesh was purposively chosen for the study, since the investigator was familiar with the local language, which would help build quick rapport and also enable in depth study combined with personal observations and research results will be useful for the women members and officials from the Integrated Watershed Management Programme (IWMP), District Watershed Management Programme (DWMP), National Rural Employment Guarantee Scheme (NREGS) and other Natural Resource Management related projects of the state.

Sampling Procedure

Selection of the Regions: All three regions of united Andhra Pradesh viz. Telangana, Rayalaseema and Andhra Pradesh were selected for the study (Figure 1).

Selection of the Districts

One district from each region i.e. Nalgonda from Telangana, Visakhapatnam from Coastal Andhra and

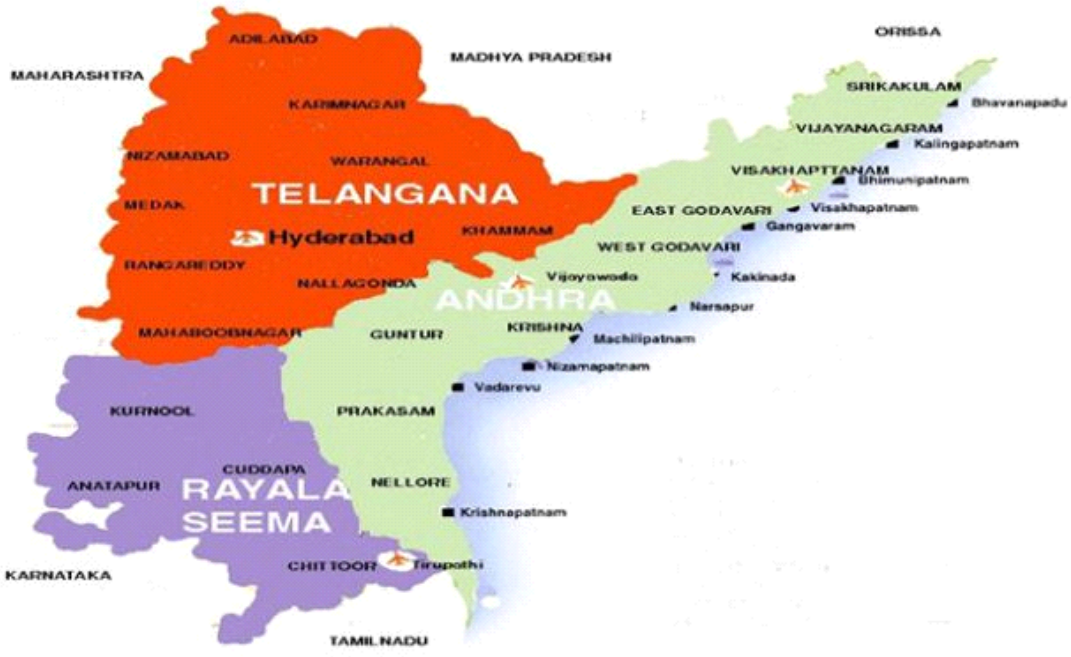

Figure 1: Three regions of Study area in united Andhra Pradesh

Ananthapur from Rayalaseema were selected purposively as these districts have more number of women participation in NRM project as per the discussion with DWMA officials and familiarity and convenience of the researcher to the study area.

Selection of Mandals

Two mandals from each district were selected randomly from each district that made six mandals from the entire state of Andhra Pradesh were studied under the research.

Selection of Villages

Two villages were selected from each Mandal in which large participation of women in natural resource management activities. One village solely promoted by the Government Organization (GO) on NRM and second village being promoted by the Non-Government Organization (NGO), thus making a total of 4 villages from each district and 12 villages from the state. Details of mandals and villages selected for the study were provided in the Table 1.

Selection of Respondents

Selection of the women members: The unit of analysis of the present study was active women members from different identified women groups (SHGs) who have participated in Natural Resource Management (NRM) activities, by availing loan from banks, NGOs and any other non-profitable institutions.

Thus, two women members were selected from each group considered as respondents of the study. Accordingly, 10 women members representing five groups from GO and 10 members representing five groups from NGO were selected from each village. Thus, a total of 240 women members representing 120 groups i.e., 60 groups belongs to GO and 60 groups belongs to NGO promoted NRM activities from 12 villages were selected as respondents for this study.

Method of data collection: Each of the selected women groups were interviewed personally by the investigator and one schedule for each respondent was filled directly with the relevant data. It was made sure that the questions in the schedule were correctly understood by the women respondents, by repeating the questions whenever necessary.

Data Analysis: The data thus collected through interview schedule were coded, tabulated, analyzed and presented in tables to make findings easily understandable. The findings emerged out of the data were suitably interpreted, necessary conclusions and inferences were drawn.

RESULTS AND DISCUSSION

An attempt was made to find out the constraints encountered and perceived by the members of women respondents and score were assigned based on the frequency percentage for a particular constraint. The results are presented in Tables 2. The constraints were identified & arranged in descending order of their frequency & %age.

Table 1: Sampling procedure followed in the study

Regions	Districts	Mandals	Villages	Women groups supported by GOs	Women groups supported by NGOs
Andhra	Vishakhapatnam	Araku	Chompi	10	10
			Kothavalasa	10	10
		Parvada	Jalerupeta	10	10
			Muthiyalamma palem	10	10
Rayalaseema	Ananthapur	Atmakur	Atmakur	10	10
			Yadiki	10	10
		B.K.Puram	Thadapathri	10	10
			B.K. Puram	10	10
Telangana	Nalgonda	Bhongir	Bhongir	10	10
			Husnabad	10	10
		Deverakonda	Girijanagar	10	10
			Chintalapalem	10	10
3 Regions	3 Districts	6 Mandals	12 Villages	120	120
Total Respondents				240	

Table 2: Distribution of the respondents according to the constraints perceived by both Government and Non-Government promoted women in groups (n=240)

Constraints	Frequency	Percentage
Lack of marketing knowledge	187	77.92
Difficulty in selecting the entrepreneurship activity	183	76.25
Lack of proper transport facilities	181	75.42
Lack of education, knowledge and managerial skills.	161	67.08
Lack of credit availability at low rates of interest and financial support	152	63.33
Lack of capacity building programmes	151	62.92
Lack of business information and experience	147	61.25
Non sanction of new loans related to agriculture and allied activities immediately	145	60.42
Scarcity of raw materials and proper markets to sell the produce.	145	60.42
Lack of update informational support on the latest technologies and schemes	138	57.50
Lack of monitoring in watersheds and NRM activities	136	56.67
Lack of support, supervision and guidance from the higher officials	129	53.75
Insufficient credit facilities	129	53.75
Lack of extension personnel and manpower support	128	53.33
Political interference and other problems in village	124	51.67
Lack of infrastructural facilities and proper marketing yards	123	51.25
High cost of production and high interest loan	121	50.42
Long period of loans and credit facilities	118	49.17
Poor technical support and guidance for women	108	45.00
More dependents on leaders	104	43.33
Lack of cooperation among the group members	88	36.67
Alcoholism	82	34.17
Lack of exposure visits and skill development programmes	80	33.33
Lack of community hall and meeting hall	68	28.33
Lack of motivation from family members	62	25.83
Taboos and customs in the village	58	24.17
Gender bias	46	19.17
Low participation of members	45	18.75
Lack of proper drinking water and sanitation facilities	41	17.08
Conflict due to middle men and agents' involvements	34	14.17

The above table indicates that majority of the constraints perceived by the women respondents were lack of marketing knowledge, difficulty in selecting the entrepreneurship activity, lack of proper transport facilities, lack of education, knowledge and managerial skills, lack of credit availability at low rates of interest and financial support, lack of capacity building programmes, lack of business information and experience, non-sanction of new loans related to agriculture and allied activities immediately, scarcity of raw materials and proper markets to sell their produce., lack of update informational support on the latest technologies and schemes, lack of monitoring in watersheds and NRM activities, lack of support, supervision and guidance from the higher officials.

It is also revealed that women were facing constraints related to their implementation of NRM activities and income generating activities rather than with their group function and activities, it was also seen that major problems were related to the production and post-production stage in particular with regard to marketing their products due to lack of adequate experience, education and knowledge

in the economic activities, even the women were facing difficultly in identifying the income generating activity that they would profitably take up from the available local resources. Availability of the raw materials, scarcity of the funds were other major problems perceived by the women due to lack of knowledge on the availability and procurement of the raw material as the women never had an experience in obtaining the raw material from the market to home and field requirements. The constraints indicated are in similar lines reported by Cain *et al.* (1999) indicating the reasons for non-implementation of NRM strategies such as development of management plans without participation of local individuals and institutions. This results in lack of stakeholder cooperation and delivery mechanisms design to implement the management plan and realization of potential benefit. The respondents were asked to indicate suggestions to improve the effectiveness of women groups in implementation of NRM activities. The suggestions offered by the women groups were arranged in descending order of their frequency and percentage (Table 3).

The Table 3 reveals that the major suggestions elicited by both government and non-government promoted women in groups are to strengthen the forward and backward linkages, loan to the individual members rather than to the entire group, increase in the loan amount to start the enterprise, transport facilities to be provided, loan purpose and utilization should make clear, increase in the frequency of loans, rate of interest to be reduced on loans, exposure visits women to the successful groups/farm activities, more training programmes in local areas, continuous job opportunities in the local areas by the government and provision of livelihood, convergence of government programme thorough participation, encourage more gender awareness programmes, increasing the saving amount of the women in group, regular monitoring to the groups by the Government and promoting farm activities.

CONCLUSION

Natural resources are the basic support system for rural people. As natural resources are degrading day by day and there is an urgent need to manage the environmental resources well. Livelihood of hundreds and millions of people, especially the rural people will be seriously jeopardized if these resources are not properly managed. Sustainable development of the rural community including women groups critically depends on natural resources and their management. Time and again, it has been adequately established that women continue to the prime users of natural resources and are closely associated with its judicious management. Further, the necessity of involvement of rural

Table 3: Distribution of women respondents based on the suggestion elicited by the women groups for effective functioning of watersheds and NRM programmes both by GOs and NGOs (n=240)

Suggestions	Frequency	Percentage
Strengthen the forward and backward linkages	170	70.83
Loan to the individual members rather than to the entire group	163	67.92
Increase in the loan amount to start the enterprise	163	67.92
Transport facilities to be provided	155	64.58
loan purpose and utilization should make clear	152	63.33
Increase in the frequency of loans	148	61.67
Rate of interest to be reduced on loans	146	60.83
Exposure visits women to the successful groups/farm activities.	142	59.17
More training programmes in local areas	141	58.75
Continuous job opportunities in the local areas by the government and provision of livelihood.	141	58.75
Convergence of government programs through women groups	140	58.33
Encourage more gender awareness programmes	132	55.00
Increasing the saving amount of the women in group	129	53.75
Regular monitoring to the groups by the Government.	126	52.50
Promoting farm activities	126	52.50
Agriculture machinery (on hiring) center in the village	119	49.58

women in the economic development in general and sustainable natural resource management in particular was emphasized in many reviews. Therefore, the study was undertaken to identify the constraints to the implementation of Natural Resource Management practices for the sustainable livelihood of women groups. The findings are summarized as following.

The constraints perceived by the women groups of both Government organizations and Non-Government organizations were lack of marketing knowledge, difficulty in selecting the entrepreneurial activity, lack of proper transport facilities, lack of education, knowledge and managerial skills, lack of credit availability at low rates of interest and financial support, lack of capacity building programmes, lack of business information and experience, non-sanction of new loans related to agriculture and allied activities immediately, scarcity of raw materials and proper markets to sell their produce., lack of update informational support on the latest technologies and schemes, lack of monitoring in watersheds and NRM activities, lack of support, supervision and guidance from the higher officials.

The study also reviled the suggestions to overcome the constraints faced by the women groups. They were to strengthen the forward and backward linkages, loan to the individual members rather than to the entire group, increase in the loan amount to start the enterprise, providing transport facilities, increase in the frequency of loans, reduced rate of interest, training cum exposure visits to the successful groups/farm activities, convergence of government programme thorough participation, encourage more gender awareness programmes, regular monitoring to the groups by the Government and promoting farm activities.

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Profitability Vs Sustainability as the Small Holder Farmers' Dilemma in Central Uttar Pradesh

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ABSTRACT

Survey was conducted (2014-16) in villages Digsara, Basirpur mar, Pokhra and Bhavanipur under Jalalabad block of Kannauj districts and; Kandharapur, Musa Khediya, Usmanganj, Daheliya, Badheli and Kanhau Yakutpur from selected two blocks of Farrukhabad districts to analyze the crop diversification systems, their profitability, perceived sustainability and the related issues. In every village, four focused group discussions (FGD) were arranged, each comprised of 30-35 farmers. Thus, 2500 farmers from all the 12 villages were interacted. Major research variables included the documentation of crop inventory along with their productivity (q/ha), gross cost of production (Rs/ha), gross return (Rs/ha), B:C ratio and employment created (mandays/year). Findings of the study showed that there were 10 different cropping systems which were cereal based, potato based, vegetable based or maize based. Even the indigenous system of mixed cropping based systems of jasmine and pumpkin with potato were also popular. The profitability, employment generation and perceived sustainability of these systems were comparatively analyzed. The perceived strength and weaknesses, and opportunity as well threat of the existing diversified systems were ascertained from the farmers' view points. Lastly, the temporal trends of various economic indicators of summer maize was depicted which was getting more popular among the farmers even it was cost intensive as compared to other options of summer crops.

Keywords: Crop diversification, Vegetable based systems, Cereal based system, Profitability and sustainability

INTRODUCTION

Small-holder farmers are vital for India's agriculture and rural economy. Small-holder farmers - defined as those marginal and sub-marginal farm households that own or/and cultivate less than 2.0 hectare of land - constitute about 78 per cent of the country's farmers (at Agricultural Census 1990-91). These small-holders owned only 33 per cent of the total cultivated land; their contribution to national grain production however, is 41 per cent. Their contribution to household food security and poverty alleviation is thus disproportionately high - and is increasing (FAO, 2014, Mulwa *et al*., 2017). Moreover, as the national population increases, so does the number of small-holdings.

Small-holder families constitute more than half of the national population. It is thus disappointing that notwithstanding their substantial and increasing contribution to the national food supply and to agricultural GDP, these small-holder families nonetheless constitute more than half of the nation's totals of hungry and poor (Joshi *et al*., 2006). Policies and programmes to lessen poverty and food insecurity, and to enhance equity and sustainability of incomes and livelihoods, should thus seek to achieve an agriculture-led broad-based economic development - and to do so by according highest priority to small-scale agriculture.

The questions are here posed: is the continuance of Indian hunger and poverty a consequence of the smallness of the preponderant majority of the nation's farms?... or may the productivity of those small farms be so increased as to allow the small-holder families - and the nation with them - to escape from hunger and poverty? We shall reason in support of the second (hopeful) option. But the hope will be realized only when the small-holders are empowered to access the crucial production resources. These resources are several: land, water, energy, and credit; appropriate technologies, and opportunities to develop

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the skills and to access the information wherewith to use them; functional and fair markets for products and inputs; health care and sanitation; and education and reproductive and social services. Given the national and international policies that facilitate access to such resources, there would be confident expectation that small-scale agriculture could and would achieve higher production and income and that the livelihoods of small-holder families and communities would be enhanced.

Between 1971 and 1991, India's total number of farm holdings (aggregate for all farm sizes) increased from 70.5 million to 106.6 million. Within those totals, the small-size holdings - encompassing the categories *sub-marginal* (less than 0.50 ha), *marginal* (0.50 to 0.99 ha), and small (1.00 to 1.99 ha) - increased from 49.1 million (70 per cent of the 70.5 million total) to 83.4 million (78 per cent of the increased total of 106.6 million). Correspondingly, the average size of holding (all sizes) decreased from 2.28 ha (1971) to 1.55 ha (1991) as the number of holdings and of farm families increased - the total agricultural-land area remained almost unchanged. Significantly, the average size of those holdings smaller than 2.00 ha did not decline; but the average size of holdings larger than 4.00 ha decreased from 9.18 ha in 1971 to 7.95 ha in 1991 - thereby lessening the national-average farm size. In 1991, small-size holdings, constituting 78 per cent of all holdings, commanded 33 per cent of the total net cropped area, while medium- and large-size holdings, constituting 22 per cent of the farmers, commanded 67 per cent. About three-fifths of all holdings were marginal or sub-marginal, and about one-fifth were small. However, sub-marginal holdings - comprising 40 percent of all holdings, commanded only 9.8 per cent of the total agricultural-land area. Contrastingly, large-size holdings (> 4.00 ha) accounted for only 9 percent of all holdings but commanded 44 per cent of the area. Between 1971 and 1991, the proportion of holdings smaller than 1.00 ha increased from 51 to 62 per cent. Under the given scenario, the farm income generated by those small holders becomes an area of interest and also it emanates the issues for investigation mainly in terms of that to what extent farmers have diversified their crop production system?, what are various crops and their combinations are prevailing alongwith their yield?, what is their relative contribution in income and employment generations?, how small holders perceive which system to be more sustainable over others and how they feel the different roles of various stakeholders in making their crop diversification system more operational friendly? Against the above background, therefore, study was conducted in the state of Uttar Pradesh to arrive at the empirical evidences to above research questions.

MATERIALS AND METHODS

The present study was conducted in the purposively selected Kannauj and Farrukhabad district of Uttar Pradesh. Two main reasons of large scale prevalence of small holders (about 75%) and mostly diversified cropping systems justified the purposive selection of the district. Further, two blocks namely Jalalabad and Kannauj from Kannauj district; and blocks Kamalganj and Mohmadabad from Farrukhabad districts were selected purposively because of meeting the above criteria. Six villages namely Digsara, Basirpur mar, Pokhra, Mitrasenpur, Baharin and Bhavanipur were randomly selected from these two blocks in Kannuaj districts. Similarly, Kandharapur, Musa Khediya, Usmanganj, Daheliya, Badheli and Kanhau Yakutpur from selected two blocks of Farrukhabad districts were randomly selected. In every village, four focused group discussions (FGD) were arranged, each comprised of 30-35 farmers. Thus, 2500 farmers from all the 12 villages were interacted during 2014-16. Major research variables included the documentation of crop inventory alongwith their productivity (q/ha), gross cost of production (Rs/ha), Net return (Rs/ha), B:C ratio and employment created (mandays/year). Accordingly, different types of cropping systems were classified as per the crop base. Further, the relative spread of summer maize and summer groundnut were analyzed over time and space to see their relative preferences among the small holders in these two crops. For each type of cropping system, crop equivalent yield (Ahlawat and Sharma, 1993) for the major crops in the given system was worked out using following formula:

$$\text{Crop Equivalent Yield (CEY)} = \sum_{i=1}^{n} Y_{xi}(P_{xi}/P_r)$$

where, Y_{xi} is the yield of i^{th} alternate crop crop(s) (kg ha^{-1}),

P_{xi} is the price of i^{th} alternate crop(s) (Rs. kg^{-1}), and

P_r is the price of main crop taken for equivalent yield (Rs. kg^{-1}).

The variables like profitability and employability in those systems were computed in terms of net return (Rs/ha/year) and mandays created (nos./year) respectively. The relative sustainability of the systems were ascertained on five points sustainability rating scores wherein 1 being the least sustainable and 5 being the most sustainable systems

as perceived by the small holders. Further, SWOT analysis and famers' perception were captured using open-ended questions and based on the response, results were arranged rank-wise. A semi-structured interview schedule supported with group discussion was utilized to elicit the information from the respondents. The collected data were analyzed (2016) using the simple statistics of average, percentage, rank, rank correlation (r) and coefficient of concordance (w) to draw meaningful conclusions.

RESULTS AND DISCUSSION

Prevailing cropping systems

Traditional system: Paddy-wheat is the major traditional cropping systems in both the districts followed by green manuring-early potato-wheat. However, paddy-wheat system emerged to be more profitable over another as indicated by higher B:C ratio of 3.0 (Table 1).

Maize based system: Four types of maize based cropping systems were observed prevailing in the districts (Table 2). The most profitable system was Green manuring-potato-maize in terms of B:C ratio (3.0). However, in terms of absolute return, green manuring-early potato-potato-maize was the most profitable (Rs 438.76 th./ha as gross return) followed by *kharif* onion-potato- maize (Rs 426.40 th./ha) and maize-potato-maize (Rs 347.64 th./ha). It is evident from the table that summer maize in all the three systems performed uniformly.

Vegetable based system: Three important vegetables namely onion, coriander and summer potatoes were integrated in the cropping system by the small holders. As indicated in the Table 3, though the B:C ratio for both the systems were same (2.7), the gross return was higher for coriander (Rs 640.13 th./ha) based system as summer onion was another vegetable in this system as compared to the system in which only one vegetable was integrated.

Summer groundnut based system: Summer groundnut has been also a good option for zaid season. This crop though requires lesser number of irrigation as compared to summer maize, its popularity has been declining owing to lesser profit earned from this crop as compared to the summer maize. Two major systems were prevalent in the area. Firstly, summer ground nut was preceded by *rabi* potato and *kharif* groundnut and secondly with *rabi* potato and *kharif* maize. However, the gross return was more in

Table 1: Traditional cropping system

Cropping system	Yield of crops (q/ha)			Cost of Production (th. Rs./ha)	Gross Return (th. Rs./ha)	B:C ratio
	Kharif	*Rabi*	*Zaid*			
Paddy-Wheat	61.33	48.29	-	66.85	201.49	3.0
GM-Early Potato-Wheat	-	192.10	46.06	114.06	243.50	2.1

Table 2: Maize based cropping systems

Cropping system	Yield of crops (q/ha)			Cost of Production (th. Rs./ha)	Gross Return (th. Rs./ha)	B:C ratio
	Kharif	*Rabi*	*Zaid*			
Maize-Potato-Maize	32.42	278.08	60.30	130.70	347.64	2.7
GM-Early Potato-Potato-Maize	-	256.00	64.17	182.15	438.76	2.4
GM-Potato-Maize	-	320.37	67.66	112.90	335.99	3.0
Kharif onion-potato-maize	176.45	252.70	65.66	194.40	426.40	2.2

Table 3: Vegetable based system

Cropping system	Yield of crops (q/ha)			Cost of Production (th. Rs./ha)	Gross Return (th. Rs./ha)	B:C ratio
	Kharif	*Rabi*	*Zaid*			
Coriander-potato-onion	40.60	296.43	236.29	236.50	640.13	2.7
Maize-Early potato- Summer tomato	33.80	200.53	476.22	188.15	505.71	2.7

case of first cropping sequence than second as evident from Table 4.

Mixed cropping based system: Two indigenous potato based mixed cropping were documented in the study area. In one case, potato was mixed cropped with jasmine flower and in another case; pumpkin was taken as the mixed crop with potato. Data (Table 5) showed that potato mixed with jasmine was more profitable (B: ratio of 2.6) as compared with potato+pumpkin (B:C ratio of 2.5).

