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Reorienting Priorities of Extension and Advisory Services in India during and Post COVID-19 Pandemic: A Review

Mahesh Chander¹ and Prakashkumar Rathod^{2*}

ABSTRACT

Extension and Advisory Services (EAS) are delivered by millions of extension professionals representing the public, private and civil society located across the globe and have been helping in addressing farmers' needs over the years, including during COVID-19 pandemic situation. However, public sector has been a major agency dealing with EAS in India and is facing several challenges and constraints to fulfil the demands of farmers on timely basis. The challenge today is to change the organizational culture to incorporate innovation as a core value and to institutionalize the emerging paradigms. Further, different strategies and measures need to be taken to ensure timely and quality EAS by reorienting extension priorities in such emergency situations and later too. In this context, an effort to review the extension mechanism across India and also has focused on reorienting extension priorities post COVID-19 scenario. The study has highlighted on strengthening extension and feedback mechanism, improving research-extension linkages, capacity building, public-private partnership (PPP), developing infrastructure, mass media support and use of Information and Communication Technologies (ICTs) etc. to improve the efficiency as the time demands. The paper concludes that reorienting extension priorities is very essential with a vast network of various stakeholders by adapting effective approaches like utilization of social media, human resource development, PPP, farmer groups etc. during and post pandemic scenario. Further, empirical efforts are also needed to develop reliable, location-specific, participatory, gender-sensitive and inexpensive extension methodologies and materials to meet the demands during such crisis. Further, developing countries like India have to invest in terms of various resources like financial, human resource etc. for promoting higher productivity and sustainability through EAS.

Keywords: Extension priorities, Extension and Advisory Services (EAS), Public-Private Partnership (PPP), Research-Extension Linkages, COVID-19 Pandemic

INTRODUCTION

Extension and Advisory Services (EAS) across the world have been helping in addressing farmers' needs over the years. However, as the world struggles to fight the pandemic, farmers across the globe face the dual burden of inadequate health services coupled with timely extension services for sustaining their livelihoods (FAO, 2020). Further, it has also been reported that about 3–6

per cent increase in total production value could be achieved if only EAS services are provided the way farmers want on real time basis (World Economic Forum, 2018). Although EAS are delivered by millions of extension professionals representing the public, private and civil society located across the globe, public sector has been a major agency dealing with EAS in India. However, Swanson and Mathur (2003) depicted narrow focus of extension, lack of farmers involvement in extension

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programme planning, supply rather than market driven extension, lack of transparency and accountability, inadequate technical capacity, lack of local capacity to validate and refine technologies, inadequate communication capacity and inadequate operating resources and financial sustainability as other major challenges for Indian extension system. Further, a study conducted by Babu *et al.* (2012) indicated that quality and reliability of public extension system is still a constraint while, Rivera and Sulaiman (2009) indicated that public-sector extension agencies and extension workers are finding it difficult to translate their roles from the classical model of agricultural extension to the innovation system perspective. Slathia *et al.* (2012) stressed that to maintain trust among the farming community requires induction of professionally qualified personnel and their regular trainings.

Owing to static and inflexible nature of the organizations, where a top-down hierarchical approach continues (Raabe, 2008), farmers' see the quality of the information provided by the public extension staff as a major shortcoming (GOI, 2005) and information flow is considered to be supply driven and not need-based or area-specific (Raabe, 2008). Also, in a developing country like India, extension models are usually top-down structures, often located within the ministry of agriculture, not usually formally associated with universities (Boone 1989) and therefore, have poor linkages with research and extension. In this context, there must be innovations in EAS delivery that embrace different methods and offer flexible adaptations to cater to the needs of users across states, regions, and communities (Glendenning *et al.*, 2010). The challenge is to change the organizational culture to incorporate innovation as a core value and to institutionalize the emerging paradigms into research for development processes. Further, different strategies and measures need to be taken to ensure timely and quality EAS by reorienting extension priorities in such emergency situations and later too.

Need and Importance for Reorienting Priorities

EAS in the past have helped countries move towards meeting food needs, conserving natural resources and developing human and social capital. However, the need

for new extension functionalities and job charts are echoed all over the world. Especially, the small holder farmers need real time solutions and become connected to the service providers (even at affordable costs). Over last few months, many organisations have realized that there's need for innovation and functional transformation to mitigate the crisis. Suddenly, there is a demand for shift in the approach of EAS from traditional face-to-face farm advisory to support farmers with marketing and use of ICTs in supply chain management. In this context, EAS organizations need to innovate continuously with the better functionalities like data driven personalized services in credit, insurance, markets, inputs supplies, aggregation models, traceability etc. (Meera, 2020) and improve the efficiency as the time demands. There are other aspects of transformation that should be simultaneously taken care such as building appropriate infrastructure with proper scales of economy, building relevant capacities of extension professionals, integrating the complex digital processes into the basic agricultural workflows etc. (Meera, 2020). In this context, different strategies and measures are necessary to reorient extension priorities and ensure food security. Also, as large numbers of migrants are returning to their respective villages, active support of the agriculture and allied departments in the states need to be emphasized at all levels. Hence, reorienting extension priorities is very essential with a vast network of various stakeholders involved in research, extension, education, marketing, agro-processing etc.

Changing Priorities of Extension and Advisory Services during and Post COVID-19

The authors have made an effort to identify the extension mechanism followed across India during COVID-19 pandemic scenario and also have focused on reorienting extension priorities post COVID-19 scenario. Some of the important components have been discussed in following section.

1. Strengthening Extension and feedback mechanism: The extension wing at different levels is looking after activities and ensures effective coordination with all agencies like ATMA, KVK, programmes and schemes of Extension. These agencies shall liaison and

encourage participation of private organizations and NGOs for their active involvement in delivery of extension services. Problems which need new technology to confront crisis have to be addressed and communicated as feedback to researchers. Such feedback in general is often missing due to poor linkage and feedback mechanism among research, extension and farmers leading to poor dissemination of agricultural technologies from researchers to farmers. Based on the farmers' feedback, the research can be field tested by various interdisciplinary teams on location and resource specific scientific recommendations. The feedback from multi-stakeholders in generation, development and transfer of technologies is highly necessary in the present scenario.

2. Improving Research-Extension linkages: The public system heavily suffers from failures of various issues like infrastructure, weak linkages and market structure failures. Hence, to improve the relevance, effectiveness, and efficiency of research outputs, stronger linkages are needed between the performers of research and its end users in the region. Developing a social network involving all the stakeholders of EAS for timely information dissemination to all agricultural subsectors is very essential at this point of time. An interaction between different multi-stakeholders should be organised at the grassroot levels to establish policy dialogues and programme plans for the future (Rathore *et al.*, 2008). The experimentation through social media with innovative farmers not only helped in scaling the farmers' innovations but also institutional innovations at large and hence, the potential of social media need to be exploited to bring location specific and commodity oriented transformative changes in the agriculture extension delivery system (Nain *et al.*, 2019).

- **Promotion of direct interface between farmers and scientists:** There are relatively high costs attached to this direct mode of technology transfer and the outreach of scientists is limited. State and region level meetings between line departments and universities must be activated in the existing interface mechanisms. In these changing times, online media may be emphasized for organizing such meetings and activities.
 - **Research priority setting based on SREP:** Micro-level extension strategies reflected in the Strategic Research and Extension Plans (SREPs) based on PRA and developed jointly by the district technology teams including the marketing department officials and scientists of the KVKs/ZRS or SAUs should formally feed back into the research systems. Participatory Technology Development is another way of connecting farmers with the scientists thus leading to need based researches.
- 3. Capacity Building in Extension:** Three fourth respondents feels that even the education system cannot afford lock down (Bhati *et al.*, 2020), an optimal requirement of human resource to support various programmes must be worked out and steps can be taken to generate the same through involvement of Government Agencies, reputed NGOs and private sector. As a consequence of the pandemic, many young people and women need to be empowered to lead farming as heads of their households.
- **Diploma Courses:** The Diploma holders can supplement the efforts of extension officers at the grassroot level by providing practical production guidelines to both, commercial and small-scale farmers helping them towards developing a sustainable agriculture and allied sector enterprise.
 - **Training of Para-professionals:** The training programmes for para-professionals and similarly placed personnel must be undertaken on regular basis.
 - **Entrepreneurship and Vocational Training:** Vocational training of rural youths and farm women in the areas of agriculture and allied sector needs to be augmented. There are various enterprises, which can be practiced on commercial scale and can be started with small investment on scientific lines by the rural youth.
 - **Farmers' training and Farmer led approach:** Farmers' training and demonstration needs may be assessed in participatory mode so that area specific tailor-made training programmes are designed by effective linkages of organizations depending on

socio-economic background of the farmers. Progressive farmers after various scientific orientations can be encouraged to act as extension agents by giving them due recognition.

- **Merging of Extension with other activities:** It is very pertinent to note that any programme can be successful when it is merged with extension activities. A carefully designed extension education campaign initiated before and after by the professional extension personnel would be highly beneficial.

4. Gender and Extension: Since there is a strong informal association of rural women with agriculture and livestock, it is necessary to create matching programmes and budgeting for women. The conventional training and extension programmes must be oriented to suit women also. It would be more effective, if women Extension workers disseminate the technologies to the women farmers both in formal and informal mode. Further, with a group mobilization approach few leading women farmers may be trained for transfer of technologies and deployed as link women extension functionaries between farmers and Department/NGO personnel.

5. Developing infrastructure in extension: The single-discipline, single-commodity based approach gradually must be replaced by an integrated systems-oriented research which demands high extension infrastructure at all the levels from village to central government and universities. The training infrastructure, by and large, is very poor in terms of facilities like hostel, classrooms, laboratories, audio-visuals, farms etc. There is a need to have equipments for print, photostat, content development and validation mechanism and printing of extension literature at state and central headquarters and universities. Further, equipments like display boards, audio-visual aids and mobile extension vehicles may also be needed at the institution or college level to reach the farmers. In this era of pandemic, the globe has realized the importance of online tools and media in transferring and sharing information apart from networking.

6. Role of public-private partnership in Extension: The public-private partnerships which do not exist effectively (Singh *et al.*, 2013) can be one of the best

modes of strengthening linkages among various stakeholders for effective research and extension activities. In this context, public-private partnerships should be the thought pattern and 'method of choice' underpinning the government's stance in extension. The ICAR draft policy of November 2012 recommends evolving appropriate models of public private partnership (ICAR, 2012). As per NASSCOM's 2019 report, India is home to more than 450 agritech start-ups, growing at 25 per cent annually and hence, new digital partnership may evolve among different agencies or start-ups for improving the impact of EAS (Meera, 2020). There is an interesting collaboration that was forged during COVID 19 i.e., between the multi-national Bayer and a Pune-based e-commerce firm AgroStar to deliver its products like seeds and pesticides to farmers (New Indian Express, 2020). Farmer gets services such as seeds and crop protection products along with the knowledge intensive advisories. AgroStar is fulfilling farmers' orders through its 500+ strong network of last mile delivery partners, who are doing doorstep delivery of agri-inputs while following hygiene and social distancing norms (New Indian Express, 2020). Experiences of institutional convergence of synergistic strengths illustrated the need for working together in spirit and action for translating maximum benefits and sustainable growth (Singh *et al.*, 2014)

7. Extensionists' competency development: Though the extension system has taken many pro-active measures to help farmers, there is a need for more involvement and formulation of innovative practices to enable them to address different challenges. EAS providers need to be properly equipped so as to address changes in the development scenario, as well as to meet the emerging demands and needs of farmers and FPOs, especially on agribusiness, value addition, and marketing (Wadkar, 2020). Extensionists need to be trained on next generation extension tools and media. COVID-19 like situations demands more knowledge and skills in social media and its uses, including the current tools, methods and models for crisis communication. Extensionists need to be equipped to use Facebook, WhatsApp, Twitter, YouTube, etc. They need to learn and master skills to disseminate information and monitor, track, measure, and analyse

social media traffic (Chander, 2020a). Besides, skills in mobilizing farmers and facilitating interaction are very much needed to secure coordination of different agencies to broker gains for farmers. Input output transactional costs can be reduced and social participation can be increased as a results of farmers' organisation into commodity groups (Parthiban *et al.*, 2018).

8. Mass Media Support & Use of Information and Communication Technologies (ICTs): ICTs have created positive impact on income growth in developing and developed countries (Waverman *et al.*, 2005). In rural areas, ICTs can raise incomes by increasing agricultural productivity (Lio and Liu, 2006) and introducing income channels other than traditional farm jobs. Studies depicted that ICTs can improve incomes and quality of life among the rural poor (Goyal, 2010; Jensen, 2007). In this context, an effort to deliver information to rural masses through ICT, free or at nominal cost, can increase the timely and transparent flow of information to build or strengthen the innovation networks among different stakeholders (Chander and Rathod, 2015). Further, ICT's can also revolutionize the interaction through Information Kiosks, Telecentres, toll-free Call Centres, websites, mobile phones software applications etc. New advanced instruments like Personal Digital Assistants may be provided to the Extension agents for technical information, communicating, field recording, database maintenance and scheduling. It is important to use ICT in combination with the more traditional extension methods such as mass media, group meetings, field days, demonstrations and exchange visits with the objective to make the information available to all the stakeholders very effectively, efficiently and quickly. Community radio is also doing tremendous service during the lockdown by organizing pertinent programmes in local dialects, which makes them effective in conveying the desired information (Chander, 2020b). Partnering with community radio stations to broadcast information to farmers would be beneficial to their production. The scope of social media in offering EAS is tremendous during COVID-19 pandemic situation. Social media such as WhatsApp, Telegram, Facebook and YouTube are successfully used by extensionists to offer EAS. Plethora of studies have already indicated the benefits of using social media like whatsapp, youtube,

telegram etc. (Thakur and Chander, 2018; Dileepkumar, 2020 and Tamizhkumaran and Saravanan Raj, 2020) but needs to emphasised on priority basis. Webpages of official websites of EAS offering institutes, containing advisory information on different relevant topics is being made directly accessible at free or very nominal cost. Hence, there is a need to synthesize learnings from different success stories and case studies and translate them into digital extension frameworks to formulate better extension strategies and policies. Extensive adoption of digital technology in EAS has been very successful during this pandemic and needs to continue in future too.

9. Market driven approach: Production and marketing of agricultural and allied sector products through creation of basic market facilities and market information for the farmers is very essential. As Swanson (2009) has pointed out that market-oriented extension is relevant in economies that are experiencing growth and changes in consumer preferences that create markets for high-value products, India can be effective in making some of their extension market-driven. Although creation of market or linkage with markets has been emphasized long before, but linking producers and small farm businesses to market and input agencies was very poor over the years. However, with an online marketing platform, the agricultural produce can also be traded at a location or with a buyer of choice. Farmers are being encouraged to use e-NAM facilities and hedge through futures and increased use of warehouse receipts (Prasad, 2020). A massive scaling up of a federal e-commerce platform for farmers and traders, known as the Electronic National Agricultural Markets or e-NAM, has given much needed impetus to the cause of smallholder farmers (Hindustan Times, 2020). There are currently 166,000 registered farmers across the country selling their produce by transacting from home and practising social distancing, with nearly half of the country's 1500 major farm-end commodity markets now going online. With more than 785 markets connected online, the e-NAM platform of India is considered one of the largest online agricultural produce market platforms (Hindustan Times, 2020). In the same way, market is also created through various social media tools like Facebook, WhatsApp etc. and needs to continue post pandemic situation.

10. Role of Farmer producer Organizations (FPO) and Farmers Groups/associations:

The extension approach needs to be changed from individual to group or association approach to have effective decision making. The Interest Groups, SHGs or Cooperatives have been very successful models for effective production or marketing. In the similar way, farm women or youth may also be promoted in the form of Joint Liability Groups for effective production and marketing. Very recently, FPOs have become an integral part of coordination and convergence of EAS along with ATMA and KVK in the district during this crisis. This has become a mechanism at district level through which FPOs are involved in accepting and sharing in the times of COVID-19. The Indian government directed state governments to make efforts to connect FPOs to the processing industry, exporters, bulk buyers and big retailers to maintain the supply line. This will help FPOs get remunerative prices for their produce and help track transportation online. Various state governments allowed FPOs to sell their produce by facilitating packaging, transport and marketing of their produce by relaxing limitations and providing certificates to them. Farmers' organizations and agro-dealers (small-scale operations that stock farming inputs) also play a key role in bridging extension services to farmers, especially when they are already equipped with ICT tools. In Maharashtra, for example, 265,000 farmers' organization members are using WhatsApp for exchange and learning purposes (Even and Nyathi, 2020). Further, this is also the time for strengthening and gearing up farmers groups and cooperatives to play a major role in aggregation and distribution of agriculture and allied farm produce. Some of the examples in different states of India (Nikam and Kale, 2020; Kanatt and Jos, 2020; Patil *et al.*, 2020 and Shabong, 2020) depict the fact that multistakeholder linkages and ICT can successfully benefit the farmers. The potential of FPOs and cooperatives needs to be effectively utilized by EAS to help farmers sell their products and share information and updates on farming post pandemic scenario also.