Crops equivalent yield: For different kinds of cropping systems. Equivalent yields for the major crops were computed and presented in the Table 6.

Therefore, potato, wheat, groundnut, maize, vegetable and jasmine equivalent yields were computed. It is observed from the table that in all the cropping systems, potato and vegetable equivalent yield was prominent. This was followed by maize equivalent yield. Whereas potato equivalent yield was highest for maize-potato-maize (556.00) sequence, vegetable equivalent yield was highest for coriander-potato-onion (550.75) sequence. Actually, spring onion fetched better price and also the coriander leaves in *kharif* had greater demand which added to the farmers' income. This was followed by the cropping sequence in which *kharif* maize was followed by early potato and then summer tomato (454.42) and *kharif* onion-potato-maize (353.3). With the advent of hybrids in maize and with ensured availability of quality inputs and procurement by the private organizations, maize based cropping system was getting more popular and profitable

Table 4: Summer groundnut based system

Cropping system	Yield of crops (q/ha)			Cost of Production (th. Rs./ha)	Gross Return (th. Rs./ha)	B:C ratio
	Kharif	*Rabi*	*Zaid*			
Kharif G/nut-potato-Summer G/nut	16.72	310.45	32.19	157.00	412.96	2.6
Maize-Potato-Groundnut	35.63	288.76	29.84	146.30	380.30	2.6

Table 5: Mixed cropping system

Cropping system	Yield of crops (q/ha)			Cost of Production (th. Rs./ha)	Gross Return (th. Rs./ha)	B:C ratio
	Kharif	*Rabi*	*Zaid*			
Potato + Jasmine	0	80.55	208.36	272.15	709.35	2.6
Potato+Pumpkin	00	300.0+ 220.0	-	112.50	280.25	2.5

Table 6: Equivalent yields of the major crops in the existing systems

Cropping system	Wheat Equiv. Yield (WEY)	Potato Equiv. Yield (PEY)	Groundnut Equiv. Yield (GEY)	Maize Equiv. Yield (MEY)	Vegetable Equiv. Yield (VEY)	Jasmin Equiv. Yield (JEY)
Paddy-Wheat	54.00	-	-	-	-	-
GM-Early Potato-Wheat	153.68	-	-	-	-	-
Maize-Potato-Maize	-	556.00	-	64.82	-	-
GM-Early Potato-Potato-Maize	-	256.00	-	512.00	-	-
GM-Potato-Maize	-	170.00	-	104.00		-
Kharif onion-potato-maize	-	110.00	-	285.43	353.3	-
Coriander-potato-onion	-	393.00	-	-	550.75	-
Maize-Early potato- Summer tomato	-	169.00	-	-	454.42	-
Kharif G/nut-potato-Summer G/nut	-	-	47.77	-	-	-
Maize-Potato-Groundnut	-	-	53.19	-	-	-
Potato + Jasmin	-	-	-	-	-	16.11

as evident from the Table 6. The lowest equivalent yield was estimated for jasmine in the mixed cropping system of potato+jasmine (16.11) followed by for groundnut in the *kharif* groundnut-potato-summer groundnut (47.77) cropping sequence.

Profitability, employability and perceived sustainability of various systems

Altogether, a complex scenario emerged in the prevailing varied cropping systems, their profitability, employment generation and farmers' perception of the sustainability of these systems. As indicated in the Table 4, flower based potato intercrop raised the highest profitability (Rs 4.37 lakh/year/ha) which was closely followed by high density vegetable based diversified system (Rs 4.04 lakh/year/ha). The employments generated by both the system were in similar order (447 and 433 mandays/year/ha) indicating thereby the ensured employment for more than family member round the year. It is also evident from the same table that the reality of less profitability from the cereal based system is being recognized by the small holders e.g. in case of paddy-wheat-green manuring, green manuring-early potato-wheat and maize-mustard-maize the profitability ranged from Rs 1.29 – 1.93 lakh/year/ha with relatively lesser mandays generated. In most of the system, where potato was the main element and groundnut was taken either as *kharif* or summer crop, the profitability was more. Farmers were also asked to accord their preference rating of the sustainability of each system in terms of likely resource exhaustion and future continuance as perceived by them. It is evident from the same table that all the input intensive systems were computed more profitable compared to others but their sustainability (on the basis of underground water exhaustion) ratings were lower. Summer maize based cropping system emerged as less perceived sustainable system whereas summer groundnut based system was felt comparatively more sustainable. Interestingly, however, the input intensive vegetable based cropping system was also rated high from sustainability points of view which may be because of the fact that small holders farmers practicing such system may be maintaining the soil fertility through appropriate measures which was also affordable for them to do so.

As indicated in the first subhead that summer maize is having stiff competition with summer groundnut on irrigation requirements, but it has considerable profitability and ease of operations including now the use of mechanization in summer maize (even combine harvester is being used) which is strongly sustaining it in the system. Albeit, there was clear cut mismatch between the perceived profitability and perceived sustainability of the system as indicated by the non-significant rank correlation value (0.355). However, in the evolution of the cropping systems as discussed above, farmers' more preference to substitute the input intensive crops by the less input demanding crops

Table 7: Crop diversification inventory and their profitability and sustainability

Cropping pattern	Profitability (lac Rs/ year/ha)	Employment (Mandays/year/ha)	Sustainability rating (out of 5)
Paddy-Wheat	134.64	205	4.10 (I)
GM-Early Potato-Wheat	129.44	213	3.40 (III)
Maize-Potato-Maize	216.94	310	4.00 (I)
GM-Early Potato-Potato-Maize	256.61	272	3.27 (IV)
GM-Potato-Maize	223.00	244	3.10 (VII)
Kharif onion-potato-maize	232.00	360	3.00 (VIII)
Coriander-potato-onion	403.63	433	3.21 (V)
Maize-Early potato- Summer tomato	317.53	451	3.11 (VI)
Kharif G/nut-potato-Summer G/nut	255.96	451	2.90 (IX)
Maize-Potato-Groundnut	234.03	383	3.45 (II)
Potato + Jasmin	437.20	447	3.10 (VII)
Rank correlation coefficient (r)	**0.67***	-	
Coefficient of concordance (w)	**0.355^{NS}**		

** p<0.01 ; NS: Non-significant; Letters in parentheses indicate the ranking*

particularly in the potato based cropping system was disclosed through this investigation.

SWOT analysis of crop diversification

The perceived strength, weaknesses, opportunities and threats of the diversification of the cropping system in the study area was analyzed and presented as in Table 8. The results indicate that providing climatic resilience and enhancing the farm income were major strength of crop diversification. However, it was also felt by the respondents that real potential of crop diversification was not tapped by them as they lacked in the know-how and do-how of the nutrient managements and the related packages of practices. This is the area which demands attention by the related KVKs or associated line departments. However, as vegetables were the key elements of the their diversified cropping systems, farmers opined that for the small holder farmers, one acre viable and sustainable model of crop diversity may be validated for its upscaling as the potential opportunity.

Similarly, as the inclusion of more crops in the system involves more economic activities, the diversified system has the potential to ensure regular and meaningful employment to the farm family, thereby checking the rural migration. Similarly, processing and value addition was also seen as the future opportunity. Paradoxically, however, most of the farmers felt that inadequate market support, high perishability of the produces and the higher storage cost are some of the potential threats which may adversely affect the crop diversification among the small holders in the area. The non-significant coefficient of concordance (w) revealed that farmers' understanding of strength, weaknesses, opportunities and threat for the diversified cropping system were not of the similar degree. Gajbhiye *et al.* (2014) and Rohit *et al.* (2017) also reported the roles of delivery system and the related stakeholders in agriculture.

Table 8: SWOT Analysis of Diversification

Perceived strength	**Rank**
Ensured production	II
Enhanced income	I
Regular farm employment	III
Provide climate resilience	I
Perceived opportunity	
Processing and value addition	III
One acre viable and sustainable model	I
May check seasonal migration	II
Perceived weakness	
Improper nutrient management	I
Poor know-how of the packages	II
Perceived Threats	
Inadequate marketing	I
High storage cost	II
Perishability of the produce	II

Coefficient of concordance (w) = 0.477^{NS}

Area expansion, production and economic trends of summer maize

Analysis done above showed that small holders have experimented a lot to evolve the most profitable and engaging cropping systems over the period of time in the selected districts of Uttar Pradesh. Two Important concluding observations were made. Firstly, the summer maize is becoming very popular as against the other low input intensive options like summer groundnut and moongbean. Secondly, the vegetable based cropping systems are becoming more remunerative and income generating on everyday basis which is also the priority of the small holders. However, both the crops of summer maize and vegetables are though input intensive but sustaining and getting popular in the system only because of the fact that it is the profitability and employability derived from these crops which is determining their continuance in the system as compared to the other less input intensive and comparatively less profitable crops as summer groundnut and green gram. Consequently, the trends of summer maize as shown in Fig 1 clearly show that even at the constant level of productivity, area under summer maize has increased multifold during last ten years. Also, the gross and net return from summer maize has shown the increasing trends over the period of time in these districts mainly because of the reason of ensured availability of inputs by the private partners and assured procurement of the produce by them at the reasonable price.

Findings of the study helped to establish that there has been a reasonably increasing trend in the crop diversification among the small holders in the state of Uttar Pradesh. Varieties of crops have emerged and taken space in the cropping system. Also, there has been shift from cereal crops to more integration of cash crops, vegetables and other commercial crops like flowers in their existing

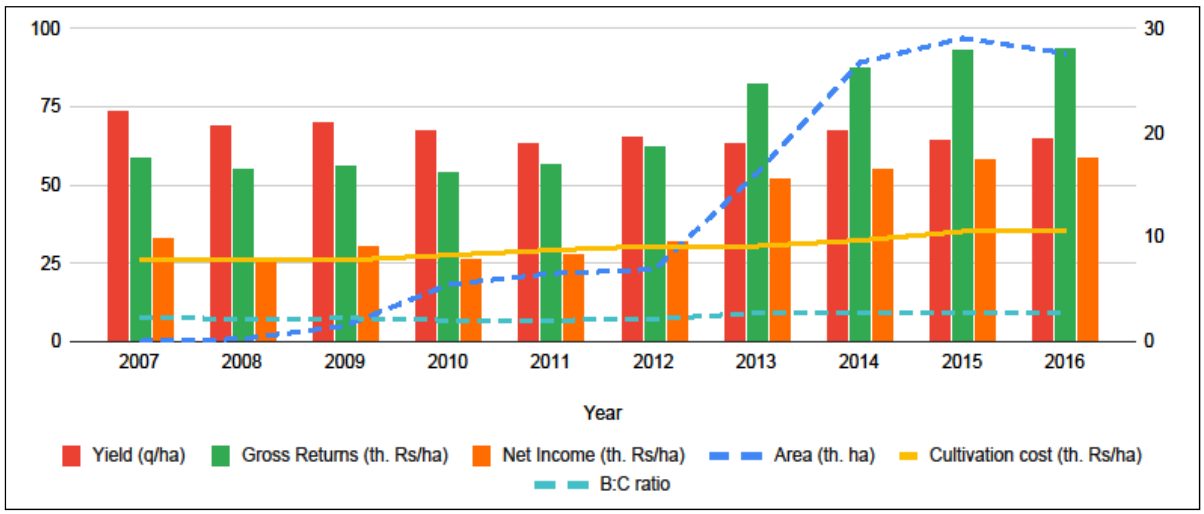

Figure 1: Area expansion of summer maize and related economics

system. The profitability of the cropping system was found to be the greater determinants than the sustainability strength of other crops if the assured supply of input coupled with procurement of produce is timely ensured by any agency. At the same time, farmers expressed that the diversified cropping systems, especially vegetable and potato based, despite being more profitable and employment generating, suffer from the usual threats of inadequate marketing logistics and storage provisions. In the given complex scenario, small holders have extended their more credence on the input dealers and also emphasized the need for strengthening farmers' organizations.

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Development and Validation of e-module on Creativity for Agricultural Students

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ABSTRACT

Creativity plays an important role in development of science and technology. The main purpose of the study was to develop and validate an e-learning module on creativity for agricultural students. Hence, the researcher developed an e-learning module by using content management software "Course Lab (version 2.4)". Topics related to creativity of students were included in the e-learning module based on comprehensive review of the available literature in an online as well as offline mode and educationist's suggestions. Data on seven validation parameters *viz.,* content, visual design, learning & support, motivation to learn, perceived utility and navigation, accessibility, interactivity were collected from agricultural students and analysed. Simple random sampling procedure was used for the selection of respondents. The results of the study showed that applicability of the e-learning module ranked first according to the students while learning and support, content, visual design, motivation to learn, perceived utility and navigation, accessibility, interactivity etc. ranked second, third, fourth, fifth, sixth and seventh respectively. The overall mean of 2.75 indicated moderately high liking/validity of the e-learning module by the students. Therefore, this study suggests that the developed e-module can be a useful tool for effective learning and enhances the knowledge and skills of the students.

Keywords: e-module and creativity, Development, Validation

INTRODUCTION

Present society is characterised by rapid change with greater acceleration in the field of technological advancement and education. Past society had never experienced such many changes occurred simultaneously and with greater speed over a spectrum of people activities. Fryer (1996) suggested that "to cope with the demands of the future, people will have to be quick, think, be flexible and imaginative". Creative people are valuable resources in the rapid process of technological change, which has wrapped up this global world in recent years. Creativity is present in the person, in the process and the outcome within a specific area where interaction with inherited effects and surrounding climate of home, community, school and culture, gender and chance (Piirto, 2004). So, creativity is considered as vital human need to make something new. Furthermore, the development of the e-learning tools must be in the interests, knowledge, understanding, abilities, needs and experiences of students. These e-learning materials are very effective in providing quality education at higher level. Apart from the textbook, the use of e-learning tools is crucial for expressive and meaningful teaching. Well-designed and tested e-learning tools can be very effective in training, which particularly requires lab activities and hands-on experience (Sung *et al.*, 2014). Additionally, current researches on instructional modules should focus on different e-learning contents in various disciplines of agriculture and their relationship with learning outcome. In the present world, e-learning is emerged as an effective, efficient and convenient option for lifelong learning. Burman *et al.* (2013) designed and validated a cyber extension model to disseminate technology information to the farmers for solving farm problems and augmenting overall agricultural development. Hence, learning through electronic medium may be considered as formal, informal or non-formal education (Maiorescu, 2013). At present there are no e-learning modules for enhancing the creativity among students for higher education in agriculture. Therefore, it is pertinent to develop a e-learning module on creativity and validate developed module in the present context. Hence, this paper aimed to bring forth the

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development and validation of an e-learning module by considering seven important parameters.

MATERIALS AND METHODS

Development of the e-learning module on creativity requires a set of rules that provide the broad framework. To prepare the rules for development of e-learning module on creativity, different principles of content structuring and composition were used. These includes chunking, relevance, labeling, modularity, sequencing, hierarchy, balance, unity, repetition, variety, rhythm, emphasis, contrast and storyboarding. Descriptive research design was used for the study (Kerlinger, 1978). For validation of the e-learning module, instrument developed by Vijayaragavan *et al.* (2009) was modified, revalidated and used. The statements were designed so as to throw light on content and design, learning and support, interactivity, ease of understanding, motivation to learn, applicability and perceived utility of the e-learning module. The responses were recorded on a five-point continuum *viz.*, strongly agree, agree, undecided, disagree and strongly disagree. Further, three-point continuum was formed *viz.*, 'agree', 'neutral' and 'disagree' by combining 'strongly agree' and 'agree'; and 'disagree' and 'strongly disagree'. 'Undecided' respondents were kept under 'neutral'. The validation of e-learning module was done through evaluation of the e-learning module by the respondents on seven very important dimensions *viz.*, content and design, learning and support, interactivity, ease of understanding, motivation to learn, applicability and perceived utility of the e-learning module. Forty students from ICAR-IARI, New Delhi constituted the sample size for this study. Simple random sampling procedure was used for this study.

RESULTS AND DISCUSSION

Validation was done through evaluation of the e-module by the respondents on seven very specific dimensions *viz.*, content and design, learning and support, interactivity, ease of understanding, motivation to learn, applicability and perceived utility.

The significance of the content of the e-learning module was studied on the basis of four factors, presented in Table 1. Eighty per cent of the respondents 'agreed' that the vocabulary and terminology used in e-learning module are suitable for the learner and 20 per cent of them were 'neutral' with the statement. Similarly, more than one third of the respondents (77.50%) were of the view that the abstract concepts (principles, rules, etc.) were illustrated with concrete, specific examples followed by 15 per cent of the respondents who were 'neutral' with the statement. Majority of the respondents (82.50 %) 'agreed' that the content of the module was comprehensive and easily understandable to the learners followed by 17.50 per cent of the respondents who were 'neutral' with the statement. Eighty per cent of the respondents 'agreed' that the content was related to specific topic *i.e.* creativity and systematically presented, followed by 17.50 per cent of the respondents who were 'neutral' with the statement. An average mean score of 2.78 obtained for the content of e-learning module shows a general acceptability of the content of the module by all the respondents. The findings reported by Rowena *et al.* (2015) reflected that respondents perceived the contents of the modules are enough and relevant to the needs of the students. Topics covered in the e-module on personality development and public relations were attractive to the interest of the learners. Also,

Table 1: Statement wise analysis of the respondents' opinions about content of e-learning module (n= 40)

Statements	Agree		Neutral		Disagree		Mean Score (out of 3)	Rank
	Freq.	%	Freq.	%	Freq.	%		
Vocabulary and terminology used are appropriate for the learner	32	80.00	8	20.00	0	0	2.80	II
Abstract concepts (principles, rules, etc.) are illustrated with concrete, specific examples	31	77.50	6	15.00	3	7.50	2.70	IV
Contents are comprehensive and easily understood	33	82.50	7	17.50	0	0	2.83	I
Contents are related to concerned topic and systematically presented	32	80.00	7	17.50	1	2.50	2.78	III
Average Mean Score				**2.78**				

information provided was adequate and enhance by the activities/exercises incorporated in each e-learning module (Rowena 2015).

The significance of the learning and support of the module was studied on the basis of four parameters, presented in Table 2. Eighty per cent of the respondents 'agreed' that the e-learning module offers tools (taking notes from module, references available, etc.) that support learning and 15 per cent of them were 'neutral' with the statement. Similarly, majority (90%) of the respondents were of the view that the module allows an individual student to learn on his own followed by 10 per cent of the respondents who were 'neutral' with the statement. Majority of the respondents (90 %) 'agreed' that the learning objectives of the e-learning module were clearly written followed by 7.50 per cent of the respondents who 'disagreed' with the statement. About 82 per cent of the respondents 'agreed' that the e-learning module had systematically presented the ideas which help interactive learning followed by 12.50 per cent of the respondents who were 'neutral' with the statement. An average mean score of 2.82 obtained for the module shows a general acceptability of the module by all the respondents with respect to learning and support provided to the students.

The significance of the visual design of the module was studied on the basis of four parameters, presented in Table 3. Ninety per cent of the respondents 'agreed' that the fonts (style, colour, saturation and contrast) used in e-learning module are easy to read and 10 per cent of them 'disagreed' with the statement. Similarly, majority (85%) of the respondents were of the view that the design was aesthetically appealing followed by 12.50 per cent of the respondents who 'disagreed' with the statement. Majority of the respondents (80 %) 'agreed' that the eye is immediately drawn to the most important informational or functional area of the page followed by 17.50 per cent of the respondents who 'disagreed' with the statement. Ninety per cent of the respondents 'agreed' that the content on each page was well organized and placed. Five per cent of the respondents were 'neutral' and 'disagreed' each with the statement. An average mean score of 2.75 out of 3, obtained for the module in terms of the visual design shows that content is well arranged in the e-learning module. Auditor and Naval (2014) reported that developed modules on Physics were found acceptable for the 10th grade physics students and there was no statistically significant difference between the evaluation of the students, peers, and experts on the module's acceptability.

Table 2: Statement wise analysis of the respondents' opinions about learning and support of e-learning module (n= 40)

Statements	Agree		Neutral		Disagree		Mean Score (out of 3)	Rank
	Freq.	%	Freq.	%	Freq.	%		
The module offers tools (taking notes, resources, etc.) that support learning	32	80.00	6	15.00	2	5.00	2.75	IV
The module allows an individual to learn on his own	36	90.00	4	10.00	0	0	2.90	I
Learning objectives are clearly written	36	90.00	1	2.50	3	7.50	2.83	II
Systematic presentation of ideas in interactive learning style	33	82.50	5	12.50	2	5.00	2.78	III
Average Mean Score					**2.82**			

Table 3: Statement wise analysis of the respondents' opinions about visual design of e-learning module (n= 40)

Statements	Agree		Neutral		Disagree		Mean Score (out of 3)	Rank
	Freq.	%	Freq.	%	Freq.	%		
Fonts (Style, colour, saturation, contrast) are easy to read	36	90.00	0	0.00	4	10.00	2.80	II
The design is aesthetically appealing	34	85.00	1	2.50	5	12.50	2.73	III
Your eye is immediately drawn to the most important informational or functional area of the page	32	80.00	1	2.50	7	17.50	2.63	IV
The content on each page is well organized and placed	36	90.00	2	5.00	2	5.00	2.85	I
Average Mean Score					**2.75**			

The significance of the navigation, accessibility, interactivity, self-assessment and learnability of the module was also studied and the results are presented in Table 4. More than half (60 %) of the respondents 'agreed' with the statement that the learner always knows where he/she is in the e-learning module followed by 22.50 per cent of the respondents who were 'neutral'. Around 17 per cent of the respondents 'disagreed' with the statement. Similarly, majority (70 %) of the respondents were of the view that the module allows the learner to leave whenever desired, but easily return to the closest logical point in the module. Fifteen per cent of the respondents were 'neutral' and 15 per cent 'disagreed' with this statement. The respondents were asked about their response on the statement that the e-learning module is free from technical problems like hyperlink errors, programming errors, etc. and it was found that 90 per cent of the respondents 'agreed' and another 10 per cent of them were 'neutral'. Around 72 per cent of the respondents 'agreed' that the module uses elements that gain attention and maintain motivation of the learner followed by 12.50 per cent of them who were 'neutral' with the statement. Eighty per cent of the respondents 'agreed' that the e-learning module can start successfully by learner, learn the things, complete the entire course and test what he/she learned using only given instructions followed by 12.50 per cent of the respondents who were 'neutral' with the statement. Only 7.50 per cent of the respondents 'disagreed' with the statement. An average mean score of 2.64 was obtained for the module in terms of the navigation, accessibility, interactivity, self-assessment and learnability dimensions. The findings are in line with Murai (2015).

The significance of the motivation to learning dimension of the e-learning module was also studied and the results are presented in Table 5. Around 72 per cent

Table 4: Statement wise analysis of the respondents' opinions about navigation, accessibility, interactivity, self-assessment and learnability of e-learning module (n= 40)

Statements	Agree		Neutral		Disagree		Mean Score (out of 3)	Rank
	Freq.	%	Freq.	%	Freq.	%		
Learner always knows where he is in the module	24	60.00	9	22.50	7	17.50	2.43	V
The module allows the learner to leave whenever desired, but easily return to the closest logical point in the module	28	70.00	6	15.00	6	15.00	2.60	III
The module is free from technical problems (hyperlink errors, programming errors, etc.)	36	90.00	4	10.00	0	0	2.90	I
The module uses elements that gain attention and maintain motivation of the learner	29	72.50	5	12.50	6	15.00	2.56	IV
Learner can successfully start, learn, complete the entire course and test what he learned using only given instructions	32	80.00	5	12.50	3	7.50	2.73	II
Average Mean Score					**2.64**			

Table 5: Statement wise analysis of the respondents' opinions about motivation to learning from e-module (n= 40)

Statements	Agree		Neutral		Disagree		Mean Score (out of 3)	Rank
	Freq.	%	Freq.	%	Freq.	%		
The module incorporates novel characteristics	29	72.50	7	17.50	4	10.00	2.63	III
The module stimulates further inquiry	26	65.00	11	27.50	3	7.50	2.56	V
It is enjoyable and interesting	26	65.00	12	30.00	2	5.00	2.60	IV
It provides learner with frequent and varied learning activities that increase learning success	31	77.50	7	17.50	2	5.00	2.73	II
Module is user friendly	39	97.50	1	2.50	0	0	2.95	I
Average Mean Score					**2.70**			

of the respondents 'agreed' with the statement that the e-learning module incorporates novel characteristics followed by 27.50 per cent of the respondents who were 'neutral'. The respondents were asked about their response on the statement that the e-learning module stimulates further inquiry on the subject and it was found that 65 per cent of the respondents 'agreed' and another 27.50 per cent of them were 'neutral'. Similarly, majority (65 %) of the respondents were of the view that the module is enjoyable and interesting followed by 30 per cent of the respondents who were 'neutral'. Around 78 per cent of the respondents 'agreed' that the module provides frequent and varied learning activities that increase learning success in learner followed by 17.50 per cent of them who were 'neutral' with the statement. Around 98 per cent of the respondents 'agreed' that the e-learning module was user friendly. An average mean score of 2.70 was obtained for the module in terms of the motivation to learning. The similar type of findings was reported by Rohit (2016).

The significance of the applicability of the e-learning module was studied and the results are presented in Table 6. Eighty per cent of the respondents 'agreed' with the statement that the e-learning module helps in understanding about the concept of creativity followed by 15 per cent of the respondents who were 'neutral'. The respondents were asked about their response on the statement that the e-learning module is helpful in enhancing the creative potential of the students and it was found that 80 per cent of the respondents 'agreed' and another 17.50 per cent of them were 'neutral'. Similarly, majority (95 %) of the respondents were of the view that the module can also be used as resource material followed by 5 per cent of the respondents who were 'neutral'. Around 78 per cent of the respondents 'agreed' that the module was also helpful for trainers followed by 7.50 per cent of them who were 'neutral' with the statement. An average mean score of 2.86 was obtained in terms of the applicability of the e-learning module under different situations by all the respondents.

The importance of the perceived utility of the e-learning module was also assessed and the results are presented in Table 7. Sixty-five per cent of the respondents 'agreed' with the statement of the e-learning module as a tool to sensitize the academicians, educationists, teachers

Table 6: Statement wise analysis of the students' opinions about applicability of the e-learning module (n=40)

Statements	Agree		Neutral		Disagree		Mean Score (out of 3)	Rank
	Freq.	%	Freq.	%	Freq.	%		
This module helps in your understanding about the concept of creativity	32	80.00	6	15.00	2	5.00	2.76	IV
This module is helpful in enhancing your creative potential	32	80.00	7	17.50	1	2.50	2.78	III
The module can also be used as resource material	38	95.00	2	5.00	0	0.00	2.95	I
This module is also helpful for trainers	37	92.50	3	7.50	0	0.00	2.93	II
Average Mean Score					**2.86**			

Table 7: Distribution of respondents on their opinions about perceived utility of the e-learning module (n=40)

Statements	Agree		Neutral		Disagree		Mean Score (out of 3)	Rank
	Freq.	%	Freq.	%	Freq.	%		
As a tool to sensitize the academicians, educationists, teachers etc. about the creativity level of students	26	65.00	6	15.00	8	20.00	2.45	IV
As a ready reference to material to refresh and enhance the knowledge on the subject	33	82.50	7	17.50	0	0	2.83	I
As a training tool to enhance the learner participation	28	70.00	8	20.00	4	10.00	2.60	III
As an ideal instructional aid for imparting knowledge about creativity	33	82.50	5	12.50	2	5.00	2.78	II
Average Mean Score					**2.67**			

etc. about the creativity level of students while 20 per cent of the respondents 'disagreed'. The respondents were asked about their response on the statement regarding the e-learning module as a ready-made reference material to refresh and enhance the knowledge on the subject and it was found that 82.50 per cent of the respondents 'agreed' and another 17.50 per cent of them were 'neutral'. Similarly, majority (70 %) of the respondents were of the view that the module is used as a training tool to enhance the learner participation followed by 20 per cent of the respondents who were 'neutral'. Around 83 per cent of the respondents 'agreed' that the module can be used as an ideal instructional aid for imparting knowledge about creativity followed by 12.50 per cent of them who were 'neutral' with the statement. An average means score of 2.67 obtained shows that the e-learning module had practical utility for the different stakeholders. The e-learning module can be also used as a training material and trainings are important aspects of thriving organizations (Varga *et al.,* 2013).

The ranking of validation parameters of e-learning module by the students are presented in Table 8. Mean scores of the seven dimensions of the validation was presented based on the responses of students. It was found that applicability of the e-learning module ranked first according to the students while learning & support, content, visual design, motivation to learn, perceived utility and navigation, accessibility, interactivity etc. ranked second, third, fourth, fifth, sixth and seventh respectively. The overall mean of 2.75 indicated moderately high liking/ validity of thee-learning module by the students. The similar finding was reported by Som (2015). Gagarin (2003) also found that e-modules proved to be effective tool in teaching physics to the students. Fartyal and Amardeep (2016) also reported that the overall instruction effectiveness of online courses as fairly effective.

Table 8: Ranking of validation parameters of e-module

Parameters	Mean	Rank
Content	2.78	III
Learning and support	2.82	II
Visual design	2.75	IV
Navigation, accessibility, interactivity and self-assessment and learnability	2.64	VII
Motivation to learn	2.70	V
Applicability	2.86	I
Perceived utility	2.67	VI
Overall mean	**2.75**	

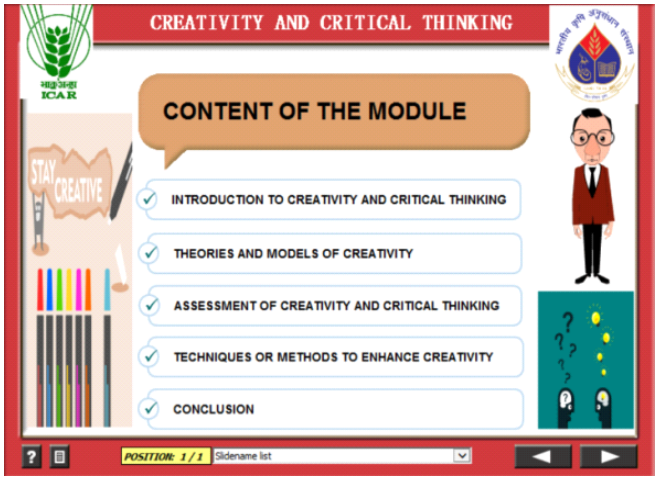

Figure 1: Glimpses of e-learning module on Creativity

CONCLUSION

It is concluded that e-learning module on creativity was highly accepted by the students. The respondents rated positively on the different parameters of validation of e-learning module on creativity. This showed that e-learning module found to be valid and acceptable among students. Therefore, the study recommends the use of e-module on creativity for teaching for higher education in agriculture. Developing and validating e-learning modules in other subjects or areas may enhance the knowledge and improve the skills of the stakeholders at different levels. Additionally, a similar type of this study with large sample size and conducted over a longer period of time could also reveal additional insight of the impact of the developed e-learning modules.

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Lentil Production Economics and Constraints: An Empirical Study in Mokama Taal of Bihar

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ABSTRACT

Lentil is an important source of protein, high in fibre content and provides ample quantity of vitamins and minerals. Lentil is performing well in Bihar and its area under cultivation is gradually increasing. This research work is carried out in Mokama Taal area of Bihar. Mokama Taal area is considered pulse bowl of Bihar. Theobjectives of the study were to assess the economics of lentil production and its constraints. The result revealed that total cost of lentil production was least for the small farmers with high B:C ratio. Lentil growers are facing the major constraints of marketing facilities, resource support, inputs availability and its cost.

Keywords: B:C Ratio, Farmer, Inputs availability, Marketing

INTRODUCTION

India is agriculture based economy with more than 60 percent population of country is dependent on agriculture. Amongst rural population more than 70 per cent of rural household depend on agriculture as their primary means of livelihood (Sharma and Sharma, 2019). Pulses in India are basic to the diet as well as cropping system across the country. These crops primarily occupy marginalized land in rainfed conditions (Sah *et al.,* 2019). Lentil crop immensely contribute in maintaining soil health and increase in productivity of subsequent crop. Lentil is important source of protein, high in fibre content and provide ample quantity of vitamins and minerals. Bihar ranks 9th in terms of pulses production with a contribution of 0.52 million tons to the national pulse pool. Lentil is only crop which has performed well in Bihar, whereas area and production of most of the major pulses have gone down (Singh *et al.,* 2017). In Bihar, a number of pulses are grown *viz.* gram, lentil, khesari, pea, summer moong (*rabi* pulse); tur, moong, urad, ghaghra, kulthi (*kharif* pulse). Mokama Taal of Bihar is well known in India for its pulse production. All categories of farmers grow pulses in Bihar. The economics of pulse cultivation is varied according to the categories of farmers. Farmers also faced number of problems in pulses cultivation. The constraints of pulse cultivation were low price to produce, labour shortage and high transportation charges (Rajput *et al.,* 2000), cultivation in rainfed condition, low adoption of high yielding varieties (Ramaswamy, 2002), adoption gap in use of micronutrients (Sharma *et al*., 2003), lack of improved varieties, infestation of pest and diseases (Burman *et al*., 2008), lack of knowledge regarding weed control (Kumar *et al.,* 2010). Patidar (2012) reported that the constraints confronted by pulse growing farmers were broadly related to economic, natural, technological, social cause, institutional and infrastructure. Under this backdrop this research work was carried out with the objectives to study the economics and constraints of lentil production in Mokama Taal of Bihar.

MATERIALS AND METHODS

Mokama Taal is not just one single Tal but a group of seven Taals covering an area of 1,062 square kilometres and the width varying from 6.5 to17.6 kilometres within the districts of Patna and Lakhisarai of Bihar state between latitudes 24°10’ N and 25°30' N and longitudes 84°40' E and 86°30’E. It is a saucer shaped depression running along the right bank of the river Ganga. The two blocks i.e. Mokama and Barahiya were purposively selected from Patna and Lakhisari districts respectively. From each block two villages were selected randomly. From each village 30 lentil growers were selected randomly, hence the sample size was 120. The data collection schedule was pretested

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over 10 non-respondents farmers and pertinent changes were made. The data was collected from the lentil growers during the period of February 2017 to April 2017.

RESULTS AND DISCUSSION

The perusal of Table 1 shows the variable cost, fixed cost and total cost of lentil cultivation of different categories of farmers *viz.* marginal, small, semi-medium, medium and large. It is noted from the table that highest variable cost (Rs. 11941.52/ha) was observed in medium category of farmers followed by large farmer, semi medium, marginal and small farmer were Rs. 11221.41/ha, Rs. 10564.94/ha, Rs. 10488.57/ha and Rs. 9757.14/ha respectively. Variable cost of medium and large farmer was greater than average variable cost (Rs. 10794.72/ha).

Table 1: Cost of lentil Cultivation (n=120)

Categories of farmers	Variable cost (Rs./ha)	Fixed cost (Rs./ha)	Total cost (Rs./ha)
Marginal	10488.57	2369.71	12858.29
Small	9757.14	1720.46	11477.61
Semi-Medium	10564.94	1389.04	11953.97
Medium	11941.52	1416.49	13358.01
Large	11221.41	1555.13	12776.53
Average	10794.72	1690.17	12484.88

From the above table it is also observed that average fixed cost of the lentil cultivation (Rs./ha) was Rs. 1690.17/ha. Fixed cost on cultivation of lentil was found maximum in case of marginal farmer and it was Rs. 2369.71/ha, followed by small farmer, large farmer, medium farmer and semi-medium farmer were Rs. 1720.46/ha, Rs. 1555.13/ha, Rs. 1416.49/ha and Rs. 1389.04/ha respectively. The fixed cost of lentil production of marginal and small farmers were more than average fixed cost (Rs. 1690.17/ha).

The average total cost of the lentil cultivation was Rs. 12484.88/ha. Total cost of lentil cultivation was found maximum with medium category farmer (Rs.13358.01/ha) followed by marginal farmer, large farmer, semi-medium and small farmer were Rs. 12858.29/ha, Rs. 12776.53/ha, Rs. 11953.97/ha and Rs. 11477.61/ha respectively. Total cost of lentil cultivation of small farmer and semi-medium farmer was lesser than average total cost (Rs. 12484.88/ha).

Table 2 shows the output, returns and B:C ratio of lentil cultivation. The average returns (Rs./ha) of the main product was Rs. 24487.37. The maximum returns from main product was found Rs. 30771.43/ha with marginal farmer followed by small farmer, large farmer, medium and semi-medium farmer were Rs. 26898.21/ha, Rs. 23727.81/ha, Rs. 20543.27/ha and Rs. 20496.10/ha respectively. The returns from the main product of marginal and small farmer were greater than average returns (Rs. 24487.37/ha)

Average returns of byproduct from lentil cultivation was Rs. 6704.12/ha. Maximum by product of output was noted for the marginal category farmer (Rs. 7260.00/ha) and minimum return was noted for semi-medium farmer (Rs. 6029.35/ha). Above table also revealed that average gross return of lentil cultivation was Rs. 31191.49/ha. Highest gross return was found in category of marginal farmer (Rs. 38031.43/ha) followed by small farmer, large farmer, medium farmer and semi-medium farmer were Rs. 33289.46/ha, Rs 30517.24/ha, Rs 27593.86/ha and Rs 26525.45/ha respectively. Gross return of marginal farmer and small farmer was greater than average gross return cost (Rs. 31191.49/ha). The average net return of lentil (Rs/ha) was Rs. 110460.21. Maximum net return (Rs. 25173.14) was found in marginal farmer followed by small farmer, large farmer, semi-medium farmer and medium farmer Rs. 21811.86, Rs. 17740.71, Rs. 14571.48 and Rs.

Table 2: Output and returns in lentil production (n=120)

Categories of farmers	Output (Rs./ha)		Returns(Rs./ha)		B : C Ratio
	Main product	By product	Gross Returns	Net Returns	
Marginal	30771.43	7260.00	38031.43	25173.14	2.90
Small	26898.21	6391.25	33289.46	21811.86	2.95
Semi-Medium	20496.10	6029.35	26525.45	14571.48	2.21
Medium	20543.27	7050.58	27593.86	14235.85	2.06
Large	23727.81	6789.43	30517.24	17740.71	2.38
Average	24487.37	6704.12	31191.49	15859.21	2.49

14235.85, respectively. Net return of semi-medium and medium farmers was less than average net return (Rs. 15859.21/ha).

Lastly, the average Benefit-Cost ratio of lentil cultivation was 2.49. While maximum B:C ratio (2.95) was found in small farmer followed by marginal farmer, large farmer, semi-medium farmer and medium farmer 2.90, 2.38, 2.21, 2.06 respectively. Benefit cost ratio of marginal and small farmer was greater than average benefit cost ratio. Farmers face a number of constraints in crop cultivation in Mokama Taal of Bihar, as it is geographically in a disadvantage position. The respondents reported number of constraints in lentil cultivation. These constraints were broadly categories into abiotic constraints, bio-physical constraints, marketing constraints, crop management and growth related constraints, resource constraints, cost of input constraints and availability of input constraints. In the following tables these constraints are separately elaborate.

Table 3: Farmers' perception on abiotic constraints in lentil cultivation (n=120)

Abiotic constraints	Weighted mean	Rank
Soil hardiness after seed sowing	4.36	I
Terminal drought problem of soil (i.e. drought during reproductive phase)	4.32	II
Soil cracking	4.28	III
Low water table	4.05	IV
Low organic matter content in soil	3.18	V
Low residual moisture in soil	2.14	VI

From the above, it is noted that soil hardness after seed sowing was the most important abiotic constraint as perceived by the respondents and it was rank *first*. Amongst the other abiotic constraints, it is noted that terminal drought problem is second most important constraint as perceived by respondent, followed by soil cracking (Rank III), low water table (Rank IV). Least perceived constraint was low residual moisture in soil as reported by respondents and it was ranked *sixth*.

The farmers' perception on crop management and growth related constraints in lentil cultivation were also studied. The result shows that short sowing period was the most important perceived constraint under this category and it was ranked *first*. Lack of short duration variety of lentil and poor seed germination were the another two important crops management and growth related constraint as shown in table.

Table 4: Farmers' perception on crop management and growth related constraints in lentil cultivation (n=120)

Crop management and growth related constraints	Weighted mean	Rank
Short sowing period	4.30	I
Lack of short duration variety	4.00	II
Poor seed germination	3.83	III

Table 5: Farmers' perception on resource constraints in lentil cultivation (n=120)

Resource constraints	Weighted mean	Rank
Non availability of credits in time	4.16	I
Scarcity of human labour during sowing of seed	4.00	II
Lack of subsidy for inputs	3.92	III
Lack of human labour during harvesting	3.88	IV
Lack of funds to purchase inputs	3.64	V
Lack of draught power at the time of sowing	2.16	VI

It is noted that non-availability of credit in time for lentil cultivation is the most important perceived constraint to the respondent accordingly it is rank *first*. Amongst the other constraints as reported by the farmer's were scarcity of human labour during sowing of seed (Rank II) and lack of subsidy for inputs(Rank III) were other major constraints as perceived by respondents. However, least perceived constraints were lack of draught power at the time of sowing (Rank VI).

Lentil growers are also facing a number of bio-physical constraints and the respondents had reported twenty bio-physical constraints (Table 6). From these twenty bio-physical constraint it is noted that the most important constraint is farmers lack of knowledge on seed treatment and it is ranked *first*, the other major constraints where post harvest losses (Rank II), non-availability of bio-fertilizer (Rank III), lack of irrigation facility (Rank IV), lack of soil testing facility (Rank V), non-application of herbicide at proper time (Rank VI). However, the least perceived constraints were non-availability of insecticide in time (Rank XX), followed by high infestation of pest and diseases (Rank XIX) and excess weed growth (Rank XVIII).

Lentil growers' perception on marketing related constraint were also studied. The result shows that

Table 6: Farmers' perception on bio-physical constraints in lentil production (n=120)

Bio-physical constraints	Weighted mean	Rank
Lack of knowledge on seed treatment	4.400	I
Extent of post-harvest losses	4.366	II
Non availability of bio-fertilizer	4.350	III
Lack of irrigation facilities	4.350	IV
Lack of soil-testing facilities	4.341	V
Less or no application of herbicide at proper time	4.191	VI
Lack of proper storage facilities at harvesting time	4.160	VII
Use of locally available seed	4.141	VIII
Difficult to control wild lentil (*Viciasativa*)	3.966	IX
Lack of improved varieties	3.916	X
Timely non availability of bio-fertilizer	3.833	XI
Lack of resistant varieties against pests and disease	3.391	XII
Lack of soil-testing facilities	3.225	XIII
Lack of knowledge on adoption of DAP spraying	3.091	XIV
Pesticide application not being cost effective	3.033	XV
Timely non availability of herbicide	2.525	XVI
Timely non availability of fungicide	2.325	XVII
Excessive weed growth	2.150	XVIII
High infestation of pest and diseases	2.041	XIX
Timely non availability of insecticide	1.908	XX

Table 7: Farmers' perception on lentil marketing related constraints (n=120)

Marketing constraints	Weighted mean	Rank
Fluctuating prices	4.208	I
Collusion among traders in reducing prices	3.633	II
Lack of regulated market	3.60	III
High Transport cost	3.55	IV
Lack of knowledge on MSP (Minimum Support Price)	3.05	V
Distress selling	2.383	VI
Large number of middleman	2.283	VII

fluctuating prices was the most important perceived constraint under this category (Table 7). The other major constraints were collusion among traders in reducing prices (Rank II), lack of regulated market (Rank III), high transport cost (Rank IV), lack of knowledge on MSP (Rank V), distress selling (Rank VI). However, the least perceived constraint was large number of middlemen (Rank VII).

The perusal of the table reveals the farmers' perception on constraints related to cost of inputs (Table 8). The result shows that increase in cost of labour is the most important perceived constraint under this category. The other major constraints where increase in cost of insecticide (Rank II), increase in cost of fungicide (Rank III), increase in price of chemical fertiliser DAP (Rank IV), increase in cost of weedicide (Rank V). However, the least perceived constraint was increase in cost of seed (Rank VIII).

From the study it is noted that timely non availability of labour was the most important constraints as perceived by the respondents and it is rank first, amongst the inputs availability constraints, it is noted that timely non availability

Table 8: Farmers' perception on cost of inputs constraint in lentil cultivation (n=120)

Cost of inputs constraints	Weighted mean	Rank
Increase in cost of labour	4.308	I
Increase in cost of insecticide	3.808	II
Increase in cost of fungicide	3.658	III
Increase in price of chemical fertiliser (DAP)	3.008	IV
Increase in cost of weedicide	2.858	V
Increase in price of bio fertiliser	2.208	VI
Increase in price of chemical fertiliser (Nitrogen)	2.041	VII
Increase in cost of seed	1.183	VIII

Table 9: Farmers' perception on availability of inputs for lentil cultivation (n=120)

Availability of inputs constraints	Weighted mean	Rank
Timely non availability of labour	4.275	I
Timely non availability of chemical fertiliser (Phosphorus)	4.125	II
Timely non availability of DAP fertiliser (DAP)	4.116	III
Non availability of irrigation water	4.108	IV
Timely non availability of desired seed	4.066	V
Timely non availability of insecticide	4.058	VI
Timely non availability of fungicide	4.033	VII
Timely non availability of bio fertiliser	4.000	VIII
Timely non availability of chemical fertiliser (Nitrogen)	3.991	IX

Table 10: Constraints of lentil cultivation (n=120)

Constraints	Weighted mean	Rank
Marketing related constraints	0.581117	I
Resource constraints	0.306433	II
Availability of inputs constraints	0.192267	III
Cost of Inputs constraints	0.189225	IV
Abiotic constraints	0.186083	V
Bio-physical constraints of pulses production	0.181333	VI
Crop management and growth related constraints	0.101083	VII

of chemical fertiliser (Phosphorus) is second most important constraint as perceived by respondent. Followed by timely non availability of DAP fertiliser (Rank III), non availability of irrigation water (Rank IV) and remaining constraints were as shown in the Table 9. Amongst the seven broad constraint categories on lentil production, it is noted that marketing constraint was the most important perceived constraint in lentil production and it was ranked *first*. The other major constraints were resource constraint (Rank II) availability of input constraint (Rank III) and other constraint as shown in Table 10.