11. Farmers as Extension Agents: The extension systems must promote innovative farmers to play local "farmer professor" roles to scale up the enterprises among different groups of farmers which can lead to

effective market-driven extension system (Davis *et al.*, 2010). The experienced farmers in Indian context needs to be encouraged to act as EAS providers with very nominal incentives. These farmers who stay in their own villages act as resource persons in villages and need not depend on the external extension agents regularly. In some situations, if the movement of project staff and government extension agents is restricted, the services of these farmers may be utilized for EAS by preparing pre-recorded videos and picture-based materials to provide quality training to their peers in the villages. Further, these farmers can also conduct trainings and field visits of their peers in smaller groups, following COVID-19 guidelines.

12. Role of Institutions and Organizations: Since the extension efforts by ICAR institutes have very limited reach (Chander *et al.*, 2010), efforts for effective university curricula involving farmers, private sector and other organizations can be planned. In this context, different universities or institutions and their associated KVKs are issuing location specific advisories on crop, livestock, fisheries and related matters using information and communication technologies (ICTs). Also, several information related to markets, availability of critical inputs, maintaining social distance, facilitating the installation of Aarogya Setu app, immunity enhancing protocol, etc. are being shared by these institutions. Interestingly, extension organizations in last few months have tried to solve immediate problems of farmers through online mode. The pandemic has compelled extension organizations and personnel to explore different online channels to remain connected with the farmers and other stakeholders. EAS is increasingly depending on these online resources indicating the fact that digital extension efforts have been emphasized during this pandemic. However, the organizations and institutions need to continue these transformational changes in EAS post pandemic. These universities and institutions may establish internship and exchange programmes for undergraduate and post graduate student with a task to develop different extension models and improve their performance to bring them on par with private organizations. Further, these institutions need to have package of practices including "Do's & Dont's" which farmers can follow to confront the crisis and also should have provision to update them regularly.

13. Investment in EAS: The economic studies from developing and developed countries have indicated that high monetary returns to extension activity (Gill 1991, Chand *et al.*, 2011) provide solid evidence as investment with high returns. However, in recent years, the GOI has spent only about 0.14% of Agricultural Gross Domestic Product (GDP) on extension services (Chand *et al.*, 2011). Further, in case of animal husbandry, Chander and Rathod and (2013) have recommended that each State should create an extension and training wing at state headquarters with regional/local wings, staffed and equipped with trained livestock extension specialists, audio-visual (AV) equipment and mobile publicity vans along with budgetary allocations of at least 10% of the departmental budget for extension activities. Hence, in the present situation, the government have to invest considerable budget for EAS in the years to come.

14. Strengthening Government Schemes and programmes: Post-pandemic, the demand for agricultural products is expected to increase with a major focus on health-conscious population. It is also good time to bring primary processing and marketing facilities closer to the farm gates and help producers gather market intelligence and manage the value chain better with digital agriculture tools. In this context, significant funds (Rs. 1 lakh crore) have been allocated for building infrastructure projects. Similarly, Rs 10,000 crore has been announced for the formalisation of micro food enterprises and Rs 20,000 crore for the Pradhan Mantri Matsya Sampada Yojana for the development of marine and inland fisheries. Most of these announcements are meant for developing infrastructure in marketing and processing, which may take much longer than expected (The Wire, 2020). However, the immediate challenges are in terms of providing EAS and village-level marketing and logistic solutions.

Government programs like PDS, MDM, and ICDS are the best possible delivery channels to leverage healthier and nutritious food products in India. Further, MGNREGA is also one of the solutions for time being to employ the labourers who has returned to their villages due to lockdown. As a safety net, MGNREGA guidelines have to be modified and permission given to use the programme's labour in farm related marketing activities.

The huge number of migrants that have returned home due to lockdown (resulting in reverse migration) should also be provided opportunities to work as labourers under MGNREGA. Further, EAS agencies also needs to educate the farmers about machineries for smooth procurement and marketing operations apart from information about different inputs and their role in farm production.

CONCLUSION

The authors have made an effort to review the extension mechanism followed across India and also have focused on reorienting extension priorities post COVID-19 scenario. The paper has highlighted on strengthening extension and feedback mechanism, improving research-extension linkages, capacity building, public-private partnership (PPP), developing infrastructure, mass media support and use of Information and Communication Technologies (ICTs) etc. to improve the efficiency as the time demands. The study concludes that reorienting extension priorities is very essential with a vast network of various stakeholders by adapting effective approaches like utilization of social media, human resource development, PPP, farmer groups etc. during and post pandemic scenario. Further, empirical efforts are also needed to develop reliable, location-specific, participatory, gender-sensitive and inexpensive extension methodologies and materials to meet the demands during such crisis. Further, developing countries like India have to invest in terms of various resources like financial, human resource etc. for promoting higher productivity and sustainability through EAS.

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Perception and Economic Impact of Agromet Advisory Services: A Case Study of Thrissur AICRPAM Centre of Kerala State

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ABSTRACT

This research explored the awareness, perception and economic impact of micro-level Agromet Advisory Services (AAS) issued by All India Coordinated Research Project on Agrometeorology of Indian Council of Agricultural Research through its 25 cooperating centres located across the country. Micro-level advisory based on weather forecast is the innovative and first of its kind in the country. Studies on economic impact of these micro-level advisories were uncommon. The study was conducted using field survey to assess the perception and economic impact of micro-level AAS at Thrissur AICRPAM centre on pilot basis. Two categories viz. AAS and non-AAS farmers, consisting of 40 farmers in each category were selected through multi-stage stratified random sampling technique. The probit regression model was employed to assess the factors determining willingness to pay (WTP) for AAS. The results revealed that 55% of AAS farmers rated the advisories as 'very good' on the scale of very poor to very good. Non-AAS farmers lagged in both awareness and adoption of services when compared to AAS farmers. Farmers' age, education and land holding size were found to be most important factors influencing farmer's willingness for pay-based services. Economic impact revealed that there was increase of 19-34 percent of income for AAS farmers in comparison to non-AAS farmers.

Keywords: Advisory service, Economic impact, Micro-level Agromet, Perception, Weather forecast

INTRODUCTION

Weather is one of the most important factor determining success and failure of agricultural production in India. It manifests its influence on agricultural operations and farm production through its effects on soil and plant growth. Weather through various atmospheric factors plays a significant role in reaping good agricultural output (Bal and Minhas, 2017). Variable and uncertain weather is a pervasive fact that farmers have to cope up and this has bearing on the livelihoods of farmers. Lack of timely and reliable agrometeorological information is a serious limitation for effective farm planning operations

(Prasad Rao and Manikandan, 2008) and could lead to significant crop losses. The loss in agricultural production could be minimized through timely and accurate weather forecast. An agriculturally relevant forecast is not only useful for efficient management of farm inputs but also leads to precise impact assessment (Gadgil, 1989). Hence, improved weather based Agromet Advisory Services (AAS) greatly helps farmers to take advantage of favourable weather and mitigate the impacts of external weather situation. The AAS provide a very special kind of inputs to farmers as advisories that can make tremendous difference to the agricultural production by taking the advantage of benevolent weather and minimize

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the adverse impact of malevolent weather. Further, weather forecast and weather based agromet advisories also help in increasing the economic benefit to the farmers with appropriate crop management practices (Ramachandrappa, 2018). Weather forecast and advisories helps to increase the crop production, reduce losses, reduce risks, reduce cost of inputs, improve the quality of yields, increase resource use efficiency and reduce pollution as a result of judicious use of agricultural chemicals.

The collaboration of India Meteorological Department (IMD) with National Centre for Medium Range Weather Forecasting (NCMRWF) has adopted district level AAS for disseminating medium range weather forecast information to farmers. However, validity of such services disseminated to district level has some limitations, particularly in view of large variability in terms of crops, varieties and spatial weather anomalies at this level. Considering the variability of weather, climate and soil, the Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad pioneered in starting flagship research programme of the Indian Council of Agricultural Research (ICAR) named National Innovations in Climate Resilient Agriculture (NICRA). As part of this project, the All India Coordinated Research Project on Agrometeorology (AICRPAM) took up a pilot project during 2010 to develop and disseminate micro-level AAS through its 25 cooperating centres spread across the country towards enabling capacity building of farmers for climate resilience (Vijayakumar *et al.*, 2017). The key attributes of micro-level AAS include preparation and dissemination of bi-weekly advisories to farmers based on the forecasted weather data of IMD in consultation with KVK Subject Matter Specialists (SMS) and Field Information Facilitators (FIF) at village level. It has been critical in instrumentalising the farmers to adjust their production plan in favour of optimum production. The studies on economic impact assessment of these micro-level advisories are uncommon. Therefore, the present study was conducted through field survey to assess the economic impact of micro-level AAS at Thrissur centre of AICRPAM on pilot basis.

METHODOLOGY

The study was based on primary data collected from 80 farm households chosen through multi-stage random sampling technique. The primary data was collected from farmers through a pre-tested interview schedule. District to which AICRPAM centre was catering AAS services was the first stage of sampling unit and taluka within the district was the second stage of sampling unit. Villages within the taluka were divided into two groups' viz., villages with AAS and village without AAS adoption for the comparative study. The final selection units i.e. farmers were divided into three groups (strata) based on size of land holding (small, medium and large). Out of 25 AICRPAM centres located across the country, Thrissur centre was selected for present study on pilot basis. In Thrissur AICRPAM centre, Mukundapuram taluka was randomly selected under which two villages namely *Puthenchira* as an AAS adopted village and *Vellangallur* as AAS non-adopted village was selected. For the study purpose, 40 adopter and 40 non-adopter in two different villages were selected. Further, care was also taken for selection of villages to ensure the similar socio-economic condition and resource base in the villages for comparison purpose. The analytical tool used includes descriptive statistics such as frequency; percentage and tabular analysis. The perception of farmers about AAS was measured on very poor to very good scale. The probit regression model was employed to assess the factors determining the willingness to pay for AAS services. With the objective of estimating the farmers willingness to pay (WTP) for AAS services and factors influencing decision of farmer, a probit regression model was used for the study. In the binary probit model, willingness to pay for service was taken as 'one', while unwillingness to pay as 'zero'. The independent variables considered in the study were age of the farmers, family size, educational level, farming experience, land holding size, income and gender of the farmers.

Probit regression model was presented as follows;

$$WTP = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + e_i$$

Where,

b_0 = Intercept, X_1 = Age of the farmer (years), X_2 = Size of the family (number of members), X_3 = Dummy variable for education level (Educated =1, Not educated =2), X_4 = Farming experience (years), X_5 = Land holding size (ha), X_6 = Level of income in percentage, X_7 = Dummy variable for gender (male =1, female =2), e_i = Error term.

RESULTS AND DISCUSSION

The socio-economic characteristics of the farm households have differential impact on farmers' perception about AAS and his/her capacity to adopt to it (Table 1). The results of socio-economic characteristics of respondents revealed that 60 per cent of AAS farmers were old aged while more than half of sample farmers

Table 1: Socio-economic characteristics of farm households in study area (n=80)

S.No.	Particulars	Category	AAS Farmers		Non-AAS Farmers	
			<i>f</i>	%	<i>f</i>	%
1.	Age (years)	Young (<35)	06	15.0	12	30.0
		Middle (36-45)	10	25.0	22	55.0
		Old (> 46)	24	60.0	06	15.0
2.	Education	Illiterate	03	7.5	15	37.5
		Primary	16	40.0	09	22.5
		Higher secondary	13	32.5	11	27.5
		Graduation	08	20.0	05	12.5
3.	Gender	Male	29	72.5	27	67.5
		Female	11	27.5	13	32.5
4.	Family size	Small (up to 5)	19	47.5	09	22.5
		Medium (6 to 8)	13	32.5	20	50.0
		Large (> 9)	08	20.0	11	27.5
5.	Family type	Nuclear family	30	75.0	26	65.0
		Joint family	10	25.0	14	35.0
6.	Farming experience	Low (up to 15 years)	12	30.0	13	32.5
		Middle (16-25 years)	10	25.0	16	40.0
		High (> 25 years)	18	45.0	11	27.5
7.	Social participation	Yes	16	40.0	09	22.5
		No	24	60.0	31	77.5
8.	Land holding (ha)	Marginal & small	13	32.5	17	42.5
		Medium	17	42.5	16	40.0
		Large	10	25.0	07	17.5
9.	Access to irrigation	Yes	23	57.5	20	50.0
		No	17	42.5	20	50.0
10.	Farmers' income (Rs)	Less than 50,000	09	22.5	13	32.5
		50,000-100,000	14	35.0	11	27.5
		Above 100,000	17	42.5	16	40.0
11.	Off-farm occupation	Yes	15	37.5	17	42.5
		No	25	62.5	23	57.5
12.	Institutional credit	Yes	19	47.5	14	35.0
		No	21	52.5	26	65.0

Source: Field survey data

were in middle aged in non-AAS category. The age of farmers usually represents his experience in farming and old aged farmers are expected to have high experience and knowledge about farming and associated risks involved in it. Nearly one-third of AAS farmers possessed higher secondary education while more than one-third of non-AAS farmers possessed primary education in the study area. Farming experience was higher in case of AAS farmers (45%) as compared to non-AAS farmers (27.5%). The access to irrigation water was marginally higher among AAS farmers (57.5%) in comparison to non-AAS farmers (50%). Agriculture was the primary source of income to both the categories of farmers. More than one-third of farmers in both categories were engaged in off-farm employment for their alternative source of income. More than half of the AAS and two-third of non-AAS farmers did not have access to institutional credit.

The results of farmer's awareness about AAS at Thrissur AICRPAM centre shown in Figure 1 reveals that nearly 73 per cent of AAS farmers were fully aware about the AAS services and 20 per cent of farmers were partially aware about the services while only around seven percent of AAS farmers were unaware about the services. On the other hand, more than half (52.5%) of non-AAS farmers were unaware about the AAS disseminated by the centre while less than one-fourth of non-AAS farmers fully aware about the service. It was also revealed from the results that farmers availed the AAS services through different mode of communication (Figure 2). The major source of information were AAS

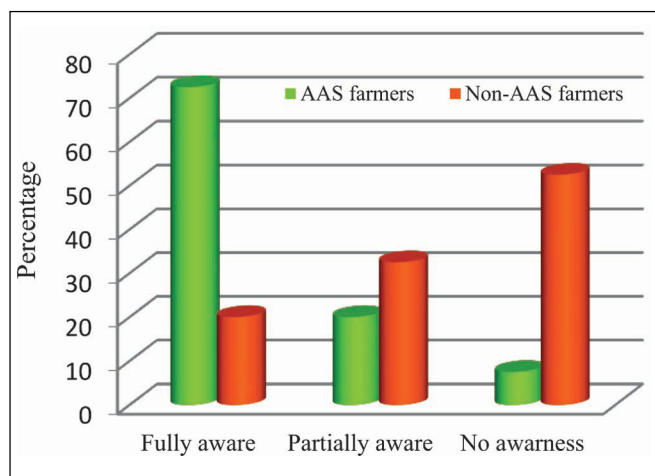


Figure 1: Awareness about AAS among respondent farmers

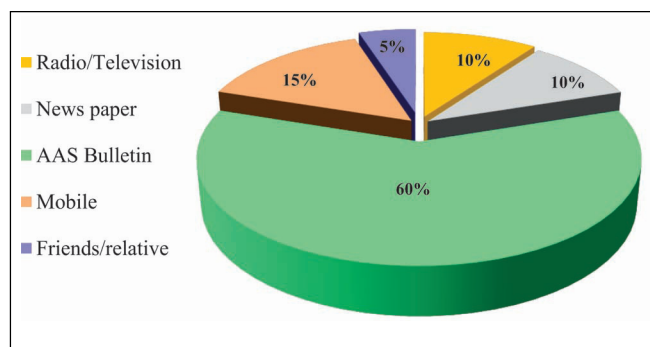


Figure 2: Source of information for AAS

bulletin published and issued by the centre (60%) followed by mobile communication (15%). AAS bulletins were published in regional language (Malayalam) which helped the farming community to understand and follow easily. In addition, Farmers also got registered their mobile number at AICRPAM centre for dissemination of need based advisories through their mobiles.

From the Table 2, it is inferred that more than half of AAS farmers (55%) rated the agromet advisory services as 'very good' on the scale of very poor to very good. Rana *et al.* (2005) reported that 38 per cent of farmers rated agromet advisories as excellent and 29 per cent of farmers rated good in mid hill region of Himachal Pradesh. About 85 per cent of farmers agreed on essentiality of AAS and believed that advisories based on predicted rainfall event is very much helpful in their farm activities followed by advisories based on the predicted temperature. These results are in conformity with studies of Maddison (2006). More than 75 per cent of farmers perceived that AAS was beneficial and it helped in reducing the costs in agricultural production and more than two-third of farmers perceived that AAS was useful in reducing irrigation charges as AAS helps to plan farm activities timely as per the weather and rainfall advisory issued by the centre well in advance. 60 per cent of farmers also perceived that AAS was helpful in managing pest and diseases during cropping season. Majority of farmers (82.5%) opined that real time AAS was critical at sowing stage as dissemination of need based weather advisories prior to cropping season particularly information on timely rainfall, temperature and humidity helped farmers to plan their farm activities timely and accurately. About 75 per cent of farmers perceived that micro-level

Table 2: AAS farmer's perception about agromet advisories issued by AICRPAM centre

Farmers perception	f	%
Perception about AAS		
Very poor	03	7.5
Poor	06	15.0
Good	09	22.5
Very good	22	55.0
Necessity of AAS		
Yes	34	85
No	06	15
For which weather parameter AAS is essential		
Rainfall	36	90.0
Temperature	30	75.0
RH	19	47.5
Wind velocity	10	25.0
Benefit of AAS		
Yes	32	80
No	08	20
Which way you are benefited from AAS		
Reducing cost during sowing	30	75.0
Managing pest and disease	24	60.0
Avoid post-harvest losses	16	40.0
Reducing irrigation charges	27	67.5
At what stage of crop AAS is essential		
Sowing stage	33	82.5
Flowering stage	25	62.5
Harvesting stage	20	50.0
Quality of AAS information disseminated		
Good	32	80.0
Average	05	12.5
Poor	03	7.5
Frequency of forecasting		
Daily	02	05.0
Weekly	10	25.0
Bi-weekly	28	70.0
Monthly	00	00.00
Willingness for pay based services		
Yes	12	30
No	24	60
Undecided	04	10
Overall satisfaction from AAS		
Yes	30	75
No	10	25

AAS disseminated through AICRPAM centres was accurate, timely available and 70 per cent of farmers opined that bi-weekly forecast information was good as it is helped to take short term decision on farming activities. Further, farmers' willingness to pay for AAS indicates that less than one-third of farmers were willing to pay for services as majority of respondents were small and marginal farmers with scarce farm resource and not in position to pay for service. From results, it is also revealed that 75 per cent of AAS farmers were presently satisfied with micro-level AAS issued by the AICRPAM centre.

The results of economic impact indicated that there was a considerable benefit to farmers who adopted and followed weather advisories from time to time issued by the Thrissur AICRPAM centre. The percent gain in income from different crops by the AAS farmers was to the tune of 34 percent in case of paddy to 19 per cent in coconut crop over non-AAS farmers (Table 3). The net income realized by AAS farmers was more as compared to non-AAS farmers which was mainly attributed to timely adoption of weather advisories and better crop management practices. The actual yield increased due to adoption of advisories was to the extent of 2.31 q/ha in paddy and 400 nuts/ha in case of coconut. A study conducted at Uttara Kannada district of Karnataka indicated that actual yield increased due to adoption of advisories was to the extent of 2 to 3 q/ha in crops like paddy, arecanut and banana and the yield increased in case of mango was 25 q/ha (Manjappa and Yeledalli, 2013). The higher net income and reduced cost of different crops under AAS category was also evident from the benefit cost ratios arrived from the results. Further, larger income and lower cost of production in case of AAS farmers was also due to judicious use of farm inputs based on the real time agromet advisories. Therefore, it can be concluded that timely weather forecast and related advisories issued by the centre benefitted the farming community. Rajegowda *et al.* (2008) reported that farmers who adopted the agromet advisories have realized an average economic benefit of 31.4, 24.7, 16.2 and 20.6 per cent in finger millet, red gram, field bean and tomato respectively in the Eastern dry zone of Karnataka.

Table 3: Economics impact of micro level AAS on crop productivity and income

Particulars	Paddy		Coconut	
	AAS farmers	Non-AAS farmers	AAS farmers	Non-AAS farmers
Variable Cost (Rs/ha)				
Seed	1640	1720	1580	1525
FYM and Fertilizers	3070	3725	12662	15330
Pesticides	1095	1876	1692	1965
Intercultural operations	-	-	1300	1700
Weedicide	900	1200	24725	25840
Human labour	16657	16140		
Bullock labour	250	290	-	-
Mechanical/Tractor	4185	4150	-	-
Harvesting	1000	1150	1895	2325
Other expenses	-	-	2150	2930
Cost of Cultivation (Rs/ha)	28797	30251	46004	51615
Returns				
Yield of main crop (q/ha)	25.37	23.06	6500*	6100*
Yield of inter crop (q/ha)	-	-	-	-
Price of main crop (Rs/q)	1800	1800	15**	15**
Price of inter crop (Rs/q)	-	-	-	-
Value of the main product (Rs/ha)	45666	41508	97500	91500
Value of the by-product (Rs/ha)	4375	4582	4225	6940
Gross returns	50041	46090	101725	98440
Net Returns	21244	15839	55721	46825
B:C Ratio	1.74	1.52	2.21	1.91

*Number of nuts per ha, ** Rupees per nut

The factors influencing the farmers' willingness to pay (WTP) for AAS were determined through probit regression model. The results indicated that age of farmer; education level and size of land holding were important factors that significantly influenced the farmers' willingness to pay for the services (Table 4). Further, all the three socio-economic variables such as age of farmer, education level and land holding size positively affected WTP for the services as evident from significant and positive coefficient (slope) of regression model and also demonstrated one to one relationship which denotes that higher the age, education level and size of land holding, then higher will be the WTP for the services.

Table 4: Probit model for factors determining farmer's willingness-to-pay (WTP) for AAS

Variable	Estimated coefficient	Std error	t-ratio
Constant	1.760	1.060	1.660
Age	0.458	0.145	3.158***
Gender	-0.056	0.030	-1.866
Education level	0.984	0.402	2.447**
Family size	0.023	0.170	0.135
Land holding size	0.217	0.094	2.308**
Farming experience	-0.044	0.388	-0.113
Income level	0.366	0.421	0.869

Note: * and **Significant at 0.05% level and 0.01% respectively; df = 7; Chi-squared = 51.75.

CONCLUSION

The micro-level AAS of Thrissur AICRPAM centre has helped in bringing out substantial awareness among farmers about adoption of weather based advisories through their timely availability and quality of the service. The perception about advisories issued by AICRPAM centres was very good and positive among AAS farmers. It helped the adopted farmers to take appropriate decision about their farm planning and better crop management thereby efficient utilization of existing farm resources. The economic impact study revealed that there were considerable benefits to farmers who adopted need based weather advisories regularly issued by AICRPAM centre as compared to non-adopted farmers. The study also revealed that micro-level AAS played imperative role in improving the productivity and farm incomes of those who adopted the AAS. However, majority of AAS farmers perceived that their willingness to pay for the services was low and they were ready to use advisories free of cost due to their farm resource constraints.

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Entrepreneurial Profile and Constraint Analysis of Farm and Non-farm Sectors Entrepreneurial Training Programmes in Krishi Vigyan Kendra and Rural Development & Self Employment Training Institute

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ABSTRACT

Even though research has proven beyond all reasonable doubt that entrepreneurship can boost the economy of many nations, this has not been true for many due to the challenges which impede entrepreneurship programmes in both farm and non-farm sectors. A study was therefore conducted with the aim of analyzing these constraints. An interview schedule was used to collect information from 120 entrepreneurs, (60 farm and 60 non-farm entrepreneurs). Result shows that the mean age of farm entrepreneurs was 38 years whereas the mean age for non-farm entrepreneurs was 28 years. In RUDSETI farm sector, more than three-fifths (66.6%) of the entrepreneurs had an annual income of less than 1 lakh whereas, in the non-farm sector, half (50.0%) of the entrepreneurs had an annual income of more than 3 lakh. Similarly in KVK, farm sector, close to half (46.7%) of the entrepreneurs had an annual income of more than 3 lakhs whereas in the non-farm sector close to half (46.7%) of the entrepreneurs had an annual income of 1-2 lakh. In RUDSETI farm and non-farm sector, all (100.0%) and half (50.0%) of the entrepreneurs had 1-3 years of entrepreneurial experience respectively. Similarly in KVK farm and non-farm sectors, 53.3 per cent and 76.7 per cent of the entrepreneurs had an entrepreneurial experience of 1-3 years respectively. It was found that the highest-ranked constraint in the farm sector was lack of market information (71.0%) and lack of financial resources (69.5) whereas in the non-farm sector, it was observed that the constraint which had the highest rank was lack market information (68.1) and lack of financial resources (63.4%).

Keywords: Employment, Entrepreneurship, Participant observation, Training, Youths

INTRODUCTION

Entrepreneurship programme plays a pivotal role in boosting the economy of many nations. Owing to the numerous challenges that are facing agriculture today such as agricultural policy reforms, climate change, dwindling budget for agriculture, changing social, political and economic conditions for farming, and the development of new global markets, entrepreneurship development among farmers is key to survive in agricultural development. Entrepreneurship is a key factor for the survival of small-scale farming in an ever-changing and

increasingly complex global economy (FAO, 2012). In many developing countries, there is a huge rate of unemployment among youths and many live in rural areas. Entrepreneurship could help provide jobs for a countless number of them. Despite this critical role, SME's are faced with tremendous challenges which tend to hinder not only their growth but keeps some out of business and the ones which struggle to survive, do so at a very slow pace.

To ensure sustainable growth in the farm sectors and hence a high contribution to employment and economic

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growth, entrepreneurship should be encouraged among youths in the farm and non-farm sectors. According to Suleiman (2006), entrepreneurship refers to a person's willingness and ability to seek for investment opportunities, establish and successfully run an enterprise. Nwangwu (2006) noted that entrepreneurship is the willingness and the ability of an individual or a firm to identify an environmental change and exploit such an opportunity to produce goods and services for public consumption. An entrepreneur is a determined and creative leader, always looking for opportunities to improve and expand his business. An entrepreneur likes to take calculated risks and assumes responsibility for both profits and losses. An entrepreneur is passionate about growing his business and is constantly looking for new opportunities (FAO, 2012). Many efforts have been made by the Government of India and other organizations to boost entrepreneurship among farm and non-farm entrepreneurs. However, the desired result and success rate has not been actualized. This is partly due to several constraints limiting entrepreneurship development. The authors, therefore, carried out this study to identify those constraints, how it affects enterprises and suggests possible ways by which such constraints can be mitigated. If these constraints are not identified and minimize, the impact of entrepreneurship development and management will not produce the desired or anticipated results.

METHODOLOGY

The study was conducted at Krishi Vigyan Kendra Shikohpur (Gurugram), Haryana State and RUDSETI Ghaziabad Uttar Pradesh State. The two states were purposively selected due to their closeness to the national capital Delhi and their active role in the conduction of entrepreneurship training in both farm and non-farm sectors over the years. Indian Council of Agricultural Research (ICAR) established Krishi Vigyan Kendra (KVK) at Shikohpur Gurugram, Haryana State in the year 1984. Since the establishment of the KVK, it has transformed the lives of many farmers and non-farmers through vocational training for rural youths, training for practicing farmers and farm women as well as in-service training for agricultural extension functionaries. KVK has the units like; vermicomposting unit, nursery unit, basic

plant healthcare unit, value addition unit, rainwater harvesting unit, IFS demonstration unit & minimal agro-processing unit, diary unit, mushroom unit, and azola unit. RUDSETI is an NGO which works in the field of capacity building of unemployed rural youth aged between 18 to 45 years through Entrepreneurship Development Programmes. It has established 26 units across 16 states in India with its headquarter located at Ujire in Dakshin Kannada district of Karnataka. On an average, around 71 per cent of the RUDSETI trained candidates successfully establish self-employment venture. RUDSETI training Institute Ghaziabad is located at Dasna, district Ghaziabad. It is well known for its efforts in conducting diverse training programmes for youths since 1984 and located at a strategic location to serve two districts, namely, Ghaziabad and Hapur (Sinha, 2016). Since its inception, it has served as an entrepreneurship and skills training institute for several youths who have gained meaningful self-employment ventures. Purposive sampling technique and random sampling were used for the study. A list of ex-trainees who have established enterprises (both farm and non-farm ex-trainees) was obtained from RUDSETI and KVK. At the first stage, farm and non-farm entrepreneurs were purposively selected who had undergone training and have set up and running an enterprise for the past three years. Sixty (60) trainees were randomly selected from each of the training institutes, that is, 30 such entrepreneurs from the farm sector and 30 entrepreneurs from the non-farm sector making a sample size of 120 entrepreneurs for the study. Primary data was obtained from the entrepreneurs using a semi-structured interview schedule which was personally administered to the entrepreneurs. Secondary data was obtained using post-training reports, personal interview with successful entrepreneurs and annual reports. Data was analyzed using SPSS, descriptive statistic and non-parametric methods. Garrett ranking was done used to rank constraints faced by farm and non-farm entrepreneurs. This is a method used to find out the most significant factor which influences the respondent. As per this method, respondents have been asked to assign the rank for all factors and the outcomes of such ranking have been converted into score value with the help of the following formula:

$$\text{Percent position} = \frac{100 (R_{ij} - 0.5)}{N_j}$$

Where,

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

N_j = Number of variable ranked by j^{th} respondents.

With the help of Garrett's Table, the per cent position estimated was converted into scores. Then for each factor, the scores of each individual were added and then the total value of the scores and mean values of the score was calculated. The factors having the highest mean value was considered to be the most important factor.

RESULTS AND DISCUSSION

From Table 1, it is found that in RUDSETI farm sector, majority (70.0%) of the entrepreneurs were in the medium age category, 20 per cent were in high age category and only 10 per cent of the entrepreneurs were in the low age category. For the non-farm sector, it was observed that majority (66.67%) of the entrepreneurs were in the medium age category, 20 per cent were in the low age category and 13.3 per cent of the entrepreneurs were in the high age category. Similarly in KVK farm sector, majority (63.3%) of the entrepreneurs was in the middle age category, 20.0 per cent were in the high age category whereas only 16.7 per cent were in the low age category. In KVK non-farm sector, majority (60.0%) of the

Table 1: Socio-demographic characteristics of entrepreneurs (n=60)

Age	RUDSETI (Ghaziabad)		KVK (Shikohpur)	
	F	NF	F	NF
	f(%)	f(%)	f(%)	f(%)
Low	3(10.0)	6(20)	5(16.7)	6(20.0)
Medium	21(70.0)	20(66.67)	19(63.3)	18(60.0)
High	6(20.0)	4(13.33)	6(20.0)	6(20.0)
Gender				
Male	0(0.0)	21(70.0)	26(86.7)	21(70.0)
Female	30(100.0)	9(30.0)	4(13.3)	9(30.0)
Marital Status				
Unmarried	0(0.0)	4(13.3)	3(10.0)	14(46.7)
Married	30(100.0)	26(86.7)	27(90.0)	16(53.3)
Family Size				
Less than 4 members	4(13.3)	7(23.3)	14(46.7)	9(30.0)
4 - 6	17(56.7)	17(56.7)	14(46.7)	21(70.0)
6 - 8	9(30.0)	5(16.7)	2(6.6)	0(0.0)
8 - 10	0(0.0)	1(3.3)	0(0.0)	0(0.0)
Income				
Less than 1 lakh	20(66.6)	0(0.0)	0(0.0)	6(20.0)
1-2 lakhs	8(26.7)	5(16.7)	10(33.3)	14(46.7)
2-3 lakhs	2(6.7)	10(33.3)	6(20.0)	10(33.3)
More than 3 Lakhs	0(0.0)	15(50.0)	14(46.7)	0(0.0)
Entrepreneurial Experience				
1-3 years	30(100.0)	15(50.0)	16(53.3)	23(76.7)
4-7 years	0(0.0)	11(36.6)	12(40.0)	7(23.3)
8-11 years	0(0.0)	2(6.7)	2(6.7)	0(0.0)
12 and above	0(0.0)	2(6.7)	0(0.0)	0(0.0)

entrepreneurs were in the middle age category, 20 per cent each of the entrepreneurs were in the low and high age categories. Mean age of farm entrepreneurs was 38 years whereas the mean age for non-farm entrepreneurs was 28 years regardless of the location. Even though results show that there is an active workforce comprising of young people which may positively impact their enterprises, however, there were more young entrepreneurs in the non-farm sector than in the farm sector. This supports the fact that farm enterprises are not as attractive to young people and are willing to leave agriculture if other options are available. This may be because of the risk associated with farm enterprises and the gestation period between establishment and profit realization. This finding was in line with the result of Sinha (2016) who reported a mean age of 32 for farm trainees and 28 for non-farm trainees. Similarly, Sushma (2007) reported that majority (68.46%) of the women EDP trainees were of young age group (less than 35 years) and Banerjee (2011) reported that 66 per cent of sampled EDP trainees were in the age bracket of 18 to 30 years. Hatch and Zweig (2000) concluded that anyone can become an entrepreneur despite age. Likewise, a related stream of research by Moore *et al.* (2008) established that there are no specific guidelines or rules concerning the right age for one to start an enterprise.