CONCLUSION

From the study it can be concluded that the total cost of lentil cultivation was least for the small farmers and maximum for medium category of farmers. This result implied that small category of farmers gave maximum emphasis for reducing the cost of cultivation through more use of family labour and precise use of other inputs. It was also noted that B:C ratio in lentil cultivation was maximum for small category of farmer. Lentil growers are facing the major constraints of marketing, resource support, inputs availability and its cost. So, for ensuring lentil cultivation more remunerative these constraints should be solved.

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Analysis of Yield Gaps in Pulse Production in South Western Punjab

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ABSTRACT

The study on analysis in yield gap in pulse production was conducted during the year 2011-2016 in Mansa, a South-Western district of Punjab. Average yield of chickpea was higher (8.1%) in improved practice (IP; 17.4 q ha^{-1}) than the farmers' practice (FP; 16.2 q ha^{-1}). In mungbean, the yield gain of 23.4 per cent in IP over FP was observed. The extension gap in chickpea and mungbean cultivation was 1.28 and 1.90 q ha^{-1}, respectively. Results revealed considerable technological gap for both the pulse crops. The technology index calculated for chickpea and mungbean was 8.6 and 10.7 per cent, respectively indicated the feasibility of IP demonstration. The B:C ratio for chickpea and mungbean was 2:1 for demonstration plots for both the crops.

Keywords: Pulse production, Extension gap, Technology gap, Economic analysis, Constraints

INTRODUCTION

Pulse, the leguminous crops are cultivated throughout the world on an area of ~70 Mha with a production of ~45 Mt. India has a share of 25 per cent in world's total pulse production (Kumar and Prajapati, 2015). Among pulse growing countries, India ranks 2nd in with 23 Mha (33% of total area worldwide) and an annual production of 13Mt (22% of total production) (Reddy and Reddy, 2010). Chickpea, pigeonpea, lentil, mungbean, urdbean and field pea are major pulses cultivated in India, and accounts for ~90 per cent pigeonpea, 65 per cent chickpea and 37 per cent lentil area on a global basis (FAOSTAT, 2009). Because of their ability to fix atmospheric N in root nodules, pulses had prime importance in soil health improvement (George and Singleton, 1992). A legume-rhizobium symbiotic association contributes to ~90 X 10^6 metric tons N $year^{-1}$ all over the world (Subba Rao, 1982). Nitrogen assimilated in the root nodules as a result of symbiotic association between host and bacteria has also been reported to improve N economy of the following crops (Subba Rao, 1982; George and Singleton, 1992). A yield gain of 20-40 per cent in the succeeding crop (Joshi, 1998) has been related to improvement in N economy of soil. In Indian context, pulses had a significant importance where majority of population is purely vegetarian (Patel and Pandya, 1980). Pulses are integral component of Indian diet for nutritional security. Pulses are important for their high protein (20-25%) and carbohydrates (55-60%), and are rich in calcium (Ca) and iron (Fe). Due to stagnant production, the net availability of pulse has come down from 60 g day^{-1} $person^{-1}$ in 1951 to <32 g day^{-1} $person^{-1}$ after 2008 (Reddy, 2009; Narayan and Kumar, 2015). Over the years, a decrease in per capita consumption of pulses in India has largely been ascribed to stagnant pulse production and increasing human population (Gangwar and Panday, 1982). The reduction in per capita pulse availability had serious dietary implications for children and women, particularly in rural area. In Punjab, an urgent increase in the area as well as the production of pulses has been emphasized (Chatha and Singh, 1983).

A low productivity of pulses has been attributed to several factors including subsistence production, cultivation on marginal lands, rainfed cultivation, risks production, assured marketing and focus on cereals for national food security and low level of technology adoption. An extensive gap exists between the available production technology and its actual application by the farmers leading to poor crop yield at farmers' fields. Use of quality seed, adoption of improved crop management technologies could help in increasing production and productivity of pulse crops. Several technologies related to nutrient management, weed management and insect pests and disease management have been generated at agricultural universities but adoption gaps in improved technologies are leading to low crop yields.

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The scientists and planners have been stressing upon diversification of agriculture by increasing area under oilseeds and pulse crops. Although legumes play an important role in sustainable agriculture but, paradoxically the area under pulse crop has been reducing over the year (Grover and Singh, 2012). Naryanamoorty (2000) analyzed the demand and supply situation of pulses in India, and reported that to meet the projected demand of 27.5 Mt pulses by 2030, production of pulse crops need to be increased. Thus, it was desirable to study the extension and technological yield gap in the pulse production to enhance productivity and economic benefits to the farmers.

MATERIALS AND METHODS

Description of the study area: The study was conducted in Mansa, a South-Western district of Punjab. This district is located between longitudes of 29°59' and latitude of 75°23' and it is situated 212 m above mean sea level. Total geographical area of this district is 2.2 lakh hectares with 1.8 lakh hectare arable land spread over 243 villages among five blocks. Annual average rainfall in Mansa is 243 mm and is mainly received during summer season. Mean annual temperature ranges between 19°C to 31°C and climate is typically arid and sub-tropical with hot and dry summer and cold winters (Singh *et al*., 2018). The underground water is mainly of poor quality having problem of salinity and alkalinity.

Details of technology demonstration: Improved technology (IP in the text) on chickpea was demonstrated against production technology prevalent among farmers' (FP in the text) at 40 different farmers' field locations during four consecutive years (2011/12 to 2015/16). Similarly, an improved technology on mungbean was demonstrated at 46 different farmers' field locations. A total of 86 demonstrations were conducted on pulse crops (chickpea and mungbean) in the district. Chickpea was grown in winter season, while mungbean was grown during summer season (spring). Improved varieties of Punjab Agricultural University, Ludhiana viz. chickpea (var. GPF 2) and mungbean (var. SML 668) were used for production technology demonstration. A brief description of crop production technology demonstration for chickpea and mungbean including improved variety seed, recommended seed rate, bio-fertilizer application, recommended weed control measures and nutrient management practices etc. are given in Table 1. Farmer practice was used as check to evaluate the performance of demonstration.

Data collection: The data were collected from all experimental sites each year. Details regarding input used, yield obtained, diesel and prevailing market prices were studied through individual interviews conducted during monitoring visits. Constraints faced by farmers in pulse production were studied using data collection through semi-structured interview schedule.

Yield gap analysis: Crop yield gap were assessed from potential yield and demonstration yield. The estimation of yield gaps in terms of technology gap, extension gap and technology index are calculated using following equations (Samui *et al.,* 2000; Mishra *et al.,* 2007).

$$\text{Extension gap} = \text{IP yield (q/ha)} - \text{FP yield (q/ha)} \quad \text{... (Eq. 1)}$$

$$\text{Technology gap} = \text{Potential yield (q/ha)} - \text{IP yield (q/ha)} \quad \text{...(Eq. 2)}$$

$$\text{Technology gap index} = \frac{(\text{PY (q/ha)} - \text{IP (q/ha)}}{\text{PY (q/ha)}} \times 100 \quad \text{...(Eq. 3)}$$

Where, IP is improved practice, FP is farmers' practice and PY is the potential yield.

Economic analysis: Average cost of cash inputs (ACCI), average gross returns (AGR), average net returns (ANR) and benefit cost (B-C) ratio were calculated for chickpea and mungbean. The ACCI included cost of inputs like seed, chemical fertilizers, pesticides and diesel, labour costs etc. The expenditure on sowing, harvesting and threshing etc. were considered for calculating ACCI (Eq. 1). The AGR and ANR were worked out by considering cost of cultivation and minimum support price (MSP) of grain yield of respective crop. Costs associated to IP and FP was calculated to compare economics and monetary benefits to the farmers. Similarly, B-C ratio and economic efficiencies of mungbean and chickpea was calculated by using following equations.

$$ACCI\ (Rs/ha) = SC_{1,2,3\ldots n} \quad \text{... Eq. 4}$$

Where, $C_{1,2,3,\ldots,}$ represents cost for different inputs and labour cost

$$\text{AGR (Rs/ha)} = \text{Grain yield} \times \text{MSP} \quad \text{... Eq. 5}$$

$$\text{ANR (Rs/ha)} = \text{AGR} - \text{ACCI} \quad \text{... Eq. 6}$$

$$\text{Benefit-Cost ratio} = \frac{\text{Gross returns (Rs/ha)}}{\text{Gross cost (Rs./ha)}} \quad \text{... Eq. 7}$$

Table 1: Improved crop production technologies for chickpea and mungbean

Packages of practices	Chickpea	Mungbean
Variety	GPF 2	SML 668
Seed rate (kg ha^{-1})	45	37.5
Seed treatment (g kg^{-1}) seed	3 g captan	3 g captan
DOS	25th Oct. - 10th Nov.	20th March - 10th April
Bio-fertilizer	*Mesorhizobium* (LGR-33) and *Rhizobacterium* (RB-1)	*Rhizobacterium* LSMR-1 and *Rhizobacterium* RB-3
Spacing	30 cm	22.5 cm X 7 cm
Weed control (L ha^{-1})	Pendimethalin 30 EC @ 2.5	Pendimethalin 30 EC @ 2.5
Fertilizer application (kg ha^{-1})		
N	6	5
P_2O_5	8	16
Insect pest management		
Pod borer		
Spinosad 45EC (ml ha^{-1})	150	150
Sucking pests		
Malathion 50 EC (ml ha^{-1})	-	250
Tobacco caterpillar		
Novaluron 30 EC (ml ha^{-1})	-	375
Irrigation	Crucial at pod formation	25 and 55 DAS
Harvesting	165 DAS	60 DAS

The constraints faced by respondents in pulse production were recorded in the interview schedule and were analysed in percentages.

RESULTS AND DISCUSSION

Grain yield and yield gaps: A total of 86 crop production technology demonstrations on improved varieties of chickpea (GPF-2) and mungbean (SML 668) were conducted during four consecutive years. Average grain yield in IP varied between 16.4 and 18.8 q ha^{-1} for chickpea during different years (Table 2). In chickpea, IP including cultivation of improved variety (GPF 2) with proper spacing, and recommended fertilizer application and plant protection measures resulted in 6.3-10.8 per cent yield gain over FP during different years. Our results corroborate the findings of Singh and Prakash (2016), who also had reported 31.8-56.4 per cent yield gain in pulse production under IP over the FP. Yield data revealed an extension gap of 1.3 q ha^{-1} and a technology gap of 2.1 q ha^{-1} (Figure 1). The technology index for chickpea varied between 5.1 and 13.9 per cent during different years (mean=8.6%). An extension gap of 1.5-4.1 q ha^{-1} in chickpea has also been reported earlier (Kumar *et al.,* 2014).

Average mungbean yield in IP during different study years varied between 9.3 and 10.8 q ha^{-1} (Table 3). In contrast, the mean (four years) mungbean yield in FP was lower by ~19 per cent than the IP. Our results showed an extension and technology gap of 1.9 and 1.5 q ha^{-1}, respectively in mungbean production (Figure 2). As compared to chickpea, higher mean technology index value indicates greater feasibility of demonstration of IP in mungbean. Lower value of technology index indicate higher feasibility of the technology demonstrated (Singh *et al.,* 2007; Mishra *et al.,* 2007).

Four year average chickpea yield in FP was 16.1 q ha^{-1}, against the PY of 19.0 q ha^{-1}, indicating a total yield gap (extension gap + technology gap) of 3.4 q ha^{-1}. In case of mungbean, average yield in FP was 8.1 q ha^{-1}, against the PY of 11.5 q ha^{-1}. A yield gain between 34 and 82 per cent with IP compared with FP has also been reported (Kumar *et al.,* 2015). A technology gap of 17 per cent in pulse production in north-western India reported by Reddy (2013) is nearly the same (15%) to that observed in present investigation. Extension gap indicated that the demonstration of IP has advantage over FP and thus, there was need to motivate farmers for adoption of

Table 2: Comparative evaluation of grain yield in improved (IP) and farmers' practice (FP) of chickpea production during different years

Year	No. of locations	Potential yield (q ha^{-1})	IP (q ha^{-1})	FP (q ha^{-1})	% increase in yield over FP	Technology index
2011-12	10	19.0	16.4	14.8	10.8	13.7
2012-13	10	19.0	16.8	15.8	6.3	11.6
2014-15	8	19.0	17.5	16.2	8.0	7.9
2015-16	12	19.0	18.8	17.6	6.8	1.1
Mean	17.4(0.17)*	16.1(0.18)	8.0 (0.32)	8.55(0.88)		

*Values in parenthesis indicates standard error from mean

Table 3: Comparative evaluation of grain yield in improved (IP) and farmers' practice (FP) of mungbean production during different study years

Year	No. of locations	Potential yield (q ha^{-1})	IP (q ha^{-1})	FP (q ha^{-1})	% increase in yield over FP	Technology index
2011-12	10	11.5	10.5	7.9	32.6	6.7
2012-13	5	11.5	9.5	7.6	25.0	15.1
2013-14	11	11.5	9.3	8.2	13.4	17.3
2014-15	20	11.5	10.8	8.8	22.7	4.0
Mean	10.0 (0.11)*	8.1(0.08)	23.4 (1.12)	10.7 (0.95)		

*Values in parenthesis indicates standard error from mean

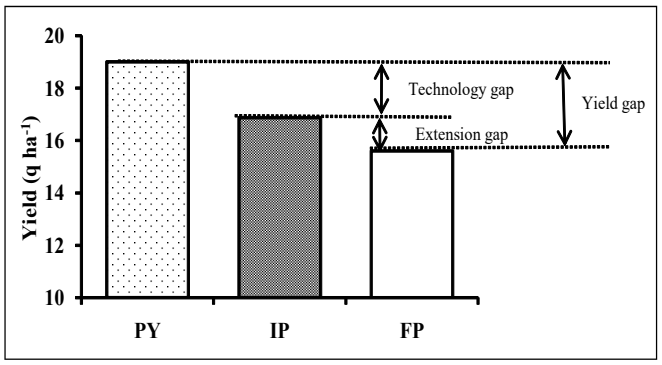

Figure 1: Framework representing the extension and technology gap in chickpea production (Acronyms indicate PY=Potential yield, IP=Improved practice and FP=Farmers' practice)

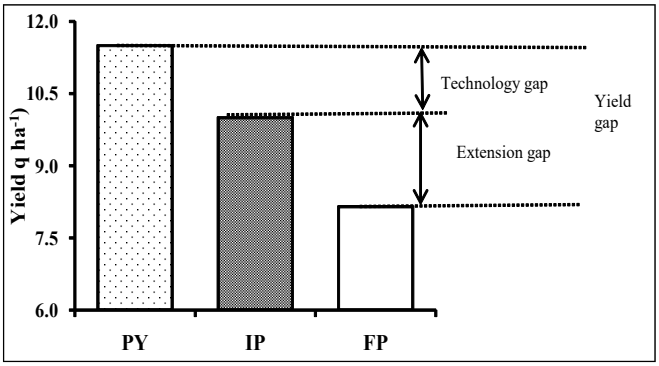

Figure 2: Framework representing the extension and technology gap in chickpea production (Acronyms indicate PY=Potential yield, IP=Improved practice and FP=Farmers' practice)

recommended practices. For this purpose, there is a need to strengthen research-extension and farmers linkages for technology dissemination. Programmes to educate farmers through extension programmes for accelerating adoption of improved production technology and to decrease yield gaps need to be planned.

Economic efficiency of demonstration plots: The ACCI value for chickpea was Rs. 27.3 X 10^3 ha^{-1} in IP, compared with Rs. 27.5 X 10^3 ha^{-1} in FP (Table 4). The marginal increase in cost of cash inputs in case of FP was due to extra expenditure incurred on insect-pest management. The AGR from chickpea in IP was Rs. 54.1 X 10^3 ha^{-1} against Rs. 50.1 X 10^3 ha^{-1} in the FP. The higher ARG from IP, compared with FP were due to use of quality seed and adoption of recommended crop management practices. Similarly, ANR of Rs. 26.8 X10^3 ha^{-1} in IP were higher by 18.6 per cent than the ANR from FP. The B-C ratio in IP of chickpea varied from 1.4 to 2.3during different study years, with an overall average B-C ratio of 2.0 in IP against 1.9 in FP.

Table 4: Average cost of cash inputs (ACCI), average gross returns (AGR) and average net returns (ANR) of chickpea production in improved (IP) and farmers' practice (FP) during different study years

Year	ACCI (Rs. X 10^3 ha^{-1})		AGR (Rs. X 10^3 ha^{-1})		ANR (Rs. X 10^3 ha^{-1})		B:C ratio	
	IP	FP	IP	FP	IP	FP	IP	FP
2011-12	29.6	29.6	45.9	41.4	16.3	11.8	1.6	1.4
2012-13	25.3	25.5	50.4	47.4	25.1	21.9	2.0	1.9
2014-15	26.6	27.1	55.6	51.4	29.0	24.3	2.1	1.9
2015-16	27.6	27.8	64.4	60.3	36.8	32.5	2.4	2.3
Mean	27.3	27.5	54.1	50.1	26.8	22.6	2.0	1.9

Table 5: Average cost of cash inputs (ACCI), average gross returns (AGR) and average net returns (ANR) of mungbean production in improved (IP) and farmers' practice (FP) during different study years

Year	ACCI (Rs. X 10^3 ha^{-1})		AGR (Rs. X 10^3 ha^{-1})		ANR (Rs. X 10^3 ha^{-1})		B:C ratio	
	IP	FP	IP	FP	IP	FP	IP	FP
2011-12	19.3	19.6	36.8	27.7	17.5	8.1	1.9	1.4
2012-13	20.3	20.6	41.8	33.4	21.5	12.8	2.1	1.6
2013-14	22.8	23.1	41.9	36.9	19.1	13.8	1.8	1.6
2014-15	23.5	24.7	49.7	40.5	26.1	15.8	2.1	1.6
Mean	21.5	22.0	42.5	34.6	21.0	12.6	2.0	1.6

The ANR in case of mungbean were Rs. 21.0 and Rs. 12.6 X 10^3 ha^{-1} in IP and FP, respectively (Table 5). The B-C ratio of IP varied from 1.8 to 2.1 during different years and overall average B-C ratio was 2.0 in IP against 1.6 in FP. Variation in B-C ratio during different years could be ascribed to the differences in grain yield and MSP for the production year. The economic analysis showed higher AGR and ANR for IP, compared with FP indicating higher profitability of adoption of improved crop management practices.

Constraints in pulse production leading to yield gap: Figure 3 illustrates data on constraints being perceived by the farmers' in chickpea and mungbean. Apart from lack of knowledge regarding economic threshold level to monitor insect-pest infestation, water and nutrient management etc. were of considerable significance in affecting crop yield. Almost 1/4th of the respondent farmers reported unavailability of quality seed as major constraints in production of chickpea and mungbean (Figure 3). Farmers were using seed retained from previous years produce. Henry *et al.* (2017) also reported that 67.9 per cent pulse producing households used seed stored from previous production. According to Jadhav *et al.* (2010), seed quality was the major contributing factor governing yield gap in pulse crops. Naryan and Kumar

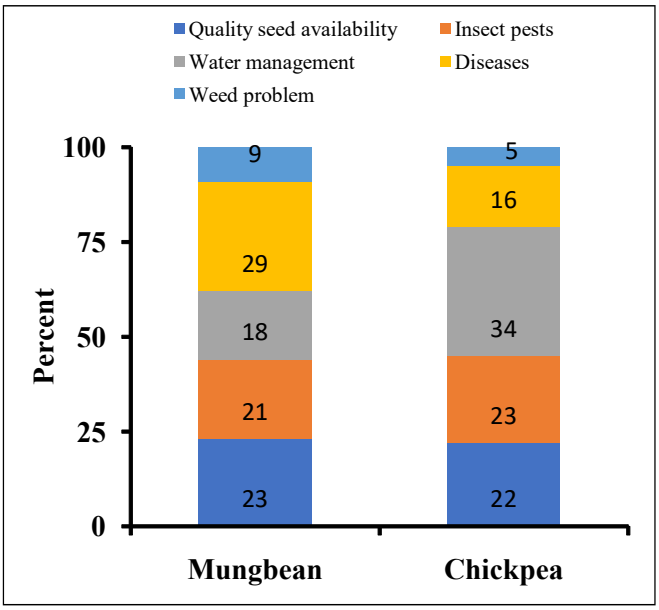

Figure 3: Percent distribution of different constraints leading to yield gaps in chickpea and mungbean production in the study area

(2015) reported that the supply of quality seed of pulses crops to the farmers has not been increasing over the years.

Insect-pests attack in chickpea and mungbean has also been yield gap governing factor, perceived as a production constraint by 23 and 21 per cent of the farmers, respectively

(Figure 3). Pod borer (*Helicoverpa* spp.) was the common pest in both the pulse crops. Attack of yellow mosaic virus in mungbean was major disease in mungbean. Reddy (2009) reported that pulse were adversely affected by biotic and abiotic stress that are not adequately controlled. A major constraint in production of chickpea was the management of irrigation water, as is perceived by 34 per cent of the farmers. In chickpea, wilting has been a serious problem at farmers' field, particularly when irrigation is applied before flower initiation. The occurrence of pod borer (insect) and wilt (disease) are among the major constraints for inefficiency of pulse production (Kumar and Burai, 2012). In mungbean, a problem of yellow mosaic virus has been perceived by 29 per cent of the farmers. The major weed that caused yield losses in mungbean was its it (*Trianthemaportulacastrum*). Adoption gap in weed and plant protection measures were observed in FP over the recommended IP. Similar observations regarding technology gaps between IP and FP in different crops were also observed (Burman *et al.,* 2010). An assessment of the relative perception towards five major constraints in pulse production indicate the importance of technology demonstration and training needs of farmers in weed management and insect pests and disease management to close the yield gap.

CONCLUSION

The yields of pulse crops can be increased by adopting the recommended IP. Extension gap in pulse crop production emphasized the need for farmers' education through training for the adoption of improved technologies. A considerable total yield gap (extension gap + technology gap) is clear indication of scope for further increase in yield of pulse crops. Economic viability of pulse crops need to be improved by providing remunerative prices to the farmers. The extension service and education system must address the constraints faced by farmers in pulse production for bridging the yield gap and enhancing profitability of pulse crops.