It was revealed that in RUDSETI farm sector, all entrepreneurs (100.0%) were female and none was male, whereas in the sector, majority (70%) of the entrepreneurs were male and only 30 per cent of the entrepreneurs were female. Similarly in KVK farm sector, majority (86.7%) of the entrepreneurs were male, 13.3 per cent of the entrepreneurs were female whereas in the non-farm sector, majority (70.0%) of the entrepreneurs were male and 30 per cent of the entrepreneurs were female. Results show that in RUDSETI farm sector, there were more female entrepreneurs. This may be as a result of special enterprise programmes that are designed especially for female entrepreneurs to empower women to be self-reliant. However, this was a different case for the RUDSETI non-farm sector as well as farm and non-farm sectors in KVK, in which majority of the entrepreneurs were male. This may be since men are

the household heads and breadwinners of most homes at the same time. Sinha (2016) had reported a higher percentage (56.90%) of male involvement in EDP than female (43.10%) whereas Banerjee (2011) reported 58.38 for male and 41.62 for female participation in EDP programmes.

Furthermore, it was observed in RUDSETI farm sector that all (100%) of the entrepreneurs were married whereas in the non-farm sector majority (86.7%) of the entrepreneurs were married and 13.3 per cent of the entrepreneurs were unmarried. Similarly, in the KVK farm sector, majority (90.0%) of the entrepreneurs were married whereas 10.0 per cent of the entrepreneurs were unmarried. In the non-farm sector of KVK, it was observed that more than half (53.3%) of the entrepreneurs were married whereas 46.7 per cent of the entrepreneurs were unmarried. This may be since married couples find it easier to establish and maintain an enterprise as they get mutual support from each other and contribute to the development of their welfare. The findings of this research are in line with that of Sinha (2016) who reported that majority of the EDP trainees were married regardless of farm or non-farm in different locations. Sarri and Trihopoulou (2005) reported that most of those entering into business were married.

It was found that in RUDSETI farm sector, slightly more than half (56.7) of the entrepreneurs have a family size between 4-6 member, 30 per cent of them had a family size between 6-7 members and only 13.3 per cent of the entrepreneurs had a family size of less than 4 members. In the non-farm sector, slightly more than half (56.7%) of the entrepreneurs had a family size between 4-6 members, 23 per cent of the entrepreneurs had a family size of less than 4 members, 16.7 per cent of the entrepreneurs had a family size between 6-8 members and only 3.3 per cent of the entrepreneurs had a family size between 8-10 members. Similarly in KVK farm sector, less than half (46.7%) of the entrepreneurs had a family size between 4-6 and fewer than 4 members in each case, and only 6.6 per cent of the entrepreneurs had a family size between 6-8 members. In the non-farm sector, majority (70.0) of the entrepreneurs had a family size between 4-6 members, and 30.0 per cent of the

entrepreneurs had a family size of fewer than 4 members. Many studies have reported a family size of fewer than five members including Sinha (2016). This is due to the nuclear type of family that is encouraged in the study area. However, in this study the family size of majority of the entrepreneurs was between 4-6, this may be as a result of the nature of their enterprises which require additional support from family members. Finding was in line with that of Benerjee and Benerjee (2012) who reported that 55.08 per cent of the sampled trainees had a family size ranging from 4 to 6 members.

It is clear that in RUDSETI farm sector, more than three-fifth (66.6%) of the entrepreneurs had an annual income of less than 1 lakh, 26.7 per cent of them had an annual income of 1-2 lakh and only 6.7 per cent of the entrepreneurs had an annual income of 2-3 lakh. In the non-farm sector, half (50.0%) of the entrepreneurs had an annual income of more than 3 lakh, 33.3 per cent of them had an annual income of 2-3 lakh, and only 16.7 per cent of the entrepreneurs had an annual income of 1-2 lakh. Similarly in KVK farm sector, close to half (46.7%) of the entrepreneurs had an annual income of more than 3 lakhs, 33.3 per cent of them had an annual income of 1-2 lakh, and 20 per cent of the entrepreneurs had an annual income of 2-3 lakh. In the non-farm sector close to half (46.7%) of the entrepreneurs had an annual income of 1-2 lakh, 33.3 per cent of them had an annual income of 2-3 lakh and only 20.0 per cent of the entrepreneurs had an annual income less than one lakh. In this study, it is seen that annual incomes were considered low for farm entrepreneurs from RUDSETI where they were high for those in KVK. This may be due to innovative and modern technologies used by KVK farm entrepreneurs such as protected cultivation, vermicomposting and mushroom cultivation. The annual income of entrepreneurs in the RUDSETI non-farm sector seems to be higher than those in the KVK, this may be due to the nature of enterprises of RUDSETI non-farm entrepreneurs and type of exposure and access to various opportunities. This was slightly different from the findings of Sinha (2016) who reported that nearly half of the respondents had an annual income of range 1-2 lakhs. Similar findings were reported by Banerjee (2011) and Badatya and Reddy (2008).

It was revealed that in RUDSETI farm sector, all (100.0%) of the entrepreneurs had 1-3 years of entrepreneurial experience. In the non-farm sector, half (50.0%) of the entrepreneurs had 1-3 years of entrepreneurial experience, 36.6 per cent of them had 4-7 years, equal proportion (6.7%) each had an entrepreneurial experience of 8-11 years and 12 years and above. Similarly in KVK farm sector, more than half (53.3%) of the entrepreneurs had an entrepreneurial experience of 1-3 years, 40.0 per cent of them had an entrepreneurial experience of 4-7 years and only 6.7 per cent of the entrepreneurs had an entrepreneurial experience of 8-11 years. In the non-farm sector, majority of the entrepreneurs (76.7%) had an entrepreneurial experience of 1-3 years and more than one-fifth (23.3%). This shows that most of the entrepreneurs in the study area were young entrepreneurs who are still in the early stages. Entrepreneurial experience is very much vital to the success of an enterprise. The experience could either influence an entrepreneur positively or negatively (Janssen, 2003). This is because the experience can either help the manager to avoid problems or quickly solve previously encountered problems. Lee and Tsang (2001) suggested that most studies confirmed a positive relationship between the entrepreneur's prior experience and survival of their businesses. Henry *et al.* (2003) reported that work experience is considered an important factor in entrepreneurial success, especially if the experience is in the specific industry sector of the proposed business venture.

Constraints for farm and non-farm sector

From Table 2, it was observed that in the farm sector, major constraints observed were lack of market information (75.0%), lengthy procedure for sanctioning loan in banks (85.0%), lack of financial resources (61.7%), middlemen share of profits (61.2%), transportation problem (50.0%), lack of storage facilities (46.7%), lack of knowledge and skills about modern technologies (43.3%), complex rules and procedures of government (36.7%), no access to new technologies (33.3%) and inadequate institutional support (26.7%).

It is seen from Table 3, that in the non-farm sector, major constraints observed were lengthy procedure for

Table 2: Constraints for farm sector

S.No.	Constraints	Frequency (N=60)	Percentage (%)
1.	Marketing information	45	75.0
2.	Lack of financial resources	37	61.7
3.	Lack of infrastructural facility (storage)	28	46.7
4.	Lack of knowledge and skills about modern technologies	26	43.3
5.	Lengthy process of loan sanctions in bank	51	85.0
6.	Transportation problem (non-motorable)	30	50.0
7.	Middlemen share of profit	37	61.2
8.	Access to new technologies	20	33.3
9.	Inadequate institutional support	16	26.7
10.	Complex rules, regulations and procedures of the Government education	22	36.7

Table 3: Constraints for non-farm sector

S.No.	Constraints	Frequency (N=60)	Percentage (%)
1.	Marketing information	40	66.7
2.	Lack of financial resources	27	45.0
3.	Lack of infrastructural facility (storage)	32	53.3
4.	Lack of knowledge and skill about modern technologies	42	70.0
5.	Lengthy process of loan sanctions in bank	45	75.5
6.	Transportation problem (non-motorable)	32	53.3
7.	Middlemen share of profit	20	33.3
8.	Access to new technologies	40	66.7
9.	Inadequate institutional support	18	30.0
10.	Complex rules, regulations and procedures of the Government education	30	36.7

sanctioning loan in banks (75.5%), lack of knowledge and skills about modern technologies (70.0%), lack of market information (66.7%), no access to new technologies (66.6%), lack of storage facilities (53.3%), transportation problem (53.3%), lack of financial resources (45.0%), complex rules and procedures of government (36.7%), middlemen share of profits (33.3%), and inadequate institutional support (30.0%).

Garrett Ranking of Constraints for farm and non-farm Sector

Results from Table 4 revealed that the highest-ranked constraint in the farm sector was lack of market information (71.0%), lack of financial resources (69.5),

lack of infrastructural facility especially storage facilities (62.4%), lack of knowledge and skill about modern technologies (61.8%), lengthy process of loan sanctions in bank (50.7%), transportation problem (47.9%), middlemen share of profit (43.9%), access to new technologies (42.7%), inadequate institutional support (35.1%), and complex rules, complex rules of government education (30.3%)

From Table 5, it can be observed that the constraint which had the highest rank in the non-farm sector was lack market information (68.1). This was followed by lack of financial resources (63.4%), lack of knowledge and skill about modern technologies (62.9%), lack of infrastructural facility (58.9%), complex rules, regulations

Table 4: Garret ranking of constraints for farm sectors

S.No.	Constraints	Total Score	Mean Score	Rank
1.	Marketing information	4262	71.0	I
2.	Lack of financial resources	4172	69.5	II
3.	Lack of infrastructural facility (storage)	3744	62.4	III
4.	Lack of knowledge and skill about modern technologies	3708	61.8	IV
5.	Lengthy process of loan sanctions in bank	3040	50.7	V
6.	Transportation problem (non-motorable)	2872	47.9	VI
7.	Middlemen share of profit	2634	43.9	VII
8.	Access to new technologies	2564	42.7	VIII
9.	Inadequate institutional support	2108	35.1	IX
10.	Complex rules, regulations and procedures of the Government education	1820	30.3	X

Table 5: Garret ranking of constraints for non-farm sector

S.No.	Constraints	Total Score	Mean Score	Rank
1.	Marketing information	4084	68.1	I
2.	Lack of financial resources	3806	63.4	II
3.	Lack of infrastructural facility (storage)	3536	58.9	IV
4.	Lack of knowledge and skill about modern technologies	3774	62.9	III
5.	Lengthy process of loan sanctions in bank	2986	49.8	VII
6.	Transportation problem (non-motorable)	2154	35.9	X
7.	Middlemen share of profit	2454	40.9	IX
8.	Access to new technologies	3216	53.6	VI
9.	Inadequate institutional support	2958	49.3	VIII
10.	Complex rules, regulations and procedures of the Government education	3244	54.1	V

and procedures of government education (54.1%), access to new technologies (53.6%), lengthy process of loan sanctions in bank (49.8%), inadequate institutional support (49.3%), middlemen share of profit (40.9%), and transportation problem (35.9%).

It is clear from the investigation that market information and lack of financial resources were ranked highest in both farm and non-farm sectors. Market information is indeed a major constraint which hinders entrepreneurs. Since they may not be aware of the prevailing market prices, middlemen may take advantage of this and reap them off the profit that they are supposed to get. Similarly, lack of financial resources can limit entrepreneurs not to be able to expand their enterprises or diversify or even take more risk in trying new ventures.

These constraints may have limited entrepreneurs from succeeding or making more wins. Findings of this study were similar to that of Obele-Agu Nzebulo (2003) who reported that major constraints limiting entrepreneurship development were inadequate capital, incompetent management, lack of technological and infrastructural facilities are the common problems, among others. Sushma (2007) in her findings suggested that major factors inhibiting establishment and development of an enterprise were more competition (78.46%), inadequate publicity (74.61%), lack of market facility (39.23%), lack of guidance (27.69%) and lack of timely availability of loan from the bank (27.69%). Report by Asian Development Bank (ADB, 2005) found that constraints to the growth of SMEs were credit rationing, high cost of credit and lease financing, high compliance cost, inadequate

infrastructure, poor skill and training, high market and transaction cost, and judicial constraints. Adekunle *et al.* (2009) from his study listed the various reasons for lower participation of youth in the agriculture sector which include high risks, huge investment costs, lack of funding and incentives, inadequate information, policy inconsistency, ineffective marketing, and its labour-intensive nature. Banerjee (2011) in his study reported that major factors inhibiting establishment and development of an enterprise by EDP trainees were more competition (78.46%), inadequate publicity (74.61%) and lack of market facility (39.23%). Other studies like Gupta *et al.* (2013); Das *et al.* (2014); Paul *et al.* (2015) and

Baliwada *et al.* (2017) enlisted different type of constraints in one or either setting.

From Table 6, it can be clearly observed that majority (81.7%), (70.0%) and (61.7%) of the entrepreneurs had suggested that continuous skill building and training about modern technologies should be done, market information should be provided and transportation facilities should be provided respectively. More than half (53.3%) of the entrepreneurs had suggested that interest rates should be reduced in banks to enable many people to have access to a loan. Half (50.0%) of the entrepreneurs each had suggested that training programmes should be flexible,

Table 6: Suggestions for overcoming problems (farm sector)

S.No.	Suggestions	Frequency (N=60)	Percentage (%)
1.	Marketing information should be provided	42	70.0
2.	Interest rates should be reduced in banks	32	53.3
3.	Lengthy procedures should be reduced	25	41.6
4.	Storage facilities should be provided	27	45.0
5.	Continuous skill building and training about modern technologies	49	81.7
6.	Entrepreneurship mentorship should be provided for start-ups	30	50.0
7.	Transportation facilities should be provided	37	61.7
8.	Market linkage to eliminate middlemen	21	35.0
9.	Access should be increased to new technologies	15	25.0
10.	Institutional support should be provided	20	33.3
11.	Training programmes should be flexible	30	50.0

Table 7: Suggestions for overcoming problems (non-farm sector)

S.No.	Training Methods	Frequency (N=60)	Percentage (%)
1.	Marketing information should be provided	37	61.7
2.	Interest rates should be reduced in banks	30	50.0
3.	Lengthy procedures should be reduced	30	50.0
4.	Storage facilities should be provided	39	65.0
5.	Continuous skill building and training about modern technologies	42	70.0
6.	Mentorship to young entrepreneurs	32	53.3
7.	Transportation facilities should be provided	22	36.7
8.	Market linkage to eliminate middlemen	40	66.7
9.	Access should be increased to new technologies	16	26.7
10.	Institutional support should be provided	28	46.7
11.	Training programmes should be flexible	32	53.3

and mentorship should be provided for young entrepreneurs. Close to half (45.0%), (41.6%) of the entrepreneurs had suggested that storage facilities should be provided and lengthy procedures for obtaining bank loans reduced respectively. 35 per cent of the entrepreneurs had suggested that market linkages should be provided, 33.3 per cent of them had suggested that institutional support should be provided and 25.0 per cent of the entrepreneurs had suggested that access should be increased to new modern technologies.

From Table 7, it can be observed that majority (70.0%), (66.7%), (65.0%) and (61.7%) of the entrepreneurs had suggested that continuous skill building and training about modern technologies should be done, market linkages should be provided to eliminate middlemen, storage facilities should be provided, and marketing information should be provided respectively. Equal proportion (53.3%) each had suggested that training programmes should be flexible and mentorship should be provided to young entrepreneurs. Similarly, equal proportion (50.0%) each had suggested that interest rates should be reduced in banks as well as lengthy procedures for obtaining bank loans. 46.7 per cent of the entrepreneurs had suggested that institutional support should be provided, 36.7 per cent of the entrepreneurs had suggested that transportation should be provided and 26.7 per cent of the entrepreneurs had suggested that there should be accessible to new and modern technologies. Singh *et al.* (2014); Singh *et al.* (2015) and Nain *et al.* (2019) also suggested institutional support for maximizing farm profits and entrepreneurship development in agriculture.

CONCLUSION

Since majority of the farm and non-farm entrepreneurs were in the medium age category, it is obvious that young entrepreneurs are more likely to take a risk and try new innovations and strategies that could overcome the barriers and limitations. This is because age is in their favour and if things do not work, they will always go back to the drawing board, unlike old people. They should therefore be encouraged by removing some of the bottlenecks that can hinder the growth and progress of farm and non-farm entrepreneurs. The entrepreneur-

ship climate and enabling environment need to be created that will ignite the spirit of entrepreneurship among young entrepreneurs. Favourable policies need to be put in place that will favour agricultural entrepreneurship especially in rural communities where most rural youths live and are deprived off basic amenities. Young entrepreneurs should be provided with start-up capital, mentoring and handholding opportunities, market linkages and good storage infrastructure to ensure that post-harvest losses are minimized. If these constraints are minimized, entrepreneurship has the tendency to reduce unemployment among rural youths and contribute immensely to economic growth and development.

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Vocational Trainings for Economic and Psychological Empowerment of Farm Women: A Study of Nainital District

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ABSTRACT

Various organization and institutes have taken the responsibility to train rural women in different sectors. Krishi Vigyan Kendras are working at grassroot level to empower the women in agriculture and allied fields by imparting training in different subject matter areas. KVK, Jeolikote had played significant role in improving the conditions of hill women and the study conducted in Nainital district falls in its jurisdiction. Data from 90 selected respondents shows significant difference between beneficiaries and non-beneficiaries in the level of economic & psychological empowerment. Three forth of the beneficiaries had high level of empowerment whereas only 15.55 per cent of non-beneficiaries were having high level of empowerment. Majority of beneficiaries had high expenditure level followed by high level of control over the economic resources. Most of the respondents had high level of critical consciousness among beneficiaries group. Whereas majority of beneficiaries had high level of role perception followed by none of the beneficiaries were found to have low level of role perception.

Keyword: Empowerment, Krishi Vigyan Kendra, Training, Women

INTRODUCTION

Women have emerged as a diverse interest group in the last few centuries basically because of the bourgeoisie democratic revolutions of 17th century that ruled out women from their concept of equality. In spite of the fact that the women's contribution and role to the country's development is equal to that of men, they still experience a diverse variety of limitations that restrain them from assimilating their full potential for expansion. This clear difference was based on gender. Since then women as a commune have waged fight for recognition of their rights as a human being. The government schemes and laws have been formulated and designed to meet the path of

women empowerment. In addition to government role the institutions like state agriculture universities and NGOs worked to develop women capabilities and skills through its training programme and other initiatives. Krishi Vigyan Kendra, Jeolikote in Uttarakhand organizes different kinds of training courses for the farmers and farmwomen in different subjects. In between the years 2017-2018 most of the vocational trainings were organized for farm women included Tailoring, Knitting and Handicraft, Mushroom cultivation, Post harvest technology, Poultry management, Candle making & Food processing (Figure 1).

However, the success of these trainings with regards to women depended upon the type of empowerment and

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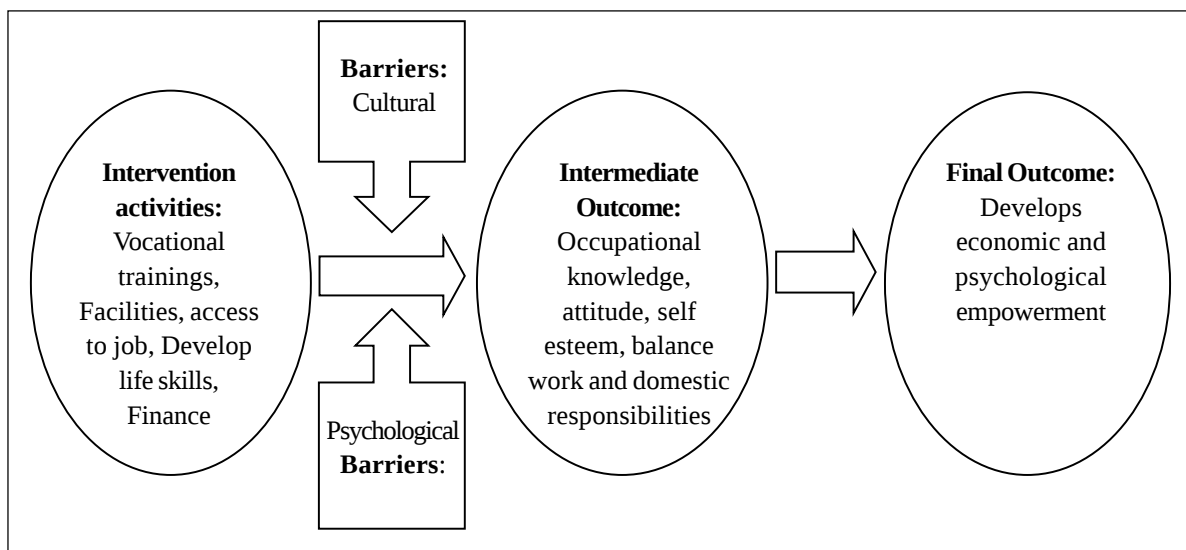


Figure 1: Diagrammatic representation of vocational training targeting women's outcome

how these trainings do help them to have better life, needs to be measured and accessed. Women's Empowerment in Agriculture Index (WEAI) is a first comprehensive survey-based innovative measuring tool for, evaluating and learning about women's empowerment and inclusion in the agriculture sector. It is introduced by International Food Policy Research Institute (IFPRI), Oxford Poverty and Human Development Initiative (OPHI), and USAID's feed the Future in February 2012. WEAI is constructed by calculating the weighted average of the 5DE (Five domains i.e.= decisions about agricultural production, access to and decision-making power over productive resources, control over use of income, leadership in the community, and time allocation) and GPI (Gender parity of empowerment within the household) giving 90 per cent weightage to 5DE and 10 per cent to GPI. As different measurement tools like indexes, scales and formulas are designed by various organizations and scholars to analyse the effectiveness of these trainings imparted by different institutions and understand how these trainings affected and contributed in their status change and empowerment.

METHODOLOGY

The present study was conducted in Uttarakhand state. Out of thirteen districts of the state, Nainital was selected purposively for the present study as Krishi Vigyan Kendra, Jeolikote has been working in this district.

Bhimtal block was selected purposively as KVK Jeolikote is located in this block and maximum numbers of vocational trainings are organized by KVK in this particular block. Selection of three Villages was done randomly. A complete list of trainees who had undergone trainings during 2017-18 conducted by KVK Jeolikote in the villages were obtained from KVK personnel. Equal numbers of non beneficiaries were selected from the villages by using proportional allocation method from which the beneficiaries were selected. Thus constituting the total sample size of 90 women in which 45 were beneficiaries and 45 were non beneficiaries. Interview schedule was administered to generate data and the collected data was statistically analyzed through frequency and percentages standard deviation, chi-square and z test.

RESULT AND DISCUSSION

Effectiveness of the vocational trainings generally, refers to sustainable socio-economic and psychological changes introduced by the given intervention in the lives of farm women in terms of economic and psychological empowerment. In the context of present study, Empowerment has been operationalized as a process where farm women become independent of doing things on their own and upgrading themselves both economically and psychologically. It was measured by using a scale developed by Shilparani (2016) with slight modifications.

Economic empowerment was measured to which farm women were involved in different types of earning income through source and expenditure, have control over economic resources, provide financial contribution to family support and are operating bank accounts independently. It is evident from the Table 1 that majority of beneficiaries (82.88%) had high expenditure level followed by 75.55 per cent of beneficiaries had high level of control over the economic resources. It was also found that majority of beneficiaries 64.44 per cent were found to have high level of financial contribution towards the family. Whereas more numbers of non beneficiaries (75.55%) had low level of financial contribution. However by the regular training and motivation most of the beneficiaries 64.44 per cent were able to operate bank work independently. Further, majority of beneficiaries (68.88%) had high level of economic empowerment. None of them was found to have low level of economic

empowerment. This might be because KVK played a significant role through training to start new ventures which made them more economically empowered. Whereas more number of non beneficiaries (62.22%) had low level of economic empowerment and only 8.88 per cent of beneficiaries had high level of economic empowerment. The findings of the study was in line with the study conducted by Nashine (2014) who also found that beneficiaries had high level of economic empowerment as compared to non beneficiaries.

Psychological empowerment refers to degree of perceived change in decision making ability, critical consciousness, role perception and self perception of farm women as a result of training received from KVK. Most of the respondents (55.55%) had high level of critical consciousness among beneficiaries group. Majority of beneficiaries (80%) had high level of role perception

Table 1: Components of economic empowerment (n=90)

Category	Beneficiaries (n ₁ = 45)		Non beneficiaries (n ₂ = 45)	
	Frequency	Percentage	Frequency	Percentage
Types of expenditure				
Low (less than 8)	0	0	19	42.22
Medium (8-12)	8	17.77	19	42.22
High (above 12)	37	82.22	7	15.55
Control over economic resources				
Low (less than 6)	0	0	34	75.55
Moderate (6-9)	11	24.44	11	24.44
High (above 9)	34	75.55	0	0
Financial contribution				
Low (less than 3)	0	0	34	75.55
Medium (3-5)	16	35.55	7	15.5
High (above 5)	29	64.44	4	8.8
Capability of operating bank account				
Low (less than 3)	0	0	25	55.55
Medium (3-5)	16	35.55	5	11.11
High (above 5)	29	64.44	15	33.33
Overall				
Low (less than 25)	0	0	28	62.22
Medium (25-34)	14	31.11	13	28.88
High (above 34)	31	68.88	4	8.88

Table 2: Components of psychological empowerment (n=90)

Category	Beneficiaries (n ₁ = 45)		Non beneficiaries (n ₂ = 45)	
	Frequency	Percentage	Frequency	Percentage
Critical consciousness				
Low (less than 9)	0	0	8	17.77
Medium (9-11)	20	44.44	24	53.33
High (above 11)	25	55.55	13	28.88
Role perception				
Low (less than 9)	0	0	10	22.22
Medium (9-12)	9	20	33	73.33
High (above 12)	36	80	2	4.44
Self esteem				
Low (less than 7)	0	0	18	40
Medium (7-10)	6	13.33	27	60
High (above 10)	39	86.66	0	0
Decision making ability				
Low (less than 5)	0	0	9	20
Medium (5-7)	6	13.33	26	57.77
High (above 7)	39	86.66	10	22.22
Overall				
Low (less than 31)	0	0	12	26.66
Medium (31-48)	10	22.22	28	62.22
High (more than 48)	35	77.77	5	11.11

Table 3: Distribution of respondents according to women empowerment (n=90)

Category	Beneficiaries (n ₁ = 45)		Non beneficiaries (n ₂ = 45)	
	Frequency	Percentage	Frequency	Percentage
Low (less than 57)	0	0	25	55.55
Medium (57-72)	11	24.44	13	28.88
High (more than 72)	34	75.55	7	15.55

followed by none of the beneficiaries were found to have low level of role perception. Most of the beneficiaries (86.66%) were also found to have high level of self-esteem while none of them was found in low level of self-esteem. None of the beneficiaries was found to have low level of decision making ability while few of non-beneficiaries 22.22 per cent had high level of decision making ability.

Data in Table 2 depicts that more than three fourth of the beneficiaries (77.77%) were high on psychological empowerment followed by 22.22 per cent of beneficiaries

were with medium level of psychological empowerment. None of them was having low psychological empowerment. This might be due to the confidence generated after starting the venture by beneficiaries. Majority of the non beneficiaries (62.22%) had medium level and 26.66 per cent of beneficiaries had low level of psychological empowerment. The findings of the study was in line with the study conducted by Nashine (2014) who also found that beneficiaries had high level of psychological empowerment as compared to non beneficiaries.

Women Empowerment

The quantitative analysis with Table 3 shows a summary of the effect of vocational trainings on employment, income, and earnings. Specifically, we highlight the effect of vocational training on self-employment and empowerment. The overall women empowerment was calculated for both the groups based on the collected sample data. Data in Table 3 represents that all most equal number of respondents in both the categories had medium level of empowerment that is 24.44 per cent of beneficiaries and 28.88 per cent of non beneficiaries. Significant difference was found between beneficiaries and non beneficiaries in case of high level of empowerment that is 75 per cent of the beneficiaries had high level of empowerment where as only 15.55 per cent of non beneficiaries were having high level of empowerment.

CONCLUSION

The results highlight the analysis of vocational training programs conducted by the Krishi Vigyan Kendra Jeolikote that had a significant impact on skill upgradation of the beneficiaries. Participation in training programmes helped the trained women to develop more skill and

generate more knowledge of income generating activities like fruit preservation, candle making and stitching of cloths etc. Women beneficiaries who had received trainings were more psychologically and economically empowered, hence enabling the women to sustain their small scale enterprises activities through regular training and support from KVK personnel. Therefore, there is need to strengthen Krishi Vigyan Kendra operating in regional area, so that the significant change in the quality can be observed in that area.

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Effectiveness of Digital Media Content on the Behaviour Domain of the Diabetic Patients

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ABSTRACT

The success of diabetes care relies mainly on patients' daily self-care activities and provider's continuous support. Diabetes, therefore, is a disease in which transmission of disease-related knowledge and skills from the patient's perspective will help to build the right attitude in self-management of the disease that can be achieved through education. Hence educating diabetic patients for effective self-management through digital media would be a significant contributor to the metabolic and psychological outcomes of the patients. The study aimed to assess the effectiveness of digital media content on the behavior domain of diabetic patients with two hundred type-2 diabetes respondents from the rural and urban areas of the Guntur district of Andhra Pradesh was conducted. A two months education program based on digital media content in different forms like 90 text, 30 voice messages, and 8 animation modules was developed and disseminated. After the education program, post-intervention changes in the knowledge, skill, and attitude of the respondents was measured with a time gap of two months. The findings revealed that the post-intervention mean score for the knowledge domain scored high in all three areas of information followed by attitude and skill. There existed a highly significant difference at pre and post-intervention with a p-value of 3.29E-06. Further, highly significant difference was also observed among knowledge, skill & attitude of the respondents with a p value of 3.67E-11. Among different areas of information in the KSA domain, the mean score difference was found to be highest for clinical followed by nutrition and for management information. The significant improvement in the KSA domain for all three areas after post-intervention may be due to the dissemination of information by using different content formats such as text, voice messages, and animation modules. Thus, digital education in vernacular language to reach all sorts of patients would be effective for self-management of the disease.

Keywords: Animation, Attitude, Diabetes, Digital media, Knowledge, Skill, Text, Voice messages

INTRODUCTION

Information is cornerstone for effective self-management of the disease thereby reduces the complexity of the diseases. People with diabetes need to be informed about their condition to prevent them from worrying unnecessarily and to allow them to effectively control their condition. They will need a variety of skills and knowledge to enable them to control their condition, sometimes on a day-to-day basis, and modify their

approach when circumstances change. The success of diabetes care relies mainly on patients' daily self-care activities and provider's continuous support. Diabetes, therefore, is a disease in which information and knowledge from the patient's perspective has an important role to its management, diabetes self-management education and on-going support are significant contributors to metabolic and psychological outcomes. With this backdrop, the present paper aimed to assess the effectiveness of digital

media content on the behaviour domain (Knowledge, Skill & Attitude) of the diabetic patients.

METHODOLOGY

An exploratory research design with two hundred type-2 diabetes respondents selected randomly from the rural and urban areas of Guntur district of Andhra Pradesh was chosen. List of the respondents was collected from three hospitals of Guntur district. Data collected from the respondents by using a pre-structured interview schedule. The study consisted of three sections viz; Development of digital media content, Execution of digital media content and Statistical tests.

Different digital media content like text, voice messages, and animation modules were developed based on the existing gaps in the knowledge of the respondents towards clinical, nutrition and, management areas of diabetes. Text and voice messages delivered through bulk messaging package by using mobile phones. By using this package messages sent to all 200 samples at a time in their native or vernacular language for better understanding. A total of 90 text and 30 voice messages developed. Out of these 36, text messages and 12 voice messages were knowledge-based, 23 text messages and 10 voice messages were skill based and 31 text messages and 8 voice messages were attitude based. The animated videos were developed based on the existing gaps in the knowledge, skills, and attitude of the respondents towards clinical, nutrition, and management areas. A total of 8 animated modules developed. Diabetes, Types of Diabetes, Body Mass Index, Dietary guidelines, Diabetes complications, Diagnostic tests, Glycemic index, and Exercise were the topics selected for animation, based

on the existing behavior domain gaps of the respondents.

For one-month animation, modules disseminated through what's up groups, email and, focused group discussion methods to reach all the respondents. For the second month, text and voice messages were sent to all the respondents through bulk message centre in the vernacular language. Everyday 3, text messages and one voice message sent. In two months, the information was disseminated through different content formats to educate the patients to bring desirable changes in their behavior domains. After the education program, post-intervention changes in the knowledge, skill and attitude of the respondents measured with a time gap of two months.

Mean scores were calculated to know the difference between pre and post intervention. Two- way ANOVA was done to assess the interaction between knowledge, skill and attitude pre and post intervention. Paired t-test was calculated to find out the significant difference of knowledge, skill and attitude of the diabetic patients at pre and post intervention.

RESULTS AND DISCUSSION

The Table 1 indicates the overall change in the behavior domain (knowledge, skill & attitude) of the respondents after intervention of digital media education programme in different areas of information. The mean score for the knowledge domain was found to be high in all the three areas of information with a value of 72.85 followed by attitude domain value of 52.92 and skill domain with a value of 51.74 after intervention. The total mean score in all three domains i.e. KSA post-intervention was high with a value of 177.51 compared to the pre-

Table 1: Overall Change in Behaviour Domain (Knowledge, Skill & Attitude) of the Respondents after Intervention (based on mean scores)

Area of information	Post intervention mean scores			Total	Pre intervention mean scores			Total	Mean difference
	K	S	A		K	S	A		
Clinical	27.51	17.2	16.075	60.785	23.96	15.2	12.35	51.51	9.27
Nutrition	31.1	16.88	18.35	66.33	27.7	14.88	14.55	57.13	9.20
Management	14.24	17.66	18.50	50.4	12.48	16.66	16.65	45.79	4.61
Total	72.85	51.74	52.92	177.51	64.14	46.74	43.55	154.43	23.0

Table 2: Two-way analysis of variance (m=3 observations per cell)

			Factor B		
Types of information			K	S	A
Factor A	Pre	C	1.29	1.27	2.117
		N	1.35	1.111	2.1207
		M	1.397	1.303	2.3007
	Post	C	1.5625	1.517	2.5625
		N	1.531	1.3785	2.6242
		N	1.556	1.576	2.64

intervention mean score of 154.43. The reason for significant improvement in knowledge may be due to the fact that more number of text, voice messages and animation modules were knowledge based compared to other two domains. Further, it will take more time for people to practice skills imparted related to diabetes, hence the improvement in skills found to be relatively less compared to knowledge and attitude. Among different areas of information in the KSA domain the mean score difference was found to be highest for clinical (9.27) followed by nutrition (9.20) and management (4.61) information. The calculated mean difference was 23.0 between pre and post-intervention. The significant improvement in KSA domain for all three areas after intervention may be due to dissemination of information by using different content formats such as, text, voice messages, and animation modules by using different channels like email, WhatsApp and focused group discussions as the respondents believed that text messages and animation modules can be stored for future reference also. Andriyanto (2019) revealed that the mean of knowledge and attitudes increased from 56.05 to 76.98 and from 22.14 to 33.36, respectively, after the

intervention. Similarly, the mean of skills increased from 5.51 to 7.13, while the mean of blood glucose decreased from 238.36 mg/dl to 231.63 mg/dl after the intervention. There were significant differences in knowledge, attitudes, skills ($p=0.001$), and glucose control ($p=0.04$) of type-2 diabetes after education.