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An Analysis of Export Growth and Instability of Processed Foods from India

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ABSTRACT

The present study is an attempt to examine the growth and in export of processed foods from India. The study is based on secondary data collected for the period 2008-09 to 2017-18 from official web-site sources. It is found that during 2017-18, groundnuts emerged as the largest contributor to total processed food export. The export earnings of the processed food increased at the annual compound growth rate of 6.80 percent during 2008-09 to 2017-18. Except mango pulp and jaggery and confectionery, the growth rates in exports were very impressive. It was further found that the extent of growth in value terms has been invariably higher than the amount of growth in quantity terms. Instability indices for export earnings was highest in case of Guar Gum and for quantity exported, was highest in case of jaggery and confectionery. Other Processed fruits and vegetables recorded least instability in terms of both export earnings and quantity exported. India's in world export of processed foods in respect of all commodities other than pulses and jaggery and confectionery was less than one percent. USA, UAE, Saudi Arabia, Bangladesh, Russia and Netherlands have been the major importers of processed foods from India.

Keywords: Export, Foods, Growth, Instability, Processed

INTRODUCTION

India is an agrarian country and due to its diverse agro-climatic conditions, is a major producer and also consumer of wide variety of farm products. India is amongst the leading producer of cereals and grains, livestock, milk, fish, etc. India ranked 1st in the world in production of rice, milk, pulses, ginger, chick pea, and fruits such as banana, guava, papaya and mango. India also is at 2nd position in the world in production of wheat, potato, garlic, ground nut, cashew nut, green pea, dry onion, pumpkin, cauliflower and guard. Processing of agricultural commodities offers great scope for making available a commodity into a better useable form with value addition and resulting higher income transfer to farmers / producers. Among the agro- processing industries, food processing industry is the dominant one. Processed food products can be classified into major groups such as cereal products, fruit and vegetable products, dairy products, meat products, and marine products. With the rapid growth of the economy, shift in the consumption pattern from cereals to more varied and value added products like milk, vegetables etc. have resulted in the development of food processing industry in India. The demand for processed food is bound to increase with the increase in real income and improvement in the standard of living, modern life style, urbanization, contribution of women in household income, etc. Trade liberalization policies resulted in a rapid transformation of the export and import situations in the developing countries (Aksoy and Beghin, 2005). Further, the levels of comparative advantage for various agricultural commodities exported in the global markets changed as a result of Agreement on Agriculture (Shinoj and Mathur, 2008).

Traditional food export has now been gradually replaced by processed food export. India is the leading country in the world in production of food. Gross Value Added (GVA) of Food Processing Industry in India has been as US $ 17.50 bn in 2016-17. In 2017-18, GVA in food processing industry grew by 7.68 percent and share of GVA- FPI to total GVA was 1.59 percent. Earlier, the food processing activities in India were mainly limited to the food preservation, packaging and transportation. However, over the years, with the emergence of new markets and technologies, the sector has started producing many new items like ready to eat food, beverages, processed and frozen fruit and vegetable products, marine

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and meat products, etc. Though the industry is large in terms of size in India, but accounts for a very small share of world trade in processed foods.

It is important to study the export growth and instability to smooth out fluctuations by taking appropriate corrective policy measures. Keeping in view the above facts, the present paper is an attempt to estimate growth and instability in export earnings and quantity exported of processed foods.

MATERIALS AND METHODS

Data: The study is exclusively based on secondary data. The ten years data series from 2008-09 to 2017-18 on export earnings and quantity exported of processed food products were compiled from an official portal of Agricultural and Processed Food Products Export Development Authority (APEDA), Government of India.

To arrive at the objectives of the study, growth rates, instability indices were estimated / determined as given below:

Growth Rate: To work out annual compound growth rates of export earnings and quantity exported, following exponential equation is used:

$Y = a\ b^t$

$Log\ Y_t = Log\ a + t\ Log\ (bi)$

Where, $\mathbf{Y_t}$ is the export earnings or quantity exported of a commodity in year t.

t = time variable

Annual compound growth rate (r) was computed as:

$r = (\text{Anti log } (b_i) - 1) \times 100$

Instability measure: This section deals with the measurement of export instability both in value and quantity terms in Indian processed foods. There is no consensus in the literature on how to determine instability (Lim, 1991; Maizels, 1992), even though export instability is widely considered to be an unpredictable deviation over an observed time series compared to its trend (Aiello, 1999). Studies by Glezakos (1983), Tan (1983) and Glezakos (1984) have shown the sensitivity of the results to the measure of instability. Therefore, the use of instability index should address to the reliability of the results. Hence, Cuddy-Della Valle (1978) index of instability has been employed for obvious reasons as follows:

Cuddy-Della Valle Index, $Ix = CV\sqrt{1-\overline{R}^2}$

Where, CV is the coefficient of variation and $\overline{R}^2$ is corrected coefficient of determination of the trend function that best fits the series of export earnings and quantity exported. Linear and log-linear functions, as log transformation is a good candidate if the range of dependent variable, say from 1 to several thousand, is very broad (Weisberg, 1980) have been used to capture the trend in exports earnings and quantity exported. If F-test is significant at 5 percent level, the index is calculated by selecting trend function (linear or log-linear) having the highest $\overline{R}^2$. If $\overline{R}^2 < 0$, then, unmodified CV is chosen.

RESULTS AND DISCUSSION

Composition of exports of processed foods: The domestic consumption of processed foods is still quite low because of traditional eating habits and low purchasing power of the masses and hence initially the success of processed food is primarily linked to exports. Processed food has a strong export potential in India provided the domestic market becomes more stable in production of standard and quality products. Changes in India's export performance of processed food have been presented in Table 1. The table shows that India's export of processed food have been increasing over the years. It increased from Rs. 9784 crore during 2008-09 to Rs. 25972 crore during 2017-18 indicating that it increased about two and half times during this period. Export of processed food includes Dried and Preserved Vegetables, Mango Pulp, Other Processed Fruits and Vegetables, Pulses, Groundnuts, Guar Gum, Jaggery and Confectionery, Cocoa Products, Cereal Preparations, Milled products, Alcoholic Beverages, and Miscellaneous Preparations.

In value terms, Jaggery and confectionery constituted the highest share (24.77%) in total processed food exports from India. Guar Gum with share of 13.68 percent comes at 2nd place followed by groundnuts (12.66%), cereal preparations (11.29%), other processed fruits and vegetables (9.05%), mango pulp (7.70%), etc. during the year 2008-09. Needless to say, the exports of all the processed food items increased over the years but the proportion of items in total processed food exports changed over time. The proportion of mango pulp reduced from 7.70 percent in 2008-09 to 2.59 percent in 2017-18 and jaggery and confectionery from 24.77 to 5.31 percent. On the other hand, the proportion of all other items increased during the period under study. The share

Table 1: Composition of export of processed foods

Product	Export Quantity (MT)		Export value (Rs. Lakh)	
	2008-09	2017-18	2008-09	2017-18
Dried & Preserved Vegetables	39905.44 (1.21)	88535.56 (2.73)	20394.03 (2.08)	94464.61 (3.64)
Mango pulp	173013.6 (5.26)	110923.7 (3.43)	75298.9 (7.70)	67392.13 (2.59)
Other Processed Fruits & Vegetables	195383.3 (5.94)	391283.8 (12.08)	88514.92 (9.05)	340469.7 (13.11)
Pulses	136880.1 (4.16)	180193.8 (5.56)	54232.48 (5.54)	147325.8 (5.67)
Groundnut	297890.4 (9.05)	504019.2 (15.56)	123900.9 (12.66)	338629.9 (13.04)
Guar Gum	258567.6 (7.86)	494101.3 (15.26)	133898.5 (13.68)	416956 (16.05)
Jaggery& Confectionery	1737191 (52.80)	252142.9 (7.79)	242333.5 (24.77)	138034.6 (5.31)
Cocoa products	6831.91 (0.21)	29582.56 (0.91)	8403.91 (0.86)	114437.3 (4.41)
Cereal Preparations	208836.8 (6.35)	353237.3 (10.91)	110514.5 (11.29)	355986.6 (13.71)
Milled Products	58406.63 (1.78)	270377.3 (8.35)	10989.03 (1.12)	87659.11 (3.38)
Alcoholic beverages	52762.01 (1.60)	241235.5 (7.45)	53462.83 (5.46)	210587.3 (8.11)
Mis. preparation	124738.9 (3.79)	322890.2 (9.97)	56500.27 (5.77)	285302.7 (10.98)
Aggregate	3290408 (100.00)	3238523 (100.00)	978443.8 (100.00)	2597246 (100.00)

Note: Figures in the parentheses indicate percentages to respective total

of cocoa products out of total processed food exports which was less than one percent during 2008-09 increased to 4.41 percent during 2017-18. During the year 2017-18, in value terms guar gum (16.05%) occupied 1st position in export of processed foods. Cereal preparations with 13.71 percent share comes at 2nd place followed by other processed fruits and vegetables (13.11%), groundnut (13.04%), Mis. preparation (10.98%), alcoholic beverages (8.11%), etc. In quantity terms groundnuts emerged as the largest contributor to total processed foods export with 15.56 percent share. At the 2nd place comes guar gum (15.26%) in quantity terms followed by other processed fruits and vegetables (12.08%), cereals preparations (10.91%), miscellaneous preparation (9.97%), milled products (8.35%), etc. The share of cocoa products was lowest (0.91%) in quantity terms and that of mango pulp (2.59%) in value terms.

Growth in export of processed foods: The annual compound growth rates in quantity and value terms of processed food items are presented in Table 2. The export earnings of the processed food have increased at the annual compound growth rate of 6.80 percent during 2008-09 to 2017-18 whereas the growth of quantity exported remained almost stagnant during this period.

Comparison of growth rates of all the commodities clearly indicate that milled products topped the list in quantity exported with 22.17 percent annual compound growth rate and in terms of export earnings, coca products topped the list with 41.52 percent annual growth rates. Milled products with 29.46 percent growth in export earnings was at 2nd place. Mis. preparation with 21.24 percent, dried and preserved vegetables (19.07%), other processed fruits and vegetables (18.25%), alcoholic

Table 2: Growth and instability in export of processed foods during 2008-09 to 2017-18

Product	Compound Growth Rate (%)		Instability index (%)	
	Quantity	Value	Quantity	Value
Dried & Preserved Vegetables	9.23	19.07	12.62	10.25
Mango pulp	-4.50	0.55	8.63	11.58
Other Processed Fruits & Vegetables	7.78	18.25	5.79	7.17
Pulses	4.29	13.51	35.46	38.32
Groundnut	6.65	13.55	31.32	30.95
Guar Gum	5.66	9.85	36.43	93.43
Jaggery and Confectionery	11.47	1.44	98.99	59.39
Cocoa products	20.24	41.52	19.66	21.42
Cereal Preparations	7.08	16.91	9.64	9.45
Milled Products	22.17	29.46	35.88	29.38
Alcoholic beverages	17.33	17.73	29.09	24.28
Mis. preparation	11.95	21.24	19.45	11.17

beverages (17.73%), cereal preparations (16.91%), groundnut (13.55 %) and pulses (13.51%) growth followed the list for export earnings. In terms of quantity exported, coca products with 20.24 percent, alcoholic beverages (17.33%), Mis. preparation (11.95), jaggery and confectionery (11.47%), dried & preserved vegetables (9.23%), other processed fruits and vegetables (7.78%), cereal preparations (7.08%), groundnut (6.65%), guar gum (5.66%), pulses (4.29%) followed the list.

Comparing the growth rates of export earnings and quantity exported, it is clear that the extent of growth in value terms have been higher than the growth in quantity terms. Jaggery and confectionery is the only item which registered higher growth in quantity exported (11.47%) than export earnings (1.44%). Mango pulp registered negative growth in export quantity (4.50%).

Instability in export of processed foods: The instability in exports discourages investment in the production of the commodities, limits the economic horizon and destroys the sense of continuity, which is necessary for planning production (Chand and Tiwari, 1991). The values of instability indices help the policy makers for formulating product by product export promotion and investment policies. The CV, $\overline{R}^2$, F value of $\overline{R}^2$, and instability indices (modified CV) for export earnings and quantity exported, are shown in Appendix I and II, respectively. Appropriate instability indices for export earnings and quantity exported, based on the criterion discussed in methodology section are presented in Table 2. It is clear from the table that instability indices for export earnings was highest in case of guar gum (93.43%) and for quantity exported, was highest in case of Jaggery and confectionery (98.99 percent) indicating that guar gum and Jaggery and confectionery were the most vulnerable commodities in terms of export earnings and quantity exported. This simply indicates wide fluctuations both in quantity exported and the export earnings. For the next highest instability, the order of commodities having highest instability got reversed i.e. jaggery and confectionery with instability index 59.39 percent recorded second highest instability in value terms and guar gum with instability index 36.43 percent recorded second highest instability in quantity terms.

Other processed fruits and vegetables recorded least instability in terms of both export earnings and quantity exported with instability index 7.17 and 5.79 percent, respectively. Cereal preparations (9.45%), dried and preserved vegetables (10.25%), Mis. preparation (11.17%), mango pulp (11.58%), cocoa products (21.42 percent), alcoholic beverages (24.28%), milled products (29.38%, pulses (38.32%) and groundnuts (30.95%), recorded next least in line of instability in export earnings. Mango pulp (8.63%), cereal preparation (9.64%), dried & preserved vegetables (12.62%), miscellaneous preparation (19.45), cocoa products (19.66 percent), alcoholic beverages (29.09%), groundnuts (31.32%), pulses (35.46%), milled products (35.88%) were next to least in line recording instability in terms of export quantity. Comparison of instability indices for the export earnings and quantity exported shows that the instability has been higher for

quantity exported than the export earnings in case of dried and preserved vegetables, groundnut, Jaggery and confectionery, milled products, alcoholic beverages and Mis. preparations. In case of cocoa products, the instability in export quantity and export earnings was almost same.

India and World export of processed foods: Share of India in the world export of processed foods during the year 2017 has been presented in Table 3. It is very discernible picture to note that India's share in world export of processed food items is less than one percent. Item-wise position indicates that India's share in world exports of processed foods was highest in case of Guar Gum i.e. about 60 percent of total export of Guar Gum was from India during 2017. Second next item is Groundnut which accounted for 16.53 percent of world export. The share for jaggery and confectionery, coca products, cereal preparations, alcoholic beverages and Mis. preparations was less than one percent.

Table 3: India and World export of important processed foods, 2017 (US $ million)

Product	World export	India's export
Pulses	12122	288 (1.88)
Groundnut	3189	527 (16.53)
Guar Gum	930	556 (59.78)
Jaggery and Confectionery	32461	210 (.65)
Cocoa products	46403	185 (0.40)
Cereal Preparations	67013	418 (0.62)
Alcoholic beverages	88583	151 (0.17)
Mis. preparation	88450	433 (0.49)
Milled products	4140	112 (2.71)
Processed fruits, Juice and nuts	39349	401 (1.02)
Proceed vegetables	32793	347 (1.06)
Total	**415433**	**3628 (0.87)**

Note: Figures in the parentheses are the India's percentage share in the world export.

Direction of trade: Comparative advantages, trade barriers geographical proximity etc. are the determinants of export destinations of any product. Direction of trade for processed foods is presented in Table 4. For processed vegetables, the major markets are USA, UK, Germany, Russia and Australia contributing 21.23, 11.39, 7.33, 4.42 and 4.15 percent, respectively of the total export of processed vegetables of India. In case of Mango pulp, 21.64 percent of its total export is to Saudi Arabia followed by Yemen Republic (11.35%), Netherlands (9.53%), Kuwait (7.84%) and UK (7.59%). For other processed fruits, juices and nuts, Netherlands (12.24%), Saudi Arabia (10.95%), USA (10.65%), UAE (5.65%) and UK (3.89%) are the main markets. In case of pulses, Algeria (17.65%) is at the top and UAE (9.31 %) is at the 2nd place followed by Sri Lanka (8.28), Turkey (6.05%), and USA (5.60%). For groundnuts, the major markets are Indonesia, Philippines, Vietnam, Malaysia and Thailand contributing 40.64, 9.84, 8.16, 6.30 and 5.53 percent, respectively of the total export of groundnuts of India. In case of Guargum, about 40 percent of its total export is to USA. Next about 30 percent of its export is made to China, Russia, Norvey and Germany. For Alcoholic Beverages, UAE is the main market contributing about 27 percent of the total export of Alcoholic Beverages of India. Singapore (10.43%) is at the 2nd place followed by Netherlands (6.47), Ghana (6.09%) and Nigeria (4.47%). In case of cocoa products, USA, Indonesia, Turkey, UAE and Nepal are the major markets contributing to about 60 percent of total exports from India. USA and Nepal were the main destination for cereal preparations import from India contributing to about 16.83 and 10.33 percent of total exports of India, respectively. On the whole, USA, UAE, Saudi Arabia, Bangladesh, Russia and Netherlands have been the major importers of processed foods from India.

From the above discussion, it is found that during 2017-18, groundnuts emerged as the largest contributor to total processed food export with 15.56 percent share in quantity terms and 16.87 percent share in value terms. There has been a tremendous growth in exports of processed foods. The export earnings of the processed foods have increased at the annual compound growth rate of 6.80 percent during 2008-09 to 2017-18. Except mango pulp and jaggery and confectionery, the growth rates in exports were very impressive. It was further found that the extent of growth in value terms has been invariably higher than the amount of growth in quantity terms. Instability indices for export earnings was highest in case of guar gum (93.43%) and for quantity exported, was highest in case of jaggery and confectionery (98.99%) indicating that these two items were the most vulnerable commodities. Other processed fruits and vegetables recorded least instability in terms of both export earnings and quantity exported with instability index 7.17 and 5.79 percent, respectively. Inspite of large production, India's share in world export of processed food is less than one percent. Export needs to be increased

Table 4: Composition and direction of trade of processed foods, 2018-19

Product	Country and share				
Processed Vegetables	U S A (21.23 %)	U K (11.39 %)	Germany (7.33 %)	Russia (4.42 %)	Australia (4.15%)
Mango Pulp	Saudi Arab (21.64 %)	Yemen Republic (11.35 %)	Netherland (9.53 %)	Kuwait (7.84 %)	U K (7.59%)
Processed Fruits, Juices & Nuts	Netherland (12.24 %)	Saudi Arab (10.95 %)	U S A (10.65 %)	U Arab Emts (5.67 %)	U K (3.89 %)
Pulses	Algeria (17.65 %)	U Arab Emts (9.31 %)	Sri Lanka Dsr (8.28 %)	Turkey (6.05 %)	U S A (5.60 %)
Groundnuts	Indonesia (40.84 %)	Philippines (9.84 %)	Vietnam Soc Rep (8.16 %)	Malaysia (6.30 %)	Thailand (5.53 %)
Guargum	U S A (41.07 %)	China P Rp (13.80 %)	Russia (7.03 %)	Norway (6.63 %)	Germany (5.43 %)
Jaggery and Confectionery	Sri Lanka Dsr (7.79 %)	Nepal (6.39 %)	Benin (5.45 %)	U S A (5.09 %)	Indonesia (4.85 %)
Cococa products	U S A (27.14 %)	Indonesia (9.70 %)	Turkey (9.05 %)	U Arab Emts (7.07 %)	Nepal (5.89 %)
Cereal preparations	U S A (16.83 %)	Nepal (10.33 %)	U Arab Emts (8.19 %)	Bangladesh Pr (7.31 %)	U K (5.18 %)
Milled Products	U S A (30.72 %)	U Arab Emts (11.68 %)	Qatar (6.64 %)	Australia (5.80 %)	U K 5.25 %)
Alcoholic Beverages	U Arab Emts (27.38 %)	Singapore (10.43 %)	Netherland (6.47 %)	Ghana (6.09 %)	Nigeria (4.47 %)
Miscellaneous Preparations	U S A (20.63 %)	U Arab Emts (10.98 %)	Nepal (7.41 %)	Indonesia (6.08 %)	Malaysia (5.44 %)

Note: Figure in the parentheses indicate percentage share of the country in the world export

by taking appropriate research and development policies and relaxing the constraints faced by the processing industry. USA, UAE, Saudi Arabia, Bangladesh, Russia and Netherlands have been the major importers of processed food from India.

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Appendix I: CV, Adj R-Square, F value and Cuddy-Delle Valley Index for export earnings

Product	CV	Linear			Log linear		
		Adj R-Square	F-statistics	Ix-1	Adj R-Square	F-statistics	Ix-2
Dried & Preserved Vegetables	45.43	0.95	112.25	***10.25***	0.90	298.16	14.71
Mango Pulp	***11.58***	-0.10	80.55	12.14	-0.10	187.27	12.16
Other Processed Fruits & Vegetables	46.47	0.98	28.17	***7.17***	0.95	36.53	10.03
Pulses	***38.32***	0.60	48.88	24.33	0.60	65.40	24.15
Groundnuts	42.83	0.38	0.57	33.85	0.48	1.24	***30.95***
Guargum	***93.43***	-0.12	26.65	99.06	-0.04	25.02	95.15
Jaggery& Confectionery	***59.39***	-0.05	11.42	60.75	-0.12	9.41	62.81
Cococa products	83.77	0.87	3.74	30.06	0.93	3.32	***21.42***
Cereal preparations	42.69	0.95	0.67	***9.45***	0.91	0.81	13.01
Milled Products	62.50	0.72	0.22	33.03	0.78	0.58	***29.38***
Alcoholic Beverages	44.12	0.69	6.03	24.67	0.70	10.55	***24.28***
Miscellaneous Preparations	49.49	0.95	4.11	***11.17***	0.90	4.17	15.47

Note: 1.Values in bold are significant at 5%, 2. Values in Italics are the final selected instability index values

Appendix II: CV, Adj R-Square, F value and Cuddy-Delle Valley Index for export quantity

Product	CV	Linear			Log linear		
		Adj R-Square	F-statistics	Ix-1	Adj R-Square	F-statistics	Ix-2
Dried & Preserved Vegetables	28.19	0.80	38.30	***12.62***	0.79	58.91	12.98
Mango Pulp	15.66	0.69	38.45	8.67	0.70	83.64	***8.63***
Other Processed Fruits &Vegetables	22.91	0.94	14.20	***5.79***	0.92	17.95	6.42
Pulses	***35.46***	-0.02	32.76	35.79	0.02	43.97	35.07
Groundnuts	***31.32***	0.16	2.40	28.64	0.28	3.59	26.62
Guar gum	***36.43***	0.00	1.13	36.41	0.08	2.21	34.94
Jaggery & Confectionery	***98.99***	0.26	9.17	85.37	0.12	7.34	92.99
Cococa products	50.88	0.85	3.32	***19.66***	0.84	5.39	20.27
Cereal preparations	21.20	0.79	0.98	***9.64***	0.73	0.66	10.92
Milled Products	58.41	0.47	0.88	42.35	0.62	0.37	***35.88***
Alcoholic Beverages	43.98	0.51	29.74	30.80	0.56	30.62	***29.09***
Miscellaneous Preparations	34.76	0.65	2.46	20.43	0.69	3.00	***19.45***

Note: 1.Values in bold are significant at 5%, 2. Values in Italics are the final selected instability index values

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Nutritional Security of Small and Marginal Farm Families in Gurgaon Division Haryana State (India)

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ABSTRACT

India has been self sufficient in food production since seventies and low household hunger rates in rural and urban areas. India compares well with developing countries with similar health profile in terms of infant mortality rate and under five mortality rate. India fares poorly when underweight in fewer than five children is used as an indicator for nutritional insecurity with rates comparable to that of other countries. If wasting [low body mass index (BMI) for age in children and low BMI in adults] which is closely related to adequacy of current food intake is used as an indicator for the assessment of household food security, India fares better. The nineties witnessed the emergence of dual nutrition burden with persistent inadequate dietary intake and under nutrition on one side and low physical activity / food intake above requirements and over nutrition on the other side. The future of sustainable agriculture growth and food security in India depends on the performance of small and marginal farmers. So there are also concerns on nutritional security and livelihoods. The study was conducted in Gurgaon division of Haryana state and two districts from Gurgaon division i.e. Rewari and Mahendragarh were selected randomly. From selected two blocks Jatusana and Kanina, four villages (two from each block) Dahina and Maseet from Jatusana and Kakrala and Rambas from Kanina were selected randomly. From the selected villages a sample of 75 small and marginal farm families from was drawn randomly to make the total sample size of 300 farm families. The results depicted that consumption of cereals (WMS 5.00, Rank I) followed by milk and milk products (WMS 4.76, Rank II), Vegetables (WMS 4.39, Rank III), pulses (WMS 1.45, Rank IV) and fruits (WMS 1.45, Rank V) respectively.

Keywords: Consumption, Diet diversity, Food, Nutrition, Livelihood

INTRODUCTION

Over decades, in India there has been increasing recognition that though there has been reduction in severe acute food insecurity, dietary intake in large segments of population does not meet energy (hunger) and micronutrient (hidden hunger) requirements and consequently under-nutrition and micronutrient deficiencies are widespread. Falling physical activity and unaltered food intake beyond requirements lead to over nutrition, and are associated with adverse health consequences. Availability of foods in urban and rural areas are depends upon a combination of different factors, such as domestic production, trade, and stocks. It is a continuous effort to ensure that the country has enough food to meet increasing demand, be it increasing domestic production, playing on the global food markets, or carrying an inventory of food grain. The emphasis has been on re-energizing the food grain sector, against a backdrop of stagnating or declining productivity of food grain crops (varying across regions) owing to technology fatigue, climate change effects, and the like. The decline in production of irrigated wheat in South Asia is likely to be from 44% to 49% in 2050 due to climate change relative to 2050 with no climate change (under different scenarios). By 2050, declining yields of production will result in a price rise, jeopardizing the food and nutrition security of the masses, and children in particular. Against these potential impacts, comprehensive adaptation measures over different time horizons are needed. It has been advocated that the farmers should be educated about climate change and the damage it can do to agricultural systems. This will help them adopt preventive measures as coping strategies in their households and communities. At the policy front, there is an urgent need to conserve water and undertake better management of water resources, and even incentivize the agriculture sector to replace water-intensive crops with

water-efficient crops. Hence, in this study, an attempt was made to delineate the nutritional security of small and marginal farm families in Gurgaon division Haryana state.

MATERIALS AND METHODS

The study was conducted in Haryana state and it has been divided into four division- Hisar division, Rohtak division, Ambala division and Gurgaon division. The present study was conducted in Gurgaon division which comprises Faridabad, Gurgaon, Mahendragarh, Mewat, Palwal, Rewari district. sarojsarojsar. Out of five districts, two districts from Gurgaon division i.e. Rewari and Mahendragarh were selected randomly. One block from each district viz., Jatusana block from Rewari district and Kanina block from Mahendergarh district, were selected randomly. From selected two blocks Jatusana and Kanina, four villages (two from each block) Dahina and Maseet from Jatusana and Kakrala and Rambas from Kanina were selected randomly. From the selected villages a sample of 75 small and marginal farm families from was drawn randomly. Thus a total of 300 respondents were selected randomly.

Nutritional Security: Nutritional security is a livelihood outcome closely related to food security, particularly the food utilization component. The indicators that measure nutritional security in women and children are well-known and accepted according to present study are: Household diet diversity, food consumption pattern of farm families, BMI of children age group 0-5 year and adult women.

Household diet diversity: Questionnaire-cum- interview method was used to study the food consumption pattern. The questionnaire was pre-tested and modified to make it more functional. Respondents were asked food groups eaten in last 24 hours. Scores (0 to 5) were assigned as number of food groups eaten by household members. The household diet diversity score was calculated by using the following formula:

HDDS	Total number of food groups consumed by members of the household. Values for A through E will be either "0" or "1."Sum (A+B+C+D+E) of all households

Household Diet Diversity= HDDS/ Total number of household members

HDDS= Household Diet Diversity Score

Consumption pattern of food groups: Consumption pattern of food groups included cereals, pulses, fruits, vegetables, milk & milk products at daily, alternately, twice in a week, weekly or rarely basis and it was measured on five point continuum with scores 5 to 1.

Body Mass Index (BMI) (kg/m^2)

Weight (kg): Weight was measured with scale with a precision of 0.1 kg. The scale was placed on a horizontally flat surface. Respondent was weighed barefooted and wearing a minimum of clothing and without touching any other surface or object and the reading was noted. The pointer on the balance scale was adjusted to zero before each weighing (WHO, 2006).

Height (cm): Measurement was done with a vertical anthropometric rod. The scale was placed on the flat surface and the respondent was asked to stand without shoes on a horizontal surface against a wall plane. Measurements were recorded at the nearest 0.1 cm (WHO, 2006).

Body Mass Index (kg/m^2):

The body mass index was calculated using the equation given by Garrow (1981).

$$\text{BMI (kg/m}^2\text{)} = \frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}}$$

Data was collected with the help of pre -structured interview schedule by the investigator from head of household of farm families. Statistical tools frequency, Percentages, weighted mean scores and ranking were applied for data analysis.

RESULTS AND DISCUSSION

Household diet diversity: Perusal of Table 1 depicts household diet diversity in both Rewari and Mahendergarh) districts. In Rewari district consumption pattern of food groups eaten by household members during last 24 hours in form of any cereals (*chapatti*, bread, biscuits, rice, food made by millets, maize, rice, wheat) was 97.33 percent whereas in Mahendergarh) it was cent percent. Consumption pattern of any vegetables (potatoes, sweet potato, onion, carrot, radish, turnip) in both the districts (Rewari and Mahendergarh) was (6.67% and 10.00%) respectively. In Rewari district consumption pattern for fruits were only 1.33 percent whereas for milk and milk products it was 52.67 percent. In Mahendergarh district consumption pattern of any vegetables, any fruits, food made from beans, peas, lentils, nuts, pulses and for milk

Table 1: Household diet diversity

Food groups eaten during last 24 hours	Rewari (n=150)		Mahendergarh (n=150)	
	f	%	f	%
Any cereals (*chapatti*, bread, biscuits, rice, food made by millets, maize, rice, wheat)	146	97.33	150	100.00
Any vegetables (potatoes, sweet potato, onion, carrot, radish, turnip)	10	6.67	7	10.00
Any fruits	17	11.33	13	15.33
Any food made from beans, peas, lentils, nuts, pulses	3	2.00	7	4.67
Milk and milk products	79	52.67	72	60.00

and milk products (15.33%, 4.67%, 60.00%) respectively. The present findings are in accordance with Arimond et *al.* (2011); Drèze and Sen (2013) and Mishra and Singh (2013).

Consumption pattern of households in Rewari district: The examination of the data presented in Table 2. Indicates that the consumption pattern of households in Rewari district. The weighted mean score (WMS) shows that consumption of cereals (WMS 5.00, Rank I) followed by milk and milk products (WMS 4.76, Rank II), Vegetables (WMS 4.39, Rank III) , pulses (WMS 1.45, Rank IV) and fruits (WMS 1.45, Rank V) respectively. The present findings are in line with Chen and Martin Ravallion (2008) and Joshi et *al.* (2018).

Consumption pattern of households in Mahendergarh district: The result of the data presented in Table 3 clearly shows that that the consumption pattern of households in Mahendergarh district. The weighted mean score (WMS) shows that consumption of cereals (WMS 5.00, Rank I) followed by milk and milk products (WMS 4.73, Rank II), Vegetables (WMS 4.50, Rank III) , pulses (WMS 1.85, Rank IV) and fruits (WMS 1.25, Rank V), respectively.

BMI of children (up to 5 years) and adult women (18 to 40 years): BMI is a relative measure of whether an individual weight is at a healthy level for their height. Data in Table 4 Cleary depicts that the BMI of children (0-5 years) in both the district (Rewari and Mahendergarh) falled in the category of underweight (49.38) followed by normal weight (34.57%), overweight (12.34%) and obese (3.70%) respectively. Whereas the data on BMI of women in Rewari district showed that more than half of the adult women (56.07%) were categorized under low BMI range (18.5 or less), 32.95 percent adult women categorized under

Table 2: Consumption pattern of households in Rewari district

Food groups	Daily (5)	Alternately (4)	Twice in a week (3)	Weekly (2)	Rarely (1)	WMS	Rank
Cereals	150(100)	-	-	-	-	5.00	I
Pulses	-	7(4.67)	13(8.67)	21(14.00)	109(72.67)	1.45	IV
Vegetables	82(54.67)	44(29.33)	24(16.00)	-	-	4.39	III
Fruits	-	3(2.00)	5(3.33)	7(4.67)	136(90.67)	1.18	V
Milk and milk products	120(80.00)	25(16.67)	5(3.33)	-	-	4.76	II

Table 3: Consumption pattern of households in Mahendergarh district

Food groups	Daily (5)	Alternately (4)	Twice in a week (3)	Weekly (2)	Rarely (1)	WMS	Rank
Cereals	150(100.00)	-	-	-	-	5	I
Pulses	4(2.67)	9(6.00)	22(14.67)	41(27.33)	74(49.33)	1.85	IV
Vegetables	93(62.00)	39(26.00)	18(12.00)	-	-	4.50	III
Fruits	-	2(1.33)	13(8.67)	6(4.00)	129(86.00)	1.25	V
Milk and milk products	116(77.33)	27(18.00)	7(4.67)	-	-	4.73	II

Table 4: BMI of children (up to 5 year), adult women

S.No.	Variables	Rewari		Mahendergarh		Total	
		f	%	f	%	f	%
1.	**Children (upto 5 year)**	**n=38**		**n=43**			
	18.5 or less: Low BMI (underweight)	19	50.00	21	48.83	40	49.38
	18.5 to 24.9: Medium BMI (normal weight)	10	26.31	18	41.86	28	34.57
	25 to 29.9: High BMI (overweight)	7	18.42	3	6.98	10	12.34
	30 and above: Very-High BMI (obese)	2	5.27	1	2.33	3	3.70
2.	**Women**	**n-173**		**n- 187**			
	18.5 or less: Low BMI (underweight)	97	56.07	94	50.27	191	53.05
	18.5 to 24.9: Medium BMI (normal weight)	57	32.95	62	33.15	119	33.06
	25 to 29.9: High BMI (overweight)	16	9.24	26	13.90	42	11.67
	30 and above: Very-High BMI (obese)	3	1.73	5	2.67	8	2.22

medium BMI range (18.5 to 24.9), 9.24 per cent adult women categorized in high BMI (25 to 29.9) and only 1.73 percent adult women fall in the category of obese (30 and above). In Mahendergarh district and it was found that half of the adult women (50.27%) were categorized under low BMI range (18.5 or less), 33.15 percent adult women categorized under medium BMI range (18.5 to 24.9), 13.90 per cent adult women categorized in high BMI (25 to 29.9) and only 2.67 percent adult women fall in the category of obese (30 and above). In pooled sample more than half of the adult women (53.05%) categorized under low BMI range (18.5 or less), 33.06 percent adult women categorized under medium BMI range (18.5 to 24.9), 11.67 per cent adult women categorized in high BMI (25 to 29.9) and only 2.22 percent adult women fall in the category of obese (30 and above The present findings are in line with Jethi *et al.* (2018).

CONCLUSION

Consumption pattern of any vegetable in both the districts was (6.67% and 10.00%) respectively. In Rewari district consumption pattern for fruits were only 1.33 percent whereas for milk and milk products it was 52.67 percent. The BMI of children (0-5 years) in both the district (Rewari and Mahendergarh) falled in the category of underweight (49.38) followed by normal weight (34.57%), overweight (12.34%) and obese (3.70%) respectively. Whereas the data on BMI of women in Rewari district showed that more than half of the adult women (56.07%) were categorized under low BMI range (18.5 or less), 32.95 percent adult women categorized under medium BMI range (18.5 to 24.9), 9.24 per cent adult women categorized in high BMI (25 to 29.9) and only 1.73 percent adult women fall in the category of obese (30 and above).

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Cultivation and Marketing of Kinnow in South-Western Region of Punjab: An Approach of SWOT Analysis

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ABSTRACT

In Punjab, cultivation of fruits is practiced from many years. Nature has gifted Punjab with the suitable agro-climatic conditions and topography for the cultivation of horticultural crops, particularly south-western region for citrus cultivation. This region has the large potential in the production of citrus fruits in terms of productivity level. Among the citrus fruits, kinnow fruit, a hybrid of two citrus cultivars, namely, King (*Citrus nobilis*) and Willow leaf (*Citrus deliciosa*) occupies an enviable prime place among the citrus and other fruit crops cultivated in Punjab. It can be easily cultivated on the sandy loam soils and has higher profitability and good market value compared to some other fruit crops in the state. In concern of steady increase in demand for cultivation of fruit crops; an agro-economic data with regard to kinnow cultivation is important for further expansion of its cultivation. Hence, an approach of SWOT analysis has been made to identify the strengths, weakness, opportunities and threats in the cultivation and marketing of kinnow in South-western region of Punjab. The results shows that cultivation and marketing of kinnow can be increased and generates an employment and source of income for the rural people.

Keywords: Kinnow, SWOT analysis, Punjab

INTRODUCTION

Fruits are of great importance in human diet. India is the second largest producer of fruits in the world, its share in the world fruit production is 10 per cent. Kinnow, belonging to the mandarin group of citrus is one of the most important fruits, cultivated throughout the tropical and subtropical regions of the world. It is primarily valued for the fruit, which is either eaten alone as fresh fruit, processed into juice or added to dishes and beverages. Commercially, kinnow mandarin is grown in states like Punjab, Haryana, Himachal Pradesh, North-Western part of Rajasthan and Uttar Pradesh. Citrus cultivation can be done in almost all over the Punjab state but the arid irrigated and sub-mountainous regions of Punjab are best suited for the production of excellent quality fruits. As per area and production statistics of Punjab Horticulture Department (Anonymous, 2019), the total area estimated under citrus cultivation was 57288 hectares with annual production of 1281632 tonnes. In citrus, kinnow fruit alone occupies an area of 53045 hectares with annual production of 1246821 tonnes. The agro-ecological conditions of Punjab are best suited for the production of Kinnow mandarin particularly South-Western region. In this region, Kinnow cultivation has proved a boon for the farmers due to its higher economic productivity as compared to other fruit crops. Kinnow has been proved promising place due to its wider adaptability and comparatively more resistant to insect pests and diseases. Its characters range between mandarin and sweet orange having neither loose nor tight skin. It has been observed that citrus plants thrive best in soils having a slightly acidic reaction with a pH range of 5.5 to 7.5. However, a well-drained fertile sandy loam soil having pH up to 8.5 and free from hard pan are best suited for citrus growing.

There is a basket of technology available in fruit production capable of transforming its complex, diverse and risk-prone nature to a profitable and productive nature (Kumar *et al.,* 2018). Although the area and production of kinnow crops is significant still the farmers face a lot of problem in production to marketing which need attention of the researchers, extension professionals as well as policy planner. Some studies reported the economic analysis and marketing of citrus crop (Bhat *et al.,* 2015). Yadav and Godara (2016) reported kinnow growers faced many problems regarding marketing of their produce. Except this study, there are many other studies available on

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constraints in kinnow production technology (Chaudhary and Bhangarwa, 2013; Meena *et al.*, 2017). Though a few studies were reported in literature regarding SWOT analysis on cultivation of Horticulture in India (Sapna, 2017; Ruchira Shukla and Srivastava, 2010; Srinivasa Rao *et al.*, 2014). There is no specific study with concern to SWOT analysis on kinnow cultivation and marketing in Muktsar district of Punjab. Hence, the present study was conducted with an objective to assess the strengths and weaknesses, opportunities and threats for commercial kinnow cultivation and marketing in Punjab using SWOT analysis.

MATERIALS AND METHODS

A total of 80 farmers were interviewed at their established kinnow orchards from the four blocks of Sri Muktsar Sahib district *i.e.* Muktsar, Lambi, Gidderbaha and Malout. The research method used was structured face-to-face interviews with the farmers. The size of the farm is very important factor, therefore, farm size was chosen as an independent variable (Table 1). Farms in the sample were divided into the following groups: Small farms-less than 2 ha, Medium size farms – between 2-10 ha and big farms – more than 10 ha. The proportions of small farms was 20% whereas, medium farms and big farms proportionate into 55% and 25% respectively. The data collected was analyzed using the Statistical Package for Social Sciences (SPSS).

RESULTS AND DISCUSSION

About the sample cultivator: The majority of the respondents were male and more than 40 years old. The proportions of the interviewees who were over 60 years old was 20%. The interviewees were well educated and with significant experience of working in horticulture. More than half respondents (60%) had secondary qualification and 40% had a university degree. More than two-thirds of the farmers (68%) had worked in the horticultural sector previously and their years of experienced varied between 5 to 40 with an average of 18 years (Mean = 18.6).

Table 1: Farm size of the kinnow farms within the sample

Farm Size	Count	Percentage
Less than 2 ha	16	20
2-10 ha	44	55
More than 10 ha	20	25
Total	**80**	**100**

SWOT Analysis: SWOT is the acronym for strengths, weaknesses, opportunities and threats. Studying the internal capacity of the (strengths and weaknesses) provided information for understanding the current situation of the farms. Strength is an inherent capacity. A weakness is an inherent limitation or constraint. An opportunity is a favorable condition and threat is an unfavorable condition in the external environment. SWOT analysis is helpful in the formulation of an effective strategy that can capitalize on the opportunities and neutralize the threats. Identification of opportunities and threats in the environment and strengths and weaknesses of the farm is the cornerstone of the farm policy formulation.

Strengths of cultivation and marketing: The results of the study revealed that the key strengths of the farms within sample are in descending order of perceived importance (Table 2). Farms of different size had different perceived 'Key' strength. The availability of input resources in horticulture (71%). There are no problems in acquiring inputs such as capital, fertilizers and farm yard manure and soluble fertilizers N:P:K 19:19:19, 12:61:0 and 13:0:45. The other strength that was mentioned by the respondents was having experience in kinnow cultivation (65%) and suitable agro-climatic conditions (56%). The vast majority of the farms with big farms identified availability of own machinery (80%), while those with farms of less than 10

Table 2: The top five strengths of the farm with different size

Strengths	Size of Farms						Total	
	Small		Medium		Big			
	Count	% of cases	Count	% of cases	Count	% of cases	Count	% of cases
Having Experience	12	60	29	66	11	55	52	65
Own Machinery	4	25	19	43	16	80	39	49
Availability of resources	12	60	32	72	13	65	57	71
Good natural conditions	12	60	24	54	9	45	45	56
Independent management	7	43	18	40	6	30	31	39

ha stated (66%) that their experience in horticulture was their key strength, whereas, small size farm considered that independent management was one of the key strength (43%) compared to the grower with medium farms (40%).

Weaknesses of cultivation and marketing: The key weakness stated by the respondents was shown in Table 3. Farms of all sizes considered lack of good and attractive quality planting materials (75%). Produce either packed in gunny bag or in net bags. Lack of packing materials like corrugated fiber box and cling film are major weakness of the farms of different sizes The results revealed that farms have lack of good quality planting materials (74%) and non-availability of skillful labour (66%) that required during training and pruning of kinnow orchard. Cost of cultivation is became a major weakness (56%) of all farm sizes due to regular increasing in price of fertilizer, wages rate etc. However, the grower with farms of less than 2 ha stated their weakness to be the use of old packing materials (87%) followed by higher cost of cultivation (81%).

Opportunities of cultivation and marketing: The results obtained from Table 4 revealed that the key opportunities for the medium farms was the plantation of orchard under High Density Planting System (48%) whereas, small farms required Govt. assistance for senile orchards (62%). Old and senile orchard must be rejuvenating to regain the productive potential. The farms of more than 10 ha were mainly oriented towards the demands of processing unit (65%). The horticulture wing Krishi Vigyan Kendra and Department of Horticulture, Sri Muktsar Sahib, Punjab is

Table 3: The top five weakness of the kinnow farm with different size

Strengths	Size of Farms						Total	
	Small		Medium		Big			
	Count	% of cases	Count	% of cases	Count	% of cases	Count	% of cases
Lack of quality materials	11	69	32	72	15	75	59	74
Lack of old machineries	11	69	30	68	13	65	54	67
Lack of skillful personnel	11	69	28	64	14	70	53	66
Lack of attractive packing materials	14	87	34	77	12	60	60	75
Higher cost of cultivation	13	81	23	52	9	45	45	56

Table 4: The top five opportunities of the kinnow farm with different size

Strengths	Size of Farms						Total	
	Small		Medium		Big			
	Count	% of cases	Count	% of cases	Count	% of cases	Count	% of cases
High Density Planting System	8	50	21	48	9	45	38	48
Govt. Assistance for senile orchard	10	62	24	54	11	55	45	56
Applying new technologies	6	37	19	43	7	35	32	40
Market expansion	7	44	20	45	12	60	39	49
Expansion of processing unit	12	75	30	68	13	65	55	69

Table 5: The top four threats of the kinnow farm with different size

Strengths	Size of Farms						Total	
	Small		Medium		Big			
	Count	% of cases	Count	% of cases	Count	% of cases	Count	% of cases
Fluctuation in water table	7	44	22	50	8	40	37	46
Smoky weather during winter	12	75	34	77	16	80	62	77
Market uncertainty	13	81	33	75	17	85	63	78
Lack of refrigerator van	11	68	23	52	14	70	48	60

guiding and supervising the cultivation and marketing of kinnow in all the four blocks of Muktsar District.