Two way ANOVA was computed to assess the interaction between variables at pre & post intervention and to assess the change in between variables. In Table 2 analysis was done on two factors where factor A is pre and post intervention and factor B is about behaviour domains i.e., knowledge, skill and attitude. Based on the results of two way ANOVA test from the Table 2 & 3 it is revealed that there existed a highly significant difference at pre and post intervention with a p value of $3.29E-06$. Further, a significant difference was also observed among knowledge, skill and attitude of the respondents with a p value of $3.67E-11$. From these results it could be concluded that there is a remarkable improvement in the knowledge, skill and attitude of the respondents after intervention when educated the patients by using different digital content formats like text, voice messages and animation modules. Chawla *et al.* (2019) indicated that education on various aspects of diabetes, its drugs, dietary and lifestyle modification along with patient education leaflet showed a significant increase of knowledge, attitude and practice of scores (10.28 ± 1.78 , 3.46 ± 0.93 , 3.14 ± 0.86) respectively at the end of the study compared to control group.

An inference could be drawn from the Table 4 that there was a significant mean difference of 2.90 in the knowledge level of the respondents' pre and post intervention as t value was found significant. The findings

Table 3: Analysis of variance for interaction between knowledge, skill & attitude pre and post intervention

Source of Variation	Two way – ANOVA Analysis					
	SS	df	MS	F	P-value	F crit
Pre and post intervention	0.401498	1	0.401498	65.68672	3.29E-06	4.747225
K,S,A	3.949311	2	1.974655	323.062	3.67E-11	3.885294
Interaction	0.041007	2	0.020504	3.354484	0.069629	3.885294
Within	0.073348	12	0.006112			
Total	4.465163	17				

Table 4: Change in overall knowledge skill and attitude of the respondents post intervention

Domain	Mean Post intervention	Mean Pre intervention	Difference (% increase)	Paired t-test result p-value
Knowledge	24.283	21.380	2.90(11.95%)	0.036
Skills	17.24667	14.28	2.9667(17.20%)	0.0444
Attitude	17.64167	14.51667	3.125(17.71%)	0.039

have similarity with other researchers who used multimedia software for diabetes education. Zhang (2019) inferred that the implementation of the self-care program with multimedia software support resulted in improvement in patients self-care behaviors' in the experimental group, but no changes observed in the control group. There exists a significant difference between the mean scores of the test and the control group at pre and post-intervention. There was a significant mean difference of 2.96 in the skills of the respondent's pre and post-intervention as t value was found significant at < 0.05 level of probability. The results are in confirmation with Farahani *et al.* (2016) revealed that implementation of the self-care program with multimedia software support resulted in improvements in patients' self-care behaviors in the experimental group, whereas these behaviors had not significant changes in the control group after eight weeks. There was a significant difference in the mean score of knowledge in both the experiment and control groups before and after the intervention ($p=0.02$). An inference could be drawn that there was a significant mean difference of 3.12 in the overall attitude of the respondent's pre and post intervention as t value was found significant at 0.05 level of probability. The respondents responded positively to the information disseminated through digital media as the content delivered was in a more convincing and thought provoking manner. Muchiri *et al.* (2016), indicated that the patient's mean score knowledge on diabetes among the intervention group was higher in the intervention group compared to the control group after 6 and 12 months of intervention and the scores were below 50 per cent. But, the patient's attitude towards diabetes was significantly higher at 12 months. Similar results by Garima (2016) and Saleh *et al.* (2017) were reported.

CONCLUSION

It could be concluded that educating the patients by using modern digital media content formats like text, voice messages, and animated modules in local language enhanced the knowledge, skill, and attitude of the respondents towards the disease for effective self-management. Further, text messages and animation modules can be stored and used by the respondents for future reference also. They can share the information with their family members, friends, and co-diabetics for better self-management of the disease. Thereby the chain of sharing and accessing the information is not only confined to the respondents of the study area but other people also. Moreover, animation is in image, audio, text and video mode these can be displayed at the hospitals for the patients to create awareness about the disease.

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Constraints in Empowerment of Rural Women in District Kanpur Dehat U.P.

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ABSTRACT

Empowerment is a multi-faceted, multi-dimensional and multilayered concept. With regards to women, empowerment is a process in which women gain greater share of control over resources- material, human and intellectual like knowledge, information, and ideas and financial like money- and control over decision making in the home and community. Rural women still do not have ownership on land and the pattas are allotted in the name of their husband. In spite of numberless efforts from government and other developmental agencies women empowerment is still a dream waiting to be reality. Present study was conducted on 240 randomly selected rural women of Bakhariya and Phoolpur villages of Maitha block of district Kanpur Dehat through personal interview method. Results revealed that major constraints towards social empowerment were illiteracy or minimal literacy along with, limited access to mass media. Limited access to credit facilities and gender discrimination were major factors which hampered economical empowerment. Perception of society and Nepotism were the factors that checked political empowerment of rural women. It is suggested to have policy for compulsory education of girls up to intermediate. Gender mainstreaming through agripreneurship could be great aid towards economic empowerment. Trainings and awareness of governmental policies can play crucial role in political empowerment of rural women.

Keywords: Constraints, Control, Empowerment, Intellectual, Knowledge, Resources

INTRODUCTION

Women play a significant role in agriculture development and allied fields. The nature and extent of women's involvement in agriculture varies greatly from region to region, they comprise largest percentage of the workforce in agriculture sector, but do not have access and control over land and productive resources. For time immemorial women in general been forced to occupy a secondary place in relation to men, rural women still do not have ownership on land and the *pattas* are allotted in the name of their husband. Rural women are key agents for achieving the economic, environmental and social changes required for sustainable development. But limited

access to credit, health care and education are among the many challenges they face. Empowering them is a key not only to the well-being of individuals, families and rural communities, but also to overall economic productivity Duflo (2012). For sustainable development it is essential to let women develop equally as men. In spite of numberless efforts from government and other developmental agencies women empowerment is still a dream waiting to be reality. Women are the vital human infrastructure and their economical, political and technical empowerment would hasten the pace of social development. Investing in women's "capabilities" and empowering them to achieve their "choices" and "opportunities" are the surest way to contribute to

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economic growth and overall development (Patnaik, 2000). An investigation of constraints in empowerment of rural women was conducted to figure out the degree and extent of problems hampering women empowerment in District Kanpur Dehat (U.P.).

METHODOLOGY

The study was conducted on 240 randomly selected farm women of Phoolpur and Bakhariya villages of Maitha Block and Daheli and Jyodi villages of Rasoolabad block of District Kanpur Dehat as a pre-requisite of KVK's interventions related to doubling farmer's income programme. Sixty Farm women from each of the village were randomly selected and personally interviewed for the purpose of data collection. A list of problems related to empowerment was prepared on the basis of PRA conducted and responses were sought on 3 point scale- Always (3), Sometimes (2) and Never (1) and mean Score was calculated for each of the problem and presented in rank order wise.

$$\text{Weighted M.S. (i}^{\text{th}} \text{ factor)} = \frac{\text{Total score earned by respondents}}{\text{Total no. of respondents}}$$

$$\bar{X} = \frac{w_1 \times 1 + w_2 \times 2 + \dots + w_n \times n}{w_1 + w_2 + \dots + w_n}$$

Where, x is the repeating value, w is the number of occurrences of x weight and $\bar{x}$ is the weighted mean

RESULTS AND DISCUSSION

From Table 1, it is clear that major constraint in social empowerment were illiteracy/ or minimal literacy (M.S. 3.41, rank I) and gender biasness (M.S. 3.23, rank II). Limited access to mass media with M.S. 2.90 on rank III and fear of society were also contributory factors that checked social empowerment of women. Dependency and introvert nature due to family pressure with M.S. 2.50 was on rank XI. Religious and cultural belief of always walking behind the man was least affecting factor (M.S. 2.45, rank XII). Rural women under study were also found unaware about policies and ordinance meant for them, about 45 per cent farm women 'always' faced this problem, while more than 75 per cent accepted that

Table 1: Constraint in social empowerment of rural women (N=240)

S.No.	Items	M.S.	Rank
1	Illiteracy/ Minimal Literacy	3.41	I
2	Dependency	2.50	XI
3	Lack of Self confidence	2.78	VII
4	Introvert nature due to family pressure	2.50	XI
5	Fear of Society (Log Kya kahenge)	2.88	IV
6	Gender Biasness	3.23	II
7	Social taboos/superstitions	2.83	V
8	Unaware about women's right	2.56	X
9	Unaware about Policies and ordinance made for women empowerment	2.73	IX
10	Lack of education facilities	2.76	VIII
11	Co-education system hampers education	2.80	VI
12	Religious and cultural beliefs	2.45	XII
13	Limited access to mass media	2.90	III

co-education system 'always' hampers their education. Results of the study are in concurrence with findings of Field *et al.* (2010) where it was quoted that gender differences in education and access to business networks could limit women's ability to benefit from physical support.

The barriers begin with comparatively low investment in female education and health, that continued with restricted access to services and assets, Data presented in Table 2 states that 'limited access to resources', was the most affecting factor in economic empowerment of rural women with M.S. 3.47, followed by 'gender discrimination in wage rates' and 'greater vulnerability to exploitation and abuse' with M.S. 3.32. Further no/ less participation in decision making (M.S. 3.27) also limited economic empowerment of rural women. Respondents were found unaware about input and infrastructure needed for an enterprise up to some extent hence, economic empowerment of rural women was not much affected by this constraint.

Data envisaged in Table 3 reveals that 'lack of social mobility because of restriction in the family' was maximum faced constraint and that hampered technological empowerment with M.S. 3.01, whereas,

Table 2: Constraint in economic empowerment of rural women (N=240)

S.No.	Items	M.S.	Rank
1	Limited access to resources	2.90	VIII
2	Limited access to credit facilities	3.47	I
3	Inadequate technical competency	3.05	VI
4	Poor participation in decision making	3.24	IV
5	Greater vulnerability to exploitation and abuse	3.32	II
6	Gender Discrimination in wage rates	3.32	II
7	No /less participation in decision making	3.27	III
8	Lack of employment opportunities	3.19	V
9	Lack of training / capacity building	2.81	IX
10	Lack of support from family	2.98	VII
11	Unaware about input and infrastructure needed for an enterprise	2.54	X

“limited access to training and extension services” (M.S. 2.35) was less faced constraint in technological empowerment. “Unavailability of technical support at door step” was also contributing factor in technological empowerment with M.S. 2.56. “Lack of knowledge and awareness of improved agricultural practices was ‘always’ faced by 65 per cent respondents while less than 25 per cent faced it ‘sometimes’”. Lack of gender friendly tool also hampered technological empowerment as little less than sixty per cent always faced this problem whereas, about 35 per cent sometimes underwent with this issue. “Lack of opportunity to access technology” and “lack of gender friendly tools” were 3rd important constraints that checked technological empowerment of rural women. It is relevant to understand that information

and communication technology was not a solution in itself and cannot solve all the problems but it could alleviate the gap by bringing new information resources and communication channels for women. Archana and Singh (2002) also found similar results while studying SHGs.

Data given in Table 4 indicated that Nepotism with means score 3.28, was the biggest problem in political empowerment of rural women, generally family members of those already in politics used to given opportunity instead of testing new person. As per the PRA conducted before the study politics was not considered as a dignified job in our society, “perception of society was not good about politics” with M.S. 3.12 was another major constraint in political empowerment. Even after so much efforts from Government, politics was still a male dominating work therefore male dominance and greater chance of being exploited (M.S. 3.10) were the factors

Table 4: Constraints in political empowerment of rural women

S.No.	Items	M.S.	Rank
1	Doubts regarding women’s capabilities	2.88	V
2	Women are over burdened with dual responsibility of managing household and economic activities	2.45	VIII
3	Nepotism	3.28	I
4	Perception of Society is not good about politics	3.12	II
5	Male dominance	3.10	III
6	Great Chance of being Exploited	3.10	III
7	Lack of motivation	2.90	IV
8	Lack of Family Support	2.76	VI
9	Lack of leadership quality	2.53	VII

Table 3: Constraint in technical empowerment of rural women (N=240)

S.No.	Items	M.S.	Rank
1	Limited access to training and extension services	2.35	V
2	Lack of knowledge and awareness about improve agricultural practices	2.36	VI
3	Lack of social mobility because of restrictions in the family	3.01	I
4	Unavailability of technical support at door step	2.56	II
5	Lack of gender friendly technologies	2.48	III
6	Lack of opportunity to access technology	2.48	III
7	Lack of ICT centers at nearby areas	2.40	IV

which check political empowerment of rural women. 53 per cent respondents complained that they always faced 'lack of motivation' followed by 50 per cent who faced 'doubts regarding their capabilities'. More than 55 per cent women accepted that they were 'always' not getting family support to get in politics while 30 per cent faced 'sometimes'. Women's participation in political process is important for strengthening democracy. Kaur *et al.* (2007); Kumari (2018) also found similar results. If women are to be empowered, it is imperative for them to be in the corridors of power so that they can represent their problem in a better way and negotiate. Empowerment of women in political field is crucial for their advancement and for building a gender equal society. It will enable them to strengthen their struggle against marginalization, trivialization and exploitation.

CONCLUSION

It is concluded that social empowerment was most affected by illiteracy or minimal literacy, gender biasness and limited access to mass media, while, least affect by 'religious and cultural belief'. Major Constraints towards Economic Empowerment were 'limited access to credit facilities', 'gender discrimination in wage rates' and 'greater vulnerability to exploitation and abuse'. Technical Empowerment was checked by 'lack of social mobility because of restrictions in the family' and "unavailability of technical support at their door step". Nepotism and "perception of society is not good about politics" were the major barrier in political empowerment of Rural women. The best way of empowerment is inducting women in the mainstream of development. Women empowerment will be real and effective only when they get share in income and property so that they may stand on their feet and build up their identity in the society. The empowerment of women has become one of the most important concerns of 21st century not only at national level but also at the international level. Government initiatives alone would not be sufficient to achieve this goal. Society must take initiative to create a climate in which there is no gender discrimination and women have full opportunities of decision making and participating in social, political and economic life of the country with a

sense of equality. Factually education of girls is made free but still education of girls has not reached to the level where it should be, so not only free education along with educating girls up to intermediate should be made compulsory with social and governmental compulsions. Gender mainstreaming through agripreneurship could be great aid towards economic empowerment. Women should be motivated to interfere in politics and trainings should be organized to develop leadership qualities. Latest technology should be made available at their door step it may lead to technical empowerment of rural women.

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Growers' Knowledge of Improved Maize Production Technologies in Jammu Region of J&K

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ABSTRACT

Knowledge is one of the important components of behaviour as such it plays an important role in the covert and overt behaviour of an individual. Knowledge as defined in present study included those behaviours and test situations which emphasised the remembering either by recognition or recall of ideas, material or phenomena about maize production technology. The study was conducted in five districts namely Doda, Kathua, Poonch, Rajouri and Udhampur of Jammu region of Jammu and Kashmir. A sample of 220 maize growers was selected by multi-stage random sampling from 22 villages of 11 tehsils of 5 selected districts. Data were collected by personal interview method. A knowledge test was developed with items related to different maize production technologies. It was measured with the scores obtained by the maize growers in the test. 47 per cent of the respondents had medium level of knowledge whereas 38 per cent had low level of knowledge. There was significant difference in mean knowledge score between farmers of districts Udhampur -Doda, Poonch -Doda, Doda -Kathua and Rajouri - Kathua. More awareness programmes should be organized to increase knowledge level of maize growers regarding maize cultivation practices which may help to enhance the production of maize in the region.

Keywords: Knowledge level, Production technologies, Maize

INTRODUCTION

Maize (*Zea mays* L.) is one of the most important crops in world agricultural economy grown over an area of 177 million hectares with a production of 967 million tonnes (KPMG, 2014). India ranks fourth in area and sixth in production of maize. As maize has yield potential far higher than any other cereal, it is referred to as the miracle crop or the 'Queen of Cereal' (Anonymous, 2011). Maize is the third most important food grain in India after wheat and rice. It is grown throughout the country, but the main producing states are Andhra Pradesh, Karnataka, Maharashtra, Bihar, and Madhya Pradesh (MoA, 2015). The area under maize crop is 9.2 million hectares with a production of 24.17 million tonnes

(AICRP on Maize, 2016). Maize is grown in all the seasons namely *kharif*, *rabi* and spring. Of these three seasons, nearly 90 per cent of the production is in kharif season, 7 to 8 per cent during rabi season and 1-2 per cent during spring season (Dass, 2009). Since 1950, there is slight increase in area of maize crop but production increased by eight times and productivity increased by three and half times (MoA, 2015).

Maize is the major crop of hilly districts of J&K and plays an important role in the livelihood of the people. In J&K, maize is predominantly grown as rainfed crop during kharif season and forms a staple food of vast majority of rural households, beside its use as livestock feed and fodder. In J&K, future increases in maize production to

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meet domestic demand will have to rely on improvements in yields rather than the expansion of maize production area. In the Jammu region 75 per cent cultivated area is rainfed (DES, 2011). The productivity of maize at the national level for 2014-15 was 2.56 t/ha whereas for the same period it was 1.49 t/ha in J&K (AICRP on Maize, 2016). With this background the present study was conducted to find out the knowledge level of maize growers in the Jammu region of J&K state.

MATERIAL AND METHODS

The study was conducted in five districts namely Doda, Kathua, Poonch, Rajouri and Udhampur of the Jammu region of J&K. A sample of 220 maize growers was selected by multi-stage random sampling from 22 villages of 11 tehsils falling in 5 selected districts. Non-experimental diagnostic research design was employed for the study. The study was aimed to find out the knowledge level of the maize growers about maize production technologies. For this purpose a knowledge test was developed consisting of forty four (44) test items which contained four (4) objective type, two (2) close ended, five (5) identification of objects from photographs and thirty three (33) open response items. Personal interview technique was used for data collection. All the maize cultivation practices recommended by Sher-e-Kashmir University of Agricultural Science and Technology of Jammu formed the content area of the knowledge test. The correct response was given a score of 'one' and incorrect responses as 'zero'. The total score for each respondent was computed by summing up the scores on all knowledge items. Based on the score obtained, the respondents were categorized into three categories viz low, medium and high on the basis of Singh's

cube root method (1975). Percentage was used to find out the knowledge level of the farmers.

Categorization of knowledge score

Knowledge score was categorized in to three groups by 'Singh's cube root method' as given below:

$$S_1 = L_1 + \frac{\frac{N}{3} - C_{i-1} \times h}{f_1}$$

Where, i = indicated category number (i=1, 2, 3.....n), S_1 = segment (e.g. I, II, III), L_1 = Lower limit of the quartile class, C_{i-1} = Cumulative frequency of the class preceding to the quartile class, f = frequency, h = width of the quartile class, N = Total cumulative cube root of frequencies

RESULT AND DISCUSSION

The maize growers were categorized into three levels of knowledge namely low (15-22), medium (23-29) and high (30-39) by employing Singh's cube root method (1975). Table 1 reveals that majority (47%) of the respondents had medium level of knowledge, followed by 38 percent had low level of knowledge and only 15 percent had high level of knowledge. Overall mean knowledge score was 24.31 with a standard deviation of 4.48. The mean knowledge score of district Kathua was the highest (26.62) and it was lowest in district Doda (22.02).

Knowledge about maize cultivation practices

Data presented in Table 2 shows that overall majority (94%) of maize growers were having the correct knowledge about recommended sowing time and 71 per

Table 1: Overall Knowledge score of maize growers

Knowledge score	District					Overall (n=220)
	Doda (n=40)	Kathua (n=40)	Poonch (n=40)	Rajouri (n=60)	Udhampur (n=40)	
Low (12-22)	68	17	28	47	30	38
Medium (23-29)	20	60	62	42	52	47
High (30-39)	12	23	10	11	18	15
Mean knowledge score	22.02	26.62	24.92	23.48	24.92	24.31
Standard deviation (±)	4.05	4.31	3.79	4.37	4.05	4.48

Decimals are rounded up to nearest whole number

Table 2: Knowledge about maize production technologies (% farmers)

Crop production technologies	District					Overall (n=220)
	Doda (n=40)	Kathua (n=40)	Poonch (n=40)	Rajouri (n=60)	Udhampur (n=40)	
Sowing Time and Land preparation						
Sowing time	93	95	95	97	90	94
Land preparation	78	85	73	70	50	71
Seed rate and Method of sowing						
Seed rate and method of sowing						
i) Hybrid	20	93	70	75	90	77
ii) Composite	15	5	15	3	25	13
iii) Local	15	53	33	33	75	41
Spacing between lines and plants	53	50	58	28	35	43
Depth of placing seed	20	23	10	17	0	14
Improved Varieties						
i) Hybrid	78	98	93	82	68	83
ii) Composite	0	3	3	2	0	1
Seed treatment						
Seed treatment chemicals	3	8	3	3	5	4
Recommended dose	0	8	3	3	5	4
Benefits	53	88	93	57	78	70
Weed management						
Keeping crop weed free till 45 days DAS	58	65	65	37	60	55
Methods of weed control	63	95	80	85	90	83
Chemicals of weed control	8	40	0	17	13	15
Dose of herbicide	8	40	0	7	15	13
Benefits of weed control	70	93	95	85	98	88
Fertilizer management						
Recommended dose of						
i) Urea	38	70	38	62	28	48
ii) DAP	50	60	38	58	18	46
iii) MOP	48	63	43	43	30	45
Number of urea splits	40	25	15	20	18	23
Application time of						
i) Urea (Basal, knee height and tasseling stage)	40	43	20	45	28	36
ii) DAP (Basal dose)	98	88	88	93	95	92
iii) MOP (Basal dose)	93	90	95	92	100	94
Water management and mixed cropping						
Effect of stagnant water on the maize crop	93	100	88	97	98	95
Mixed cropping						
Mixed cropping of maize	100	98	90	82	70	87
Benefits of inter cropping	100	98	90	82	78	89

Table 2 contd...

Crop production technologies	District					Overall (n=220)
	Doda (n=40)	Kathua (n=40)	Poonch (n=40)	Rajouri (n=60)	Udhampur (n=40)	
Seed replacement and Harvesting						
Replacement of hybrid seeds every year	90	100	100	78	100	92
Replacement of composite seeds not required	98	98	93	93	98	95
Benefits of seed replacement	95	95	98	87	100	94
Stage of harvesting of maize crop	93	95	90	80	100	90

Decimals are rounded up to nearest whole number

cent had correct knowledge about land preparation. Rajouri district had the highest percentage of respondents (97%) having correct knowledge about sowing time of maize crop followed by farmers of Kathua and Poonch (95%), Doda (93%) and Udhampur (90%) respectively. Regarding knowledge about land preparation, a minimum of three ploughings was the highest in district Kathua where 85 per cent maize growers know about it followed by Doda (78%), Poonch (73%), Rajouri (70%) and Udhampur (50%).

It was found that majority (77%) of maize growers had the correct knowledge about seed rate of hybrids, 41 per cent had correct knowledge about seed rate of local varieties and only 13 per cent had correct knowledge about seed rate of composite varieties. As for as knowledge regarding spacing between the lines and plants was concerned, 44 per cent maize growers had the correct knowledge about spacing. Only 14 per cent maize growers had the knowledge about depth of placing seed in the soil. In respect to varieties of maize crop, majority (77%) of the maize growers had the knowledge about the different hybrids of maize whereas only one per cent had the knowledge about composite varieties. Only four percent of the maize growers had the knowledge about seed treating chemical and its recommended dose 2 g/kg seed.

It is clear from the data that 55 per cent of the maize growers had the knowledge to keep the crop weed free up to 45 days after sowing (DAS) and 83 per cent knew about the different methods of weed control in maize crop. Only 15 per cent maize growers knew about the herbicide (Atrazine) for weed control and only 13 per

cent had the knowledge about correct dose of herbicide (1 kg/ha in 800-1000 litre of water). As for as benefits of weed control, 88 per cent respondents knew about the benefits of the weed control in maize crop and the benefits reported by the maize growers were: high production, ease in intercultural operations, less insect pest and disease attack and crop getting proper light, moisture, and nutrients for growth.

Fertilizer management includes various aspects namely recommended dose, number of urea splits and application time. The recommended dose of urea, diammonium phosphate (DAP) and murate of potash (MOP) per hectare is 145 kg, 132 kg and 50 kg for irrigated plain areas and 100 kg, 90 kg and 33 kg for unirrigated plain and hilly areas. It is clear from the data that 48 per cent of the maize growers had the correct knowledge about the recommended dose of urea, 46 per cent had the correct knowledge about the recommended dose of DAP and 45 percent had the correct knowledge about the recommended dose of MOP (Table 2). In maize urea is recommended to be applied in three splits at different stages of crop. But only 23 per cent of the maize growers possessed the knowledge of applying the urea in three splits. Thirty six percent maize growers possessed correct knowledge of applying the urea at right time whereas the percentage of respondents who had possessed correct knowledge of application time of DAP and MOP were 94 and 92, respectively.

Maize is a rainy season crop in the study area and does not withstand water logging condition. Proper water management practices should be followed for getting higher yield. It is evident that 95 per cent maize growers

possessed the knowledge about the adverse effect of stagnant water on the maize crop. Pulses are generally recommended for mixed cropping in maize crop. Beside pulses, maize growers sow cucumber in maize crop. Eighty seven percent respondents had the knowledge about mixed cropping in maize and 89 per cent possessed the knowledge regarding benefits of mixed cropping. 92 per cent respondents had the knowledge of replacing hybrid seeds every year and 95 per cent had the knowledge that composite seeds are not replaced every year. Moreover, 90 per cent respondents had the knowledge of harvesting of maize crop at right stage i.e. when cob cover and leaves of the plants get dry.

Knowledge about insect pest and disease management

Majority of the farmers reported that in maize crop stem borer (*Chilo partellus*), cut worm (*Agrotis ipsilon*) and blisterbeetle (*Mylabris postulata*) are some of the

major insect pests and head smut (*Sphacelotheca reiliana*) and common smut (*Ustilago maydis*) are the major diseases that mostly harm the crop. The maize growers' knowledge with respect to these insect pests and diseases was measured by identification of these insect pests and diseases from photographs. The percentage of maize growers identifying blister beetle, stem borer and cut worm was 97, 88 and 80, respectively (Table 3). A very less percentage of maize growers were having the knowledge about chemical control of these insect pests. Similar results were reported by Nain *et al.* (2007) in case of adoption. The percentage of respondents identifying head smut and common smut was 90 and 78 respectively. Only less than 0.50 per cent maize growers were having the knowledge about chemical control of these diseases. Eighty five percent of respondents possessed knowledge about harmful effect of pesticides and 55 per cent possessed the knowledge about first aid in case of pesticide poisoning (Table 3).

Table 3: Knowledge about insect pest and disease management (% farmers)

Insect and disease management	District					Overall (n=220)
	Doda (n=40)	Kathua (n=40)	Poonch (n=40)	Rajouri (n=60)	Udhampur (n=40)	
Identification of insect pests						
i) Blister beetle (<i>Mylabris postulata</i>)	98	95	98	95	100	97
ii) Stem borer (<i>Chilo partellus</i>)	85	73	88	95	98	88
iii) Cut worm (<i>Agrotis ipsilon</i>)	68	68	93	77	95	80
Chemical control of						
i) Blister beetle	0	0	0	2	0	0
ii) Stem borer	0	0	0	2	0	< 0.50
iii) Cut worm	0	0	0	3	5	2
Identification of diseases						
i) Head smut (<i>Sphacelotheca reiliana</i>)	90	78	98	87	100	90
ii) Common smut (<i>Ustilago maydis</i>)	75	55	95	73	95	78
Chemical control of						
i) Head smut	3	0	0	2	0	< 0.50
ii) Common smut	0	0	0	3	0	< 0.50
Precautions taken during pesticide spraying	73	85	90	85	98	85
Harmful effect of insecticides	45	85	70	73	78	75
First aid for insecticide poisoning	93	68	50	45	75	55

Table 4: Multiple comparison of districts in case of mean knowledge score of maize growers

District (i)	District (j)	Mean difference (i-j)	Std. error	Sig.
Udhampur	Poonch	0	0.95392	1
	Doda	2.90000*	0.95392	0.003
	Rajouri	1.44167	0.87081	0.099
	Kathua	-1.7	0.95392	0.076
Poonch	Udhampur	0	0.95392	1
	Doda	2.90000*	0.95392	0.003
	Rajouri	1.44167	0.87081	0.099
	Kathua	-1.7	0.95392	0.076
Doda	Udhampur	-2.90000*	0.95392	0.003
	Poonch	-2.90000*	0.95392	0.003
	Rajouri	-1.45833	0.87081	0.095
	Kathua	-4.60000*	0.95392	0
Rajouri	Udhampur	-1.44167	0.87081	0.099
	Poonch	-1.44167	0.87081	0.099
	Doda	1.45833	0.87081	0.095
	Kathua	-3.14167*	0.87081	0
Kathua	Udhampur	1.7	0.95392	0.076
	Poonch	1.7	0.95392	0.076
	Doda	4.60000*	0.95392	0
	Rajouri	3.14167*	0.87081	0

Multiple comparison of districts in case of mean knowledge score of maize growers

The mean knowledge score difference among the five sampled districts is given in Table 4. Test of mean difference using one way ANOVA shows that there was significant difference in mean knowledge score between farmers of districts Udhampur and Doda, Poonch and Doda, Doda and Kathua, and Rajouri and Kathua.

CONCLUSION

Overall mean knowledge score was 24.31 with a standard deviation of 4.48. The mean knowledge of district Kathua was the highest and it was lowest in district Doda. A high percentage of maize growers were having good knowledge about sowing time, land preparation, hybrid varieties, seed rate, identification of insect pests and disease, water management, mixed cropping, seed replacement and stage of harvesting. Only 4 per cent maize growers had knowledge about seed treatment and

less than 1 per cent had knowledge about management of insect pests and diseases. There was significant difference in mean knowledge score among the districts: Udhampur-Doda, Poonch-Doda, Kathua-Doda and Kathua-Rajouri. There is need of widespread training and demonstration of package of practices for scientific maize cultivation. Extension agencies should demonstrate to the farmers the process of seed treatment, balanced use of fertilizers, insect pest and disease management. So there is need of widespread trainings, awareness camps, front line demonstrations of package of practices for scientific maize cultivation.

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Media Exposure of Apple Growers about Recommended Apple Production Technology

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ABSTRACT

Kashmir apple has lived up to its reputation for being one of the choicest fruits, and Kashmir has for long been considered as the home of apples. Kashmir valley is endowed with congenial agro-climatic conditions for a wide range of horticultural crops. The area and production has increased, but the productivity of apple fruit is not up to the mark despite of the fact that the climate in the region is conducive for apple cultivation. There could be various reasons for the low productivity of apple fruit and one of them is low level of media exposure of apple growers. The present study was conducted to study different aspects of media exposure of apple growers about recommended technologies of apple production. The study was conducted in three districts of Kashmir division selected purposively, having maximum area under apple cultivation. A multistage sampling procedure was adopted for the study. The data was collected during 2019. It was observed that majority of the apple growers in Shopian (54.46 %) and Baramulla (53 %) were having medium level of media exposure and low level of media exposure was found in district Budgam (50 %).

Keywords: Apple, Exposure, Growers, Media, Technology

INTRODUCTION

Apple is commercially the most important temperate fruit and occupies the fourth (4th) position in the world in terms of production (2.87 million tons) after banana, orange and grapes. China, USA and Poland are the top three countries in the world as far as apple production is concerned, followed by Turkey, India and Iran. According to USDA, China is the top-most producer of apple, producing 44 million tonnes annually, followed by United States (4.6 million tons), Poland, (3.6 million tonnes) in the year 2016-17. Turkey produces one of the finest apples in the world and it produced 2.92 million tonnes of apples, which are being exported throughout the world (Sheth, 2018).

India has emerged as one of the major producer of horticultural crops in the world. The area and production of horticultural crops has been estimated to be 24925,000 hectares and 295164,000 MT respectively with productivity of 11.84 MT/ha during the year 2016-17, while as the area and production of fruit crops has been estimated to be 6480,000 hectares and 92846,000 MT respectively with productivity of 14.33 MT/ha. Among the fruit crops, apple is considered as one of the most important horticultural produce and is renowned worldwide for its taste and health benefits. The area and production of apple in India was 277300 hectares and 2241700 MT respectively with productivity of 08.10 MT/ha during 2016-17, (Anonymous, 2017). India annually exports apple worth of Rs 400 million (Nearly US \$ 10

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million), out of which Rs 200 million comes from the apples of Jammu and Kashmir state which provides job opportunity to 1.2 million people directly or indirectly. The area under apple cultivation in Jammu and Kashmir is estimated to be the second largest in the world and second largest producer in Asia, thereby making it the largest contributor to the state GDP. J&K has the highest average yield and accounts 67 per cent of total apple production and 50 percent of its export in the country, hence a substantial foreign exchange earner and important for economic growth (Parrey and Hakeem, 2015). Almost 89 per cent of the horticulture land in Kashmir is under apple cultivation. With more than Rs. 9000 crore turnover, the apple cart is the main mover and shaker of Kashmir's economy (Ashraf, 2018). There is considerable increase in the area of apple cultivation in the state but the productivity is not up to mark. This low productivity of apple is probably due to lack of information about different aspects of apple cultivation. As innovative techniques and technologies which can boost the apple productivity in the state are being developed at different research stations, however the innovative technology is not being disseminated properly and apple growers do not utilize it judiciously. Media exposure have the capacity to enhance the adoption of innovative techniques but the apple growers mostly do not have much exposure to different mass media channels such as Newspaper, Extension Pamphlets, Radio, Television and its degree of utilization is very low. Since scanty studies have been undertaken so far, related to the media exposure of apple growers, the importance and need to examine the media exposure of apple growers clamoured to take up the issue.