Threats of cultivation and marketing: All farms irrespective of their size were threatened mostly by the unpredictable weather conditions as result showed in Table 5. The farms more than 10 ha threatened 80%, medium 72% and small farms 75%. During winter season as smoky weather occurred due to burning of residue of paddy effects the productivity of kinnow. There is no fixed MSP on kinnow. During the glut season, farmers sometimes did not get its remunerative price. Lack of refrigerator vans facility during long distance transportation, the quality of fruits becomes deteriorate. Productivity of kinnow may be affected by high temperature, hormonal imbalance and physiological disorders that leads highly fruit drop in kinnow orchards.

CONCLUSION

The vast majority of the rural poor continue to be dependent on land and water resources for their meager livelihoods. Paradoxically, however, various phenomena including flood, deforestation, drought, soil erosion, low risk bearing capacity of farmers, small holding size, traditional methods of cultivation, poor net-work of transport, lack of marketing avenues etc. have resulted in decreased incomes for farming families. In the present study it is noticed that the strengths outweigh the weaknesses. The opportunities outweigh the threats. India needs more number of job creators and not job seekers. To generate self-employment, the cultivation of kinnow may be encouraged by the government with subsidies, supervision, guidance and training in skills required for working in farms of kinnow. This activity generates income to the rural poor.

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Perception of University Students Towards e-learning in Punjab

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ABSTRACT

The study was conducted to analyze the perception of students towards e-learning system. The data was collected randomly from 200 students drawn four old and well established universities of Punjab by using questionnaire as data collection tool. It was found that most of the students had access to various e-learning devices such as smartphone, laptop and computer. All students had internet access and majority of them were using it at college, hostel and home. YouTube, e-mail, web-portals and instant messaging came out to be leading applications used by students for learning purposes. Interestingly seeking general information was foremost purpose of using e-learning followed making assignments and extra courses content. The findings of the study revealed that students had positive perception towards e-learning system and they showed interest to use e-learning system in their learning activities. Hence, it is recommended that educational institutes should motivate their faculty to blend e-learning system with traditional instructional methods, as it creates interesting, attractive and impactful teaching-learning environment.

Keywords: e-learning, e-learning devices, Internet, Perception, Students

INTRODUCTION

The rapid growth of technology contributed a lot to progress of all industries. The advances of ICT have encouraged development in different fields such as business, economy, health, communication, education and training. Educational sector has thoroughly revised the learning and teaching strategies with the objective of giving better service to learners by the use of ICT (Suri and Sharma, 2013). E-education refers to use of internet technologies and other electronic media for teaching and learning. According to Govindasamy (2001) e-learning is an instruction delivered via all electronic media including the internet, intranets, extranets, satellite broadcasts, audio/ video tape, interactive TV, and CD-ROM. ICT upgrades the education process and its standards by putting electronic devices and technology differently to make the students' learning successful (Abdullah and Toycan, 2017).

E-learning has developed quickly, educationists have been stimulated to implement e-learning to transfer traditional education environment, as it creates additional resourceful surrounding with attractive education environment and learning experiences. Zhang *et al.* (2004) reported that e-learning provides institutions with the opportunity that to have self-faced and learner-centered courses, flexibility in time and location and cost effective option for learners. It presents the strategic opportunities to extend institution offerings and reach across geographical borders and regions. Thus the teaching and learning process have benefited from electronic delivery by providing learning chances for anyone, anywhere, anytime and in any form and thus, overcoming barriers related to time, space and location. Murai *et al.* (2018) puts forward that e learning courses should use mix of strategies to deliver the information with relevant examples, visuals, audios etc. to be effective, self-paced or instructor led, need and interest based.

There are number of factors which influence the adoption and acceptance of e-learning technology in the teaching-learning process by both teachers and students. These are perceived ease of use, usefulness, behavioral intention, attitude, etc. Consequently, developers and delivers of e-learning needs more understanding of students how they perceive and how they react to e-learning to enhance e-learning effective (Koohang and Durante, 2003). Unless learners do not have positive perception towards e-learning, creating a knowledge based community is a far of reality. In fact, adoption is a central concern of e-education or e-learning. The Technology Acceptance

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Model (TAM) has become well-established model for predicting IT acceptance, usage intensions and behavioural attitude. Perceived usefulness (PU) and perceived ease of use (PEOU) are the two mediating variables which predict the acceptance of information technology (Davis, 1986). Various studies have been conducted abroad to study the TAM model efficiency for studying acceptance of e learning. Hence in the current study an attempt was made to study the access and usage pattern of internet and e-learning tools by students, followed by studying their perception towards e-learning system using Technology Acceptance Model (TAM).

MATERIALS AND METHODS

Four old and well established universities of Punjab *i.e.* Punjab Agricultural University (PAU), Ludhiana; Guru Nanak Dev University (GNDU), Amritsar; Panjab University (PUC), Chandigarh and Punjabi University (PUP), Patiala were purposively selected for the study. From each selected university, students were selected only from the main campus. Independent of discipline/stream of degree, a total of 50 students comprising of 30 undergraduate and 20 postgraduate students were selected from each university using random sampling technique. Thus, the sample comprised of 200 respondents. To fulfil the objectives of the study, questionnaire was prepared to collect the data from the respondents. It consisted of items for studying students' perception towards e-learning in terms of perceived ease of use and perceived usefulness. The responses were taken on five-point Likert Scale varying from strongly agree to strongly disagree. The prepared questionnaire was pretested and necessary modifications were done. The reliability of the scale used was tested by split-half method for which correlation coefficient was found to be significant (i.e. r=0.68). The data was analysed by using various statistical tools i.e. frequency distribution, percentage, mean, Kruskal Wallis H-test.

RESULTS AND DISCUSSION

Students' access and usage of various e-learning devices and e-services and their perception towards e-learning are discussed below as under

Access and usage pattern of internet and e-learning tools

Access of e-learning devices: Table 1 depicts the access of various e-learning devices among students. It shows that most of the respondents had access to sartphone (97.00%), laptop (88.50%) and computer (70.00%). While only 29.00 per cent had access to tablet. In case of access to Smartphone and laptop there was not much difference amongst students of different universities. Access to computer was more among students of GNDU (74.00%) and PAU (74.00%) as compared to PUP (66.00%) and PUC (66.00%). Although overall access to tablet was low, but comparatively students of Panjab University, Chandigarh had better access (40.00%) followed by students of Punjab Agricultural University, Ludhiana (30.00%).

Type of data plan: A perusal of data in the Table 2 shows that overall, majority (59.00%) of the students were

Table 1: Distribution of respondents according to the access of e-learning devices (n=200)

Access of e-learning devices	University				Total
	GNDU (n_1=50)	PUC (n_2=50)	PUP (n_3=50)	PAU (n_4=50)	
Computer	37(74.00)	33(66.00)	33(66.00)	37(74.00)	140(70.00)
Laptop/ Notebook	43(86.00)	45(90.00)	44(88.00)	45(90.00)	177(88.50)
Smartphone	49(98.00)	49(98.00)	49(98.00)	47(94.00)	194(97.00)
Tablet	14(28.00)	20(40.00)	9(18.00)	15(30.00)	58(29.00)

*****Multiple responses

Table 2: Distribution of respondents according to the type of data plan (n=200)

Data plan	University				Total
	GNDU (n_1=50)	PUC (n_2=50)	PUP (n_3=50)	PAU (n_4=50)	
Limited cellular data plan	23(46.00)	33(66.00)	29(58.00)	33(66.00)	118(59.00)
Unlimited cellular data plan	27(54.00)	17(34.00)	21(42.00)	17(34.00)	82(41.00)

*****Multiple responses

using limited cellular data plan and rest had unlimited cellular data (41.00%). Comparing universities, majority of university students (66.00% in PUC and PAU each, 58.00% in PUP) had limited cellular data plan while in case of GNDU, majority (54.00%) had unlimited cellular data plan.

Type of internet connection: Table 3 shows the type of internet connection used by students. Majority (72.00%) of the students were having local area network connection (LAN) while hotspot (27.00%), broadband digital subscriber line connection (21.00%) and net connector/ dongle (8.00%) users were less. Only 3.00 per cent student had broadband cable connection.

Similar trend was observed when universities were compared as majority of the students from all universities i.e. PUC (76.00%), PAU (76.00%) GNDU (72.00%), and PUP (66.00%) were using local area network (LAN) for internet connection followed by hotspot (34.00% in PUP, 26.00% in GNDU and 24.00% each in PUC and PAU) and broadband digital subscriber line connection (24.00% each in PAU and PUP, 22.00% in PUC and 14.00% in GNDU).

Internet usage: Further, the students were asked to report the time spent by them daily in internet surfing and then the average time spent by them was calculated in hours per day. They also stated the duration of using internet.

A glance at Table 4 reveals that on an average, students were using internet for more than three and half hours daily. Students of PUC and PUP were using internet more (3.6 hours/day each) as compared to GNDU and PAU students who were using internet less (3.3 hours/day each). With regard to time span of using internet in years, on an average students were using internet since more than five years. Comparatively students of GNDU, PUC and PAU were using internet since more than five years while students of Panjabi University, Patiala started using internet later i.e. since four and half years and it was statistically significant ($H=30.54$, $p\leq0.01$). It shows that students of PUP started using internet later than other universities.

Place of internet access: Regarding place of internet access, most of the students i.e. 99.50 per cent were using internet in college followed by hostel (89.00%) and home (86.00%). Notably the day scholars were also using hostel internet facility in their leisure time or while with their friends at hostel. Further, half (50.50%) of the students were using cyber library as internet access place, while internet café was used by only one fourth (25.00%) of the students.

Most of the students of all universities had internet access at college and hostel and there was no much difference amongst them. The PUC (94.00%) and PUP (96.00%) students were had more access to internet at home as compared to GNDU (78.00%) and PAU (76.00) students. The internet café was used less by students of GNDU (i.e. 16.00%) as compared to other universities instead they were using internet at cyber library more (58.00%).

Mean use of e-learning tools: On an average students were using YouTube mostly ($\bar{x}=3.0$) for learning purpose

Table 3: Distribution of respondents according to the type of internet connection (n=200)

Internet connection	University				Total
	GNDU (n_1=50)	PUC (n_2=50)	PUP (n_3=50)	PAU (n_4=50)	
Local Area Network	36(72.00)	38(76.00)	33(66.00)	38(76.00)	145(72.00)
Hotspot	13(26.00)	12(24.00)	17(34.00)	12(24.00)	54(27.00)
Broadband Connection -Digital Subscriber Line	7(14.00)	11(22.00)	12(24.00)	12(24.00)	42(21.00)
Broadband Connection-Cable	1(2.00)	1(2.00)	0(0.00)	4(8.00)	6(3.00)
Net Connector/ Dongle	7(14.00)	3(6.00)	1(2.00)	5(10.00)	16(8.00)

*****Multiple responses

Table 4: Distribution of respondents according to internet usage (n=200)

Usage	University				Kw Value	Total
	GNDU (n_1=50)	PUC (n_2=50)	PUP (n_3=50)	PAU (n_4=50)		
Hours/day	3.3±1.0	3.6±0.9	3.6±0.8	3.3±1.1	3.01	3.5±0.8
Time span (years)	5.4±1.0	5.3±1.3	4.5±1.5	5.3±1.3	30.54*	5.2±1.3

*****$p\leq0.01$

Table 5: Distribution of respondents according to place of internet access (n=200)

Place	University				Total
	GNDU (n_1=50)	PUC (n_2=50)	PUP (n_3=50)	PAU (n_4=50)	
College	49(98.00)	50(100.00)	50(100.00)	50(100.00)	199(99.50)
CyberLibrary	29(58.00)	24(48.00)	26(52.00)	22(44.00)	101(50.50)
Hostel	43(86.00)	42(84.00)	48(96.00)	45(90.00)	178(89.00)
Internet café	8(16.00)	13(26.00)	14(28.00)	15(30.00)	50(25.00)
Home	39(78.00)	47(94.00)	48(96.00)	38(76.00)	172(86.00)

*****Multiple responses

Table 6: Use of e-learning tools by students of selected universities (n=200)

Tools	University				Total
	GNDU (n_1=50)	PUC (n_2=50)	PUP (n_3=50)	PAU (n_4=50)	
YouTube	2.7±0.9	3.0±0.9	3.1±0.9	3.1±1.0	3.0±0.9
e-mail	2.3±1.2	2.5±1.2	2.3±1.1	2.4±1.2	2.4±1.2
Web-portals	2.6±1.1	2.2±1.5	2.5±1.4	2.3±1.3	2.4±1.3
Instant messaging	2.3±1.2	2.4±1.4	1.9±1.9	2.3±1.1	2.2±1.3
Facebook	1.8±1.2	1.8±1.4	1.4±1.2	1.7±1.3	1.7±1.3
Online discussion	0.8±1.1	0.7±1.9	1.0±1.1	1.4±1.3	1.0±1.2
Blogging	0.8±1.1	0.8±1.1	0.8±1.0	0.7±1.1	0.8±1.1
Instagram	0.1±0.8	0.3±0.8	0.2±0.9	0.2±0.8	0.1±0.8
Overall	1.7±1.1	1.7±1.2	1.7±1.2	1.8±1.1	1.7±1.0
Kw Value	209.71*	201.80*	180.35*	171.45*	

***** $p \leq 0.01$; Mean range: 0 to 4

followed by web-portals, e-mail ($\bar{x}$ =2.4 each) and instant messaging ($\bar{x}$ =2.2) for their learning purposes. Students used facebook, online discussion, blogging and instagram rarely ($\bar{x}$ =1.7, 1.0, 0.8 and 0.1 respectively) for learning purposes.

YouTube was used more by students of PUP and PAU ($\bar{x}$ =3.1 each) while students of Panjab University, Chandigarh lead the other universities in use of e-mail, instant messaging, online discussion, facebook for learning purposes. Web-portals were used more by students of GNDU, Amritsar while PAU's students use online discussion for learning more than other universities. Further, within each university, YouTube is used the most as compared to other e-learning tools which was statistically significant at 1.00 per cent level of significance (H; GNDU-209.71, PUC-201.80, PUP-180.35 and PAU-171.45).

Use of e-learning tools for learning purposes: The data in the Table 7 confirms that on an average the students were using e-learning tools frequently for seeking general information ($\bar{x}$ =3.3) followed by assignment making ($\bar{x}$ =3.1) and for extra course content ($\bar{x}$ =2.5). Sometimes they used e-learning tools for the reading online books ($\bar{x}$ =2.0) followed by e-courses ($\bar{x}$ =1.7) while they used e-learning tools for doing online certificate courses rarely ($\bar{x}$ =0.8).

Students of PUC and GNDU, frequently used the e-learning tools for the purpose of seeking general information ($\bar{x}$ =3.4, 3.3 respectively) followed by assignment making ($\bar{x}$ =3.1 each). In case of PAU and PUP, students used e-learning tools for making assignments ($\bar{x}$ =3.2, 3.0 respectively) more in compare to other purposes. If we compare purposes within each university there was statistical significant difference at 1.00 per cent level of significance (H; GNDU=209.71, PUC=201.80, PUP=180.35, PAU=171.45). Students from all three universities were using these tools for the purpose of extra course content more than Punjabi University, Patiala ($\bar{x}$ =2.4). Sometimes, students were also using these tools

Table 7: Mean use of e-learning tools for learning purposes (n=200)

Purpose	University				Kw	Total
	GND (Un_1=50)	PUC (n_2=50)	PUP (n_3=50)	PAU (n_4=50)	value	
General information	3.3±0.6	3.4±0.7	2.4±0.7	2.8±0.7	1.16	3.3±0.7
Assignment making	3.1±0.8	3.1±1.0	3.0±1.0	3.2±0.8	2.82	3.1±0.9
Extra course content	2.5±1.0	2.5±1.0	2.4±1.1	2.8±0.9	3.94	2.5±1.0
Online books	2.0±1.0	1.8±1.1	2.1±1.2	2.1±1.3	1.36	2.0±1.2
e-courses	1.9±1.2	1.3±1.2	1.6±1.1	2.1±1.3	9.81*	1.7±1.3
Online certificate courses	1.0±1.1	0.7±0.9	0.6±0.9	0.9±1.1	3.46	0.8±1.0
Kw Value	113.94**	146.07**	128.42**	109.78**		

***** $p \leq 0.05$, ****** $p \leq 0.01$; Mean range: 0 to 4

Table 8: Perception of students towards e-learning (n=200)

Constructs	University				Kw	Total
	GNDU (n_1=50)	PUC (n_2=50)	PUP (n_3=50)	PAU (n_4=50)	Value	
Perceived ease of use	3.8±0.8	3.8±0.8	3.7±0.9	3.7±0.9	1.07	3.8±0.4
Perceived usefulness	3.5±0.9	3.5±0.9	3.5±1.0	3.5±0.9	NA	3.5±0.3
Overall perception	3.7±0.3	3.7±0.3	3.6±0.4	3.6±0.3	0.96	3.7±0.3

Mean range: 1 to 5

for reading online books while use for online certificate courses was rare. Students of PAU used e-learning tools more for doing e-courses as compared to other universities ($\bar{x}$ =2.1) and it was statistically significant at the 5.00 per cent level of significance.

Perception of university students towards e-learning

As mentioned in the methodology, perception was studied in terms of perceived ease of use (PEOU) and perceived usefulness (PU). The responses were taken in five-point Likert scale ranging from strongly disagree to strongly agree.

Perceived ease of use (PEOU) referred to the degree to which students believed that e-learning system was free of physical and mental effort while using it. On an average mean score for perceived ease of use was 3.8 which depicts that students had positive perception towards its ease of use. In each university, ease of use for e-learning was perceived positively ($\bar{x}$; GNDU=3.8, PUC=3.8, PUP=3.7 and PAU=3.7) and there was no significant difference amongst them statistically. The results are in conformity with Chinyamurindi and Shava (2015); Harun and Abdullah (2013); Alharbi and Drew (2014); Mamattah (2016); Hussein *et al.* (2007) and Punnoose (2012) who reported that perceived ease of use (POEU) influence the perception of students towards e-learning.

Perceived usefulness (PU) referred to the degree to which students believed that e-learning system enhances their performance in academics. On an average mean score for perceived usefulness was 3.5 which depicts that students had positive perception towards its usefulness of e-learning. Interestingly, the mean score of perceived usefulness was same in all four universities ($\bar{x}$ =3.5). Chinyamurindi and Shava (2015); Harun and Abdullah (2013); Alharbi and Drew (2014); Mamattah (2016); Hussein *et al.* (2007); Farahat (2012) and Punnoose (2012) also reported that perceived usefulness (PU) influence the perception of students towards e-learning.

Average mean score for perceived ease of use and perceived usefulness gave perception mean score. Overall, the mean score of students' perception towards e-learning was high ($\bar{x}$ =3.7). It means students had positive perception towards e-learning and they showed interest to use e-learning system in their learning activities. Similarly, if we see perception of students within each university it was positive as shown from their respective mean scores ($\bar{x}$; GNDU-3.7, PUC-3.7, PUP-3.6 and PAU-3.6) and there was no statistical difference amongst universities. It can be concluded that overall students had positive perception towards e-learning system. The results are in line with the findings of Dukic (2011); Gamal and Aiz

(2011); Latt (2012); Adewole-Odeshi (2014); Huss and Eastep (2013); Bauk *et al.* (2014); Ncube (2015); Mahajan and Kalpana (2018) who concluded that students in higher education had positive perception towards e-learning system. A study was conducted by Rakshit and Sharma (2019) to study the attitude of instructors towards integrating educational technology in classroom instruction and results reveal that most of the instructors had medium to highly favourable attitude towards using latest educational technologies in classroom. This shows that these days, teachers as well as students are oriented positively towards the use of e learning.

CONCLUSION

The findings showed that students had positive perception towards perceived ease of use and usefulness of e-learning system. It is recommended that educational institutes should motivate their faculty to blend e-learning system with traditional instructional methods, as it creates additional resourceful surroundings with attractive teaching-learning environment. It will help to overcome barriers related to traditional learning as students would be able to store, revise, refer and learn at their own pace, place and needs. Majority of the students were using youtube, e-mail, web-portals and instant messaging more as compared to other e-learning tools for learning purpose. Thus, it is suggested that teachers and management of educational institutes should use these e learning tools for dissemination of learning materials and information. Seeking general information came out to be major purpose of using these e-learning tools followed by assignment making and reading extra course content which shows that students use e-learning more for general learning as compared to their degree course requirements.

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Knowledge level of Farmers about Improved Cultivation Practices of Onion Farmers in Nagaur District of Rajasthan

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ABSTRACT

The present study was conducted during 2018-19 in Nagaur district of Rajasthan, to understand the Knowledge level of farmers about improved cultivation practices of onion. The study revealed that half of the respondents were middle aged ranging from 35 to 50 years age group and belonged to backward caste, majority of the respondents were middle to secondary standard educated and engaged in agriculture. In case of knowledge level about improved onion cultivation practices study revealed that, nearly half (54.69%) of the onion farmers had medium level of knowledge followed by high (25.00 %) and low (20.31%) level of knowledge. With respect to adoption of individual improved cultivation practices of onion, more than 90 percent of onion growing farmers had thorough knowledge about ploughing, harrowing followed by knowledge of other practices in descending order *viz*., appropriate irrigation interval (78.13%), selection of soil (76.56%), time of seed sowing (76.56%), transplanting time of onion seedlings in main field (68.75%), selection of varieties for *rabi* crop (65.63%), time of weeding (65.63%), suitable harvesting stage/time (60.94%), etc. Very low extent of knowledge regarding improved production technology of onion was found in case of different colour varieties of onion (23.44%), application of micro- nutrients (21.88%) and grading of onion bulb (18.75%). Thus, study suggests the need of conducting trainings, FLDs and efficient use of all means of extension methods to train the onion growers for achieving higher income of onion in the district.

Keywords: Knowledge level, KVK, Onion, Training, Production technology

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important bulbs as well as cash vegetable crop belongs to family Alliaceae. It is one of the few versatile vegetable crops that can be kept for a fairly long period and can safely withstand the hazards of rough handling including long distance transport. It is liked for its flavour and pungency which is due to the presence of a volatile oil '*Allyl Propyl Disulphide*'- an organic compound rich in sulphur. Onion bulb is a rich source of minerals like phosphorus, calcium and carbohydrates. It also contains protein and vitamin C. It is mostly used as salad, pickles and garnish in cooked, fried, boiled and baked curries. Dietary demand of onion is increasing day by day due to the awareness of nutritional and medicinal importance. Nutritive value of onion varies from variety to variety; small multiplier onions are more nutritive and healthy with major value of flavour, flavonoids and other dietary values. India is the second largest producer of onion in the World next to China, with production of 215.64 lakh millions tons from an area of 12.70 lakh hectare (Gupta and Tiwari, 2019). The major onion growing states in India are Maharashtra, Madhya Pradesh, Karnataka, Gujarat, Rajasthan and Bihar. Maharashtra and Karnataka are the two states that contributes huge share in the production of onions. In Rajasthan, it is grown extensively in the districts of Jodhpur, Sikar, Alwar, Nagaur, Jhunjhunu, etc. In Nagaur district, the cropping season for onions begins in the months of September-October.

Most of the farmers prefer local cultivar for sowing in their field during *rabi* season in order to get good returns during winter. Onion production is not always profitable for farmers owing to certain risks associated with it. Due to various constraints like poor knowledge about proper storage methods of onion bulbs, poor keeping quality of local cultivar, negligible area under *kharif* onion, lack of storage facilities, etc. farmers sold their produce at a price below their cost of production. Lack of knowledge of the farmers about appropriate seasons, varieties, post harvest management, climate, soil and improved cultivation

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techniques are the main reasons, unawareness of the characteristic of the varieties, seasonalities and adoption of proper package of practices are also the reasons responsible for limiting the production and productivity of onion directly or indirectly (Bhise *et al*., 2014). Therefore, an appropriate understanding of Knowledge level of improved cultivation practices and the constraints analysis would help to arrive at appropriate extension and research strategies to increase their knowledge level. Keeping this in view a study was conducted to know the level of knowledge about improved cultivation practices of onion by the farmers of Nagaur district of Rajasthan.

MATERIAL AND METHODS

The study was conducted in Nagaur district of Rajasthan. This study was undertaken in 4 villages of Didwana tehsil (Berwa, Alakhpura, Rasidpura, Dabra) and from each village 16 farmers were selected randomly thus, making a total sample size of 64 farmers. The data were collected through personal interview by designing a questionnaire. The knowledge test executed to the respondents consisted 34 statements pertaining to preparation of land and soil testing, nursery management, transplanting of nursery in main field, nutrient management, weed management, irrigation management, plant protection and post harvest management. The responses were recorded either as "correct" or "incorrect" and a score of "1"and "0"were given, respectively. The maximum score was 34 and minimum was zero. The data were collected, tabulated and analyzed by using statistical tools like frequency and percentage.

RESULTS AND DISCUSSION

Socio-Economic Status of Respondents: The socio keep-economic status scores of the respondent were computed and their distribution is given in Table 1. It is evident from the table that the majority of respondents (50.00%) were in middle age group of 35-50 followed by young age (29.69%), whereas 20.31 per cent respondent were above 50 years of age. It is obvious from table that majority of farmers were educated (92.19%) and only 7.81 per cent were illiterate. Majority of farmers *i.e*., 65.63 per cent belonged to other backward class followed by general and scheduled caste with 20.31 and 14.06 per cent, respectively. The perusal of data indicated that majority (71.88%) of the farmers were engaged in agriculture, while, 10.94 and 6.25 per cent farmers were engaged in agriculture along with labour and agriculture along with business and independent profession, respectively for their livelihood. It can be concluded that maximum land holding was small (43.75%) followed by marginal (29.69%), medium (18.75%) and large (7.81%). In case of income, majority of farmers belonged to medium income group. This income group alone constituted 59.38 per cent of the total sample. Further, 34.38 and 6.25 per cent farmers were from low and high income groups, respectively. In case of experience of onion cultivation the data revealed that highest (59.38%) onion growers had medium experience

Table 1: Distribution of respondents based on their socio-economic (N=64)

Variables	Category	Freq.	%
Age (years)	Young (18-35)	19	29.69
	Middle (35-50)	32	50.00
	Old (50 and above)	13	20.31
Education	Illiterate	05	7.81
	Primary	10	15.63
	Middle	17	26.56
	High School	15	23.44
	Secondary	10	15.63
	Graduate	07	10.94
Caste	General	13	20.31
	OBC	42	65.63
	SC/ST	09	14.06
Occupation	Labour	7	10.94
	Agriculture	46	71.88
	Business	4	6.25
	Independent profession	4	6.25
	Service	3	4.69
Operational land holding	Marginal (less than 1 ha land)	19	29.69
	Small (1-2 ha land)	28	43.75
	Medium (2-5 ha land)	12	18.75
	Large (above 5 ha)	05	7.81
Income	low	22	34.38
	Medium	38	59.38
	High	04	6.25
Experience in onion cultivation	Low (1-5 years)	16	25.00
	Medium (5-10 year)	38	59.38
	High (above 10 year)	10	15.63
Mass media exposure	Low	23	35.94
	Medium	27	42.19
	High	14	21.88

followed by low (25.00%) and high (15.63%) experience of onion cultivation. Out of total 64 respondents under study, 42.19 per cent had a medium exposure to the mass media followed by 35.94 per cent and 21.88 per cent had low and high exposure to the mass media, respectively. The findings are in conformity with those of Prashanth *et al.* (2018) and Singh (2010).

Knowledge Level of Recommended Cultivation Practices of Onion: The statistical data regarding the level of knowledge of farmers about improved production technology of onion were presented in Table 2. The data revealed that majority of the farmers *i.e.*, 54.69 per cent had medium level of knowledge followed by high and low level of knowledge with 25.00 per cent and 20.31 per cent farmers, respectively. The results were also in line with the findings of Waman and Patil (1996) observed that majority (70.0%) of onion growers had medium to high level of knowledge regarding onion cultivation technology. The findings of the study are in conformity with the finding of Verma and Bharati (2017) in ginger and Jat *et al.* (2011) in tomato.

Table 2: Distribution of the onion growers under different knowledge levels regarding improved production technology (N=64)

Knowledge level categories	No. of respondents	Percentage
Low Knowledge (Score below 8.04)	13	20.31
Medium Knowledge (Score from 8.05 to 24.26)	35	54.69
High Knowledge (Score above 24.27)	16	25.00
Total	**64**	**100**

Mean Score = 16.41; s = 8.37 score

The data in Table 3 reveals that the highest level of knowledge was observed in ploughing and harrowing (90.63%) followed by knowledge of other practices in descending order *viz.* appropriate irrigation interval (78.13%), selection of soil (76.56%), time of seed sowing (76.56%), transplanting time of onion seedlings in main field (68.75%), selection of varieties for *rabi* crop (65.63%), time of weeding (65.63%), suitable harvesting stage/time (60.94%), major disease occurrence during nursery (64.06%), suitable size of raised nursery bed (59.38%), appropriate time of fertilizer application (59.38%), recommended dose of fertilizer application (57.81%), seed rate/ha (54.69%), identify major pests of onion crop (53.13%), plant protection measures against onion diseases (51.56%), plant protection measures against onion pests

Table 3: Distribution of the onion growers according to their knowledge level of improved production technology of onion

Parameters	Knowledge level (N=64)	
	Frequency	Percentage
Preparation of land and soil testing		
Selection of soil	49	76.56
Ploughing and harrowing	58	90.63
Soil testing	24	37.50
Selection of Variety		
Rabi crop	42	65.63
Kharif crop	17	26.56
Different colour varieties of onion	15	23.44
Nursery Management		
Time of seed sowing	49	76.56
Suitable size of raised nursery bed	38	59.38
Appropriate method of seed sowing	20	31.25
Seed rate/ha	35	54.69
Dept of seed sowing	29	45.31
Name of bio agent/fungicide for Seed treatment	28	43.75
Knowledge of chemicals used of weed control	21	32.81
Major disease occurrence during nursery	41	64.06

Table 3 contd.....

Parameters	Knowledge level (N=64)	
	Frequency	Percentage
Transplanting of nursery in main field		
Transplanting time of onion seedlings in main field	44	68.75
Required spacing for onion crop.	31	48.44
Name of bio agent/fungicide for seedling treatment	24	37.50
Nutrient Management		
Recommended dose of fertilizer application	37	57.81
Appropriate time of fertilizer application	38	59.38
Identify nutrient deficiency symptoms	19	29.69
Application of micro- nutrient	14	21.88
Weed management		
Time of weeding	42	65.63
Use of weedicide	22	34.38
Irrigation management		
Appropriate irrigation interval	50	78.13
Method of taking water sample	23	35.94
Plant Protection		
Identify major pests of onion crop	34	53.13
Plant protection measures against onion pests	31	48.44
Identify major diseases of onion crop.	25	39.07
Plant protection measures against onion diseases	33	51.56
Bio-agents for control of pests and diseases	21	32.81
Post Harvest Management		
Suitable harvesting stage/time	39	60.94
Curing of onion	25	39.06
Grading of onion bulb	12	18.75
Different storage methods of onion	20	31.25

(48.44%), required spacing for onion crop (48.44%), dept of seed sowing (45.31%), name of bio agent/fungicide for seed treatment (43.75%), identify major diseases of onion crop (39.07%), curing of onion (39.06%), use of weedicides (34.38%), soil testing (37.50%), name of bio agent/fungicide for seedling treatment(37.50%), method of taking water sample (35.94%), knowledge of chemicals used of weed control (32.81%), bio-agents for control of pests and diseases (32.81%), appropriate method of seed sowing (31.25%), different storage methods of onion (31.25%), Identify nutrient deficiency symptoms (29.69%) and selection of variety for *kharif* crop (26.56%). Very low extent of knowledge regarding improved production technology of onion was found in case of different colour varieties of onion (23.44%), application micro- nutrient (21.88%), and grading of onion bulb (18.75%). Similar results were also observed by Bhise *et al.* (2014) and Bhise and Kale (2014) in onion crop.

Data furnished in the Table 4 illustrate that farmers had very good extent of knowledge about preparation of land and irrigation management practices with 68.23 and 57.03 mean per cent score (MPS) and given rank first and second, respectively. Similarly, the practices like transplanting of nursery in main field, nursery management, weed management, plant protection and nutrient management were showed relatively at higher degree with 51.56, 50.98, 50.00, 45.00 and 42.19 MPS respectively. Only 37.50 per cent respondents had knowledge about post-

Table 4: Knowledge levels of respondents about improved production technology of onion (N=64)

Knowledge level about different practices	MPS	Rank
Preparation of land and Soil testing	68.23	I
Selection of variety	38.54	VIII
Nursery management	50.98	IV
Transplanting of nursery in main field	51.56	III
Nutrient management	42.19	VII
Weed management	50.00	V
Irrigation management	57.03	II
Plant protection	45.00	VI
Post harvest management	37.50	IX

harvest management of onion which was ranked last because most of the respondents had less knowledge about this practice. The findings of the study are in line with the findings of Jat *et al.* (2011) in tomato and Tagor *et al.* (2017) in onion crop.

CONCLUSION

Study findings showed that a total of 25 per cent of onion farmers were in high category of knowledge level. Knowledge is generally understood as an intimate acquaintance of an individual with facts. It is one of the important prerequisites for the covert and overt behaviour of an individual. Therefore, it was a necessary for keeping the farmers updated about new improved practices and there is a scope for improving the knowledge level of the farmers, who have low and medium level of knowledge about improved cultivation practices in onion by providing updated information. Thus, there is urgent need to enhance the good communication, training and extension system to make the farmers aware about latest innovations related in the locale. With this approach, the knowledge of the both categories of the farmers can be improved. Along with the changing situation, the people also need to acquire new knowledge, skills and attitude to keep up with the changing environment. Hence farmers need to be convinced about the positive consequences and benefits of knowing and using improved onion cultivation practices in order to enhance the knowledge level of onion farmers.

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Short Communication

Participation of the Members of Self Help Groups of Jorhat District of Assam in Different Entrepreneurial Activities

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ABSTRACT

Entrepreneurial activities is defined as those activities through which an entrepreneur organizes and manage the selected activities which are related to skill/activities of an entrepreneur such as managerial and marketing activities. The study was carried out in the Jorhat district of Assam. Four Blocks were selected from National Rural Livelihood Mission (NRLM) initiative blocks. Thus all total 16 Self Help Groups were selected from these blocks for the present study. Ten members from 16 SHG's, total 160 members were selected using simple random sampling for the study. From the study, it was observed that majority (46.00 %) of the members of SHG had medium level of participation in managerial activities. Majority (51.00 %) of the respondents had medium level of participation in marketing activities. A highest percentage (48.00%) of the respondents had medium level of participation in the selected entrepreneurial activities. It can be concluded that majority of the respondents had medium level of participation in terms of selected entrepreneurial activities in managerial and marketing activities.

Keywords: Entrepreneurial activities, Managerial activities, Marketing activities, Self help groups

Entrepreneurship and innovation are priority areas for Assam as they offer opportunities to overcome the current crisis, increase global competitiveness and ensure sustainable and profitable growth (Homolova *et al.*, 2013). Moreover, entrepreneurship is regarded as "the heart of innovation, productivity growth, competitiveness, economic growth and job creation" (Grilo and Thurik, 2006), being associated with personal success. Entrepreneurship is the dynamic process of creating incremental wealth and wealth is created by the person who can take the major risks in terms of equity, time and career commitment of providing value to some product or service. Bolton and Thompson (2000) have defined an entrepreneur as "a person who habitually creates and innovates to build something of recognized value around perceived opportunities".

From different research study we were found that lots of SHG have been formed and engaged in micro finance transaction only. They do not go for any enterprise creation. Now it has been realized that sustainability of Self Help Group is possible through inoculation of the entrepreneurial behavior, participation of members of SHG in different entrepreneurial activities and qualities among the members of SHG. Therefore, an attempt is very urgent to explore the extent of participation of members of SHG in different entrepreneurial activities and to help the policy makers as well as extension functionaries to use appropriate methods of interventions for improving the participation of SHG members. Keeping this in view, the present study was designed to find out the extent of participation of the members of Self Help Group in different entrepreneurial activities.

The study was carried out in the state of Assam which is situated in the north east part of India. A purposive cum random sampling design was followed for the present study. Jorhat district was purposively selected for the present study. Blocks will be selected from National Rural Livelihood Mission (NRLM) initiative blocks. NRLM has clustered all blocks of Jorhat district into 6 blocks. Out of the 6 blocks, 4 blocks were selected purposively. A list of SHG from each selected blocks who had continuously functioning for the last 10 years and engaged in some entrepreneurial activities were prepared. From the list four SHG favorable were selected by using simple random sampling method. Thus all total 16 Self Help Groups were

selected for the present study. After selection of the SHG, 10 members from each SHG were selected using simple random sampling for the study. Thus a total of 160 respondents were taken as a sample for the study.

Interview schedule were designed and used to collect information according to the objective of the study. The data were collected through structured interview schedule and analysed with the help of frequency distribution, Friedman test, mean and standard deviation. The data presented in Table 1 indicates that a large majority of the members of the SHG were sometimes involved in product preparation (87.50%), execution of plan of work (74.40%), keeping records of selling of products (78.10%), maintaining savings bank account (66.90 %) and promotion of prepared products (86.30%). Further it was seen that more than 70.00 per cent of the members were always involved in sharing information (82.50%) and motivation the group members (74.40%). It was also seen that a majority (80.00%) of the members never participated in making strategy for future work plan, selection of products (68.10 %), monitoring of the quality of products (72.50 %) and maintaining of the stock book (75.60 %).

Figure 1 shows that majority (46.00%) of the members of SHG had medium level of participation in managerial activities followed by 33 per cent and 21.00 per cent had low level of participation and high level of participation

Table 1: Distribution of respondents according to the extent of participation in managerial activities (N = 160)

S.No.	Managerial activities	Category	Frequency	Percentage
1.	Selection of products	Never	109	68.10
		Sometimes	45	28.10
		Always	6	3.80
2.	Executing the plan of work.	Never	25	15.60
		Sometimes	119	74.40
		Always	16	10.00
3.	Product preparation	Never	12	7.50
		Sometimes	140	87.50
		Always	8	5.00
4.	Monitoring of the quality of product	Never	116	72.50
		Sometimes	39	24.40
		Always	5	3.10
5.	Keeping records of selling of the products	Never	17	10.60
		Sometimes	125	78.10
		Always	18	11.30
6.	Sharing information	Never	14	8.80
		Sometimes	14	8.80
		Always	132	82.50
7.	Motivating the group members.	Never	18	11.30
		Sometimes	23	14.40
		Always	119	74.40
8.	Making strategy for future work plan	Never	128	80.00
		Sometimes	26	16.30
		Always	6	3.80
9.	Maintaining the stock book.	Never	121	75.60
		Sometimes	30	18.80
		Always	9	5.60
10.	Maintaining savings bank account.	Never	3	1.90
		Sometimes	107	66.90
		Always	50	31.30
11.	Promotion of prepared products.	Never	10	6.30
		Sometimes	138	86.30
		Always	12	6.30

Table 2: Distribution of the respondents according to the participation in marketing activities (N = 160)

S.No.	Marketing activities	Category	Frequency	Percentage
1.	Market survey	Never	16	10.00
		Sometimes	138	86.30
		Always	6	3.80
2.	Identification of market place	Never	111	69.40
		Sometimes	43	26.90
		Always	6	3.80
3.	Purchase of raw materials	Never	20	12.50
		Sometimes	33	20.60
		Always	107	66.90
4.	Keeping records of the products.	Never	17	10.60
		Sometimes	135	84.40
		Always	8	5.00
5.	Collection of fund	Never	17	10.60
		Sometimes	132	82.50
		Always	11	6.90
6.	Fixation of price of the item	Never	123	76.90
		Sometimes	32	20.00
		Always	5	3.10
7.	Distribution of work	Never	17	10.60
		Sometimes	131	81.90
		Always	12	7.50
8.	Promotion of marketing	Never	4	2.50
		Sometimes	44	27.50
		Always	112	70.00
9.	Arrangement of finance	Never	100	62.50
		Sometimes	40	25.00
		Always	20	12.50
10.	Procurement of raw materials	Never	40	25.00
		Sometimes	95	59.37
		Always	25	15.62

in managerial activities respectively. This might be due to regular contact with the concerned Community Resource Person (CRP). The data presented in Table 2 indicates that a large majority of the members of the SHG were sometimes involved in taking responsibility in market survey (86.30%), keeping records of the products (84.40%), collection of fund (82.50%) and distribution of work (81.90%) and procurement of raw materials (95.00%).

Further, it was seen that a very high percentage of the members always involved in promotion of marketing (70.00%) and in purchase of raw materials (66.90%). It was also seen that a majority (76.9 %) of the members never participated in fixation of price of the item (76.90%), identification of market place (69.40%) and arrangement of finance (62.50%). From Figure 2 shows that majority (51.00%) of the respondents had medium level of participation in marketing activities followed by 29.00 per cent of the respondents who never participated in the marketing activities. A low percentage of the respondents (20.00%) always participated in marketing activities. Such level of participation among the SHG members might be due to the fact that they do not have adequate support and guidance in terms of information and technology and they have been pursuing their enterprise with whatever entrepreneurial qualities existed in them of their own efforts and limited support.

From Figure 3 it shows that a highest percentage (48.00%) of the respondents had medieval level of participation in the selected entrepreneurial activities followed by a percentage of 31.00 per cent who never participated in the selected entrepreneurial activities. A low percentage of the respondents (21.00%) had high level of

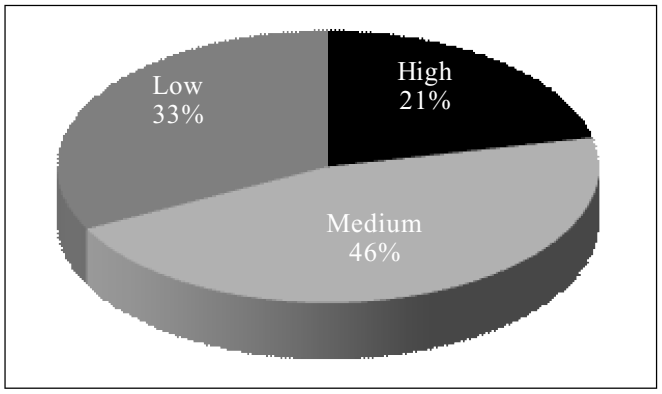

Figure 1: Overall participation in managerial activities

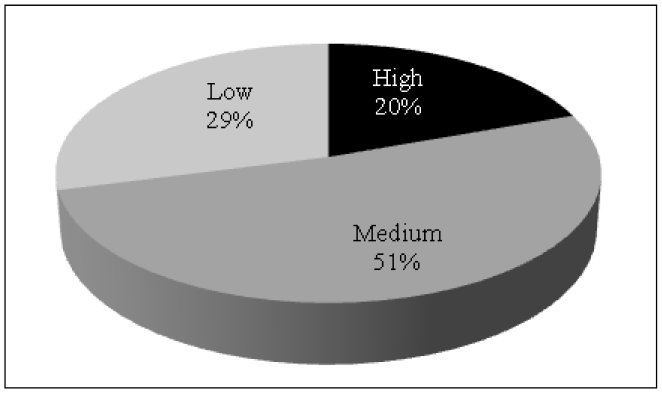

Figure 2: Overall participation in marketing activities

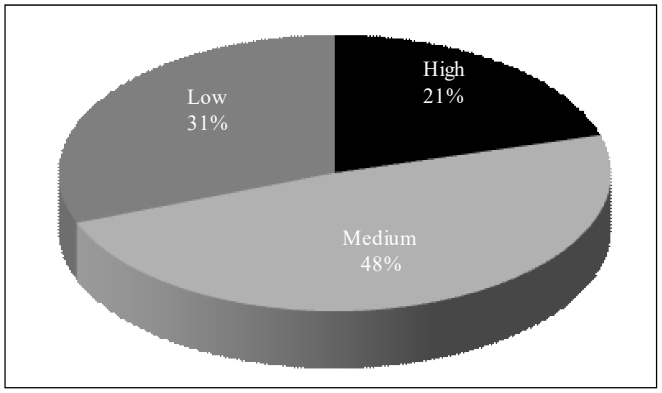

Figure 3: Overall extent of participation of the respondents

participation in the selected entrepreneurial activities. It can be concluded that most of the members were dedicated to their services in different entrepreneurial activities to meet their additional demand of the family and strong motivation through timely receiving training has lead to an increase in the attitude, knowledge and skills of the members and also helped them in knowing the benefits of joining in different income generating activities in the self help groups.

CONCLUSION

From the above findings it can be concluded that a large majority of the members of the SHG were sometimes involved in product preparation, execution of plan of work, keeping records of selling of products, maintaining savings bank account and promotion of prepared products. A large percentage of the members of SHG have medium level of participation in managerial activities. A highest percentage of the members of the SHG were sometimes involved in taking responsibility in market survey, keeping records of the products, collection of fund and distribution of work and procurement of raw materials. Nearly fifty percent of the members of SHG had medium level of participation in managerial activities. More than fifty percent of the respondents had medium level of participation in marketing activities. A highest percentage of the respondents had medium level of participation in the selected entrepreneurial activities. From the above findings it can be recommended that there is a need to establish a linkage between enterprises run by women and Government organizations and NGO's for marketing of their products. Members of the SHG's should be given exposure visit to industries and marketing agencies, small scale industries to improve their quality and exchange their ideas. Proper technical guidance should be given to the SHG members based on their need and interest.

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