METHODOLOGY

The present study was conducted in the state of Jammu and Kashmir-the northern most state of India. It extends from 32°-17' to 37°-05' N latitude and 72°-20' to 80°-30' E longitude. The altitude ranges from 215-7012 meters above mean sea level.

Three districts from Kashmir valley namely district Shopian from Southern region, district Budgam from Central region, and district Baramulla from Northern region were selected purposively for the study. A multistage sampling procedure was adopted for the

selection of districts, horticultural zones, villages and sample apple growers. From the selected districts, three horticultural zones from each district having maximum area under apple cultivation were selected purposively. From each horticultural zone, one village was selected having maximum area under apple cultivation. A list of apple growers (orchardists) of selected villages was obtained from concerned Horticultural Development Offices and a sample of different apple growers (orchardists) having marginal, small, medium and large land holdings, were selected proportionately from selected villages. Thus, a total of 300 apple growers (orchardists) were selected purposively from nine (9) selected villages as shown in Table 1.

The structured interview schedule was prepared which include relevant questions for seeking information about different aspects of media exposure of apple growers. The interview schedule was pretested prior to its finalization by the researcher in the non-sampled area for its practicability and relevancy. It was pretested by interviewing fifteen (15) apple growers from different areas which were not included in the sampling unit in order to know whether the apple growers furnish the required information. The data was collected by administering the pretested interview schedule to the apple growers. The apple growers were personally interviewed by the investigator which enabled him to get first-hand information and an opportunity to observe the apple growers response. It was made sure that the questions which were not correctly understood to the apple growers were repeated whenever necessary. The researcher attempted to contact the apple growers at home as well as at their farms (apple orchards) during their convenient time in order to get the information. The qualitative data was converted into quantitative data by giving scores. The scores obtained by each apple grower in respect of a particular characteristic under the study was worked out. The apple growers were thus, classified logically into different categories on the basis of scores obtained by them.

RESULTS AND DISCUSSION

The data presented in the Table 2 revealed that in district Shopian, a majority (54.46%) of the apple growers

Table 1: Sampling Plan

Region	District	HorticulturalZone	Village	Number of orchardists	Orchardists to be studied
South	Shopian	Shopian	Wathoo	234	21
		Imam Sahab	D K Pora	412	37
		Zaina pora	Chitragam	488	43
		Total (A)			1134
Central	Budgam	Khag	Ichahama	162	14
		Kanir	Sursyar	541	48
		Beerwah	Lalpora	269	24
		Total (B)			972
North	Baramulla	Wagoora	Nowpora Jagir	639	57
		Baramulla	Singpora	73	06
		Sopore	Nowpora	562	50
		Total (C)			1274
Grand Total (A+B+C)				3380	300

were having medium level of media exposure, followed by 35.64 percent of the apple growers having high level of media exposure and 09.90 per cent of the apple growers had low level of media exposure. In district Budgam, 50 per cent of the apple growers were having low level of media exposure, followed by 43.02 per cent of the apple growers having medium level of media exposure and only 08.14 per cent of the apple growers had high level of media exposure. While, in case of district Baramulla, 59.29 per cent of the apple growers were having medium level of media exposure, followed by 24.78 percent of the apple growers having high level of media exposure and only 15.93 per cent of the apple growers had low level of media exposure. As such most of the apple growers were having medium level of media exposure in district Shopian and district Baramulla, while majority of the apple growers had low level of media exposure in district Budgam. However, in case of overall media exposure of apple growers from all the three districts, it was observed, that more than 50 per cent of the apple growers had medium level of media exposure, followed by 23.66 per cent of the apple growers having high level of media exposure and only 23.64 per cent of the apple growers had low level of media exposure. The results indicate that in district Baramulla and district Shopian, electronic media like television, radio and print media such as newspaper and extension pamphlets were

frequently utilized by a majority of the apple growers. It might be due to more educational level, economic status and standard of living of apple growers in these areas. Low level of media exposure of majority of the apple growers in district Budgam might be due to the fact of low economic status, lower educational level and lack of interest in reading newspaper and extension pamphlets.

Further perusal of data from the Table 3 reveals that in case of district Shopian, more than fifty percent (56.43%) of apple growers read horticultural news and other information on apple cultivation through newspapers, which reflects the growers had medium level of exposure about newspapers, followed by 30.69 per cent of apple growers having high level of exposure regarding newspaper and only 12.87 per cent of apple growers had low level of exposure regarding newspapers. In case of district Budgam, fifty percent (50.00%) of apple growers had low level of exposure about newspapers, followed by 44.19 per cent of apple growers having medium level of exposure about newspaper and only 05.81 per cent of apple growers were having high level of newspaper exposure. While as, in case of district Baramulla, 56.64 per cent of apple growers had medium level of exposure regarding newspapers containing information about apple cultivation, followed by 23.01 per cent of apple growers having high level of newspaper exposure and 20.35 per

Table 2: Distribution of apple growers according to the media exposure

Media Exposure	District			Overall (N=300)
	Shopian (n ₁ =101)	Budgam (n ₂ =86)	Baramulla (n ₃ =113)	
Low	10(9.90)	43(50.00)	18(15.93)	71 (23.64)
Medium	55(54.46)	37(43.02)	67(59.29)	159(53.00)
High	36(35.64)	07(8.14)	28(24.78)	71 (23.66)
Mean $\pm$ S.D	14.05 $\pm$ 8.71	8.01 $\pm$ 6.58	12.49 $\pm$ 6.66	11.51 $\pm$ 7.31
Observed range	0-32	0-32	0-32	0-32

Figures within parenthesis indicate respective percentage.

Table 3: Distribution of apple growers according to their exposure to various media

Media Exposure		District			Overall (N=300)
		Shopia (n ₁ =101)	Budgam (n ₂ =86)	Baramulla (n ₃ =113)	
News Paper	Low	13(12.87)	43(50.00)	23(20.35)	79(26.33)
	Medium	57(56.43)	38(44.19)	64(56.64)	159(53.00)
	High	31(30.69)	05(5.81)	26(23.01)	62(20.67)
	Mean $\pm$ S.D	3.30 $\pm$ 2.56	2.87 $\pm$ 2.03	2.82 $\pm$ 2.22	2.99 $\pm$ 2.27
	Observed range	0-9	0-9	0-9	0-9
Extension Pamphlet	Low	18(17.82)	48(55.81)	30(26.55)	96(32.00)
	Medium	61(60.40)	32(37.21)	71(62.83)	164(54.67)
	High	22(21.78)	06(6.98)	12(10.62)	40(13.33)
	Mean $\pm$ S.D	3.29 $\pm$ 2.30	2.72 $\pm$ 2.19	3.12 $\pm$ 2.24	2.89 $\pm$ 2.24
	Observed range	0-8	0-7	0-9	0-9
TV	Low	23(22.77)	31(36.04)	27(23.89)	81(27.00)
	Medium	49(48.52)	41(47.67)	61(53.98)	151(50.34)
	High	29(28.71)	14(16.28)	25(22.12)	68(22.67)
	Mean $\pm$ S.D	4.24 $\pm$ 2.88	3.41 $\pm$ 2.37	4.60 $\pm$ 2.53	4.08 $\pm$ 2.59
	Observed range	0-9	0-9	0-9	0-9
Radio	Low	15(14.85)	25(29.07)	11(9.73)	51(17.00)
	Medium	55(54.46)	43(50.00)	72(63.72)	170(56.67)
	High	31(30.69)	18(20.93)	30(26.55)	79(26.33)
	Mean $\pm$ S.D	5.23 $\pm$ 2.91	3.52 $\pm$ 2.79	4.37 $\pm$ 2.33	4.37 $\pm$ 2.68
	Observed range	0-9	0-9	0-9	0-9

Figures within parenthesis indicate respective percentage.

cent of apple growers had low level of exposure regarding newspapers. The possible reason for medium level of newspaper exposure in district Shopian and district Baramulla was due to medium level of educational status, lack of interest in reading newspapers and non-availability

of newspapers in rural areas. As for as district Budgam is concerned, large percentage of apple growers did not read newspapers, because majority of them were illiterate, having low economic status and lack of information about media exposure.

The data from the table also revealed, the access of the growers to different extension pamphlets (Spray Schedule, Apple Scab, and Advisory for Orchardists booklet), it was observed from the data, that in case of district Shopian, a majority (60.40%) of apple growers were having access to Extension Pamphlets containing horticultural (apple) cultivation/production related information. In case of district Budgam, a majority (55.81%) of the apple growers had low level of exposure about extension pamphlets. While as, in case of district Baramulla, a majority (62.83%) of apple growers had medium level of exposure regarding extension pamphlets. However, in case of overall exposure of apple growers from all the three districts about extension pamphlets, it was found, that more than fifty percent (54.67%) of the apple growers had medium level of exposure about extension pamphlets, followed by 32.00 per cent of the apple growers having low level of exposure and only 13.33 per cent of the apple growers had high level of exposure about extension pamphlets. These findings were due to the fact, that majority of the apple growers having medium level of educational status, were more innovative, and have good economic status. In district Budgam, majority (55.81 %) of apple growers were having low level of exposure of extension pamphlets which may be due to the fact, that majority of the apple growers having low level of educational status, were less innovative, and have low level of economic status.

In case of horticulture related information/ programmes telecasted through television (*Krishi Darshan, Butraat, Zarayi Khabarnama*), it was revealed, that in district Shopian, near about fifty percent (48.52%) of apple growers had medium level of exposure about these programmes being telecasted on television. In case of district Budgam, a majority (47.67%) of apple growers had medium level of exposure regarding these television programmes, whereas, in case of district Baramulla, a majority (53.98%) of apple growers had medium level of exposure regarding different programmes of apple cultivation telecasted through television. It is evident from the data, that majority of the apple growers from all the three districts had medium level of exposure regarding different information of apple cultivation telecasted through television. However, in case of overall exposure of apple growers from all the three districts

about horticulture related information/ programmes telecasted through television, it was found that 50.34 per cent of the apple growers had medium level of exposure about television programmes. These results were because of the fact that television has become more popular for the programmes being telecasted through it. Further, in district Shopian, a majority (54.46%) of apple growers were listening different horticultural related programmes (*Kisan Vani, Kashkaran Khatre* programme and *Gami Bhayun Hindi Khatre* programme) being broadcasted through radio, had medium level of exposure regarding these programmes. In case of district Budgam, fifty percent of apple growers listening different horticultural programmes through radio were having medium level of exposure regarding these radio programmes, whereas, in case of district Baramulla, a majority (63.72%) of apple growers had medium level of exposure regarding these programmes. As such majority of the apple growers from all the three districts had medium level of exposure regarding horticulture related programmes being aired through radio. However, in case of overall exposure of apple growers from all the three districts about horticulture related information/ programmes aired through radio, it was found, that 56.67% of the apple growers had medium level of exposure about these programmes.

CONCLUSION

Majority of the apple growers from district Shopian and district Baramulla were having medium level of media exposure of apple growers in district Baramulla, followed by in district Shopian. In district Budgam, 50 per cent of the apple growers were having low level of media exposure. Further, it was also observed, that a majority of the apple growers from all the three districts were having medium level of media exposure. It could be concluded that need of the hour is that both print and electronic media should be made easily available to the apple growers at local level. More efforts are required by the extension agencies to increase as well as update the knowledge of apple growers about recommended cultivation practices of apple production and to motivate them for their proper use to obtain higher yields.

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Assessment of the Constraints Perceived by the Self-Help Groups Members and Impact on their Livelihood

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ABSTRACT

Self-Help Group (SHG) program a pragmatic approach is initiated as a self-employment program in the jargon of poverty eradication measures as well as to improve their livelihood and empowerment. This study was designed to trace out the constraints and impact of Self-Help Groups in women empowerment in Bhiwani district of Haryana, India. The research area was selected purposively and data was collected from different Self-Help Groups selected randomly from 4 blocks and 8 villages and fifteen respondents per village on the basis of their participation in SHG activities. The results revealed that the majority of the respondents (42%) perceived family responsibility as major constraint due to which they were unable to take part in Self Help Group (SHG) activities. Among Bank-SHG coordination constraints, 28.70 per cent respondents perceived that bank officials' perception about SHGs is poor as major constraint. Maximum respondents (35.70%) faced marketing problems due to distant location of market as major institutional constraint. Among educational constraints 39.5 per cent of the respondents perceived having lack of knowledge about advantages and facilities provided by the government as major constraint. Other major problems perceived by the respondents in effective functioning were: price problems, delay in getting loans, improper demand and supply chain of commodities, and transportation. The SHGs could be used as an effective mechanism for technology dissemination to support the public extension system, social and mutual learning, institutionalized process of empowerment, conflict management, participatory extension and sustainable and equitable development.

Keywords: Constraints, Poverty, Women, Livelihood

INTRODUCTION

The Self-Help Groups can be used as an effective mechanism for technology dissemination to support the public extension system; social and mutual learning, institutionalized process of empowerment and for sustainable, equitable and participatory extension and development. Besides effective cooperation and coordination among the members, the most essential is to infuse positive and favorable intentions and attitude, self-confidence and capacity for self-determination among the clientele system. The expansion in the range

of potential choices available to women includes three inter-related dimensions that are inseparable in determining the meaning of an indicator and hence its validity as a measure of empowerment. These dimensions are; resources (pre-condition necessary to exercise choice, must have access and future claims to material, human and social resources), agency (process of decision-making, including negotiation, deception and manipulation that permit to define their goals and act upon) and the achievements (well-being outcomes that can be experienced as a result of access to resources and agency). The success of the Indian Self-Help Groups

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contributed in realizing the fact that the rural people will be able to save and are capable enough to repay the loans in time and opened the potential markets for formal financial institutions. Self help groups are promoting saving, credit along with other income generating activities. SHGs now-a-days are becoming the vehicle of change and transforming the lives of the people below poverty lines. SHGs are playing a great role in technology dissemination and improvement of livelihoods of rural women (Khan *et al.*, 2010). SHGs specifically women oriented had made a positive attempt towards women socioeconomic transformation and upliftment to make them torch bearer of the society and to take the nation safely towards vision India 2020 (Slathia *et al.*, 2006). Realizing that problems cannot be solved alone these small voluntary groups are formed so as to pool their resources, skills and talent for raising the livelihood or living standards. Therefore, Aajeevika Mission NRLM was launched by the Ministry of Rural Development (MoRD), Government of India (June 2011) and supported by the World Bank. This mission aimed to create efficient and effective institutional platforms for the rural poor people, so as to enable them to increase their household income through sustainable livelihood enhancements and improved access to financial services. In November 2015, the program was renamed as Deendayal Antayodaya Yojana (DAY-NRLM).

In developing countries, Swanson (2006) clearly mentioned that building social capital is critical to agricultural development strategies aimed at reducing rural poverty. SHGs have been recognized as reliable and efficient mode of technology transfer, but it needs positive attitude of SHG members as a prerequisite. Training programme will have significant impact on knowledge level of SHG members while the experience and family size had contributed significantly (Singh and Meena, 2012). The Government of India and state authorities alike have increasingly realized the importance of devoting attention to the economic betterment and development of rural poor. In spite of the rapid growth of SHGs in India, the full potential of utilizing SHGs remains unexploited. The impact of Self-Help Groups (SHGs) noteworthy in terms of self-worth like self-confidence cum capacity building by providing self-employment opportunities to meet the economic crisis. It also improves

the assessment making capacity in terms of various social, political, economic, help and educational dealings and mobilize women to fight against various types of exploitation against them in family and society at large (Chiru, 2018). Many other institutions like government bodies, NGOs, youth clubs, health care workers and cooperative societies are using this approach for the overall empowerment of women's and development in all the senses social as well as in economic terms. The present study was thus, undertaken to find out the constraints faced by the SHG members and the impact of these groups on their livelihood in selected blocks and villages of Bhiwani district, Haryana.

METHODOLOGY

The present study was conducted in Bhiwani district of Haryana state, this district was selected, purposively as it has the history of SHGs work and has the second highest number of working women SHGs. From Bhiwani district two blocks i.e. Bhiwani and Bawani Khera were selected randomly. From two blocks, four villages, were selected by random sampling technique. From the selected area total 120 respondents were selected, thus, a sample of 30 women's from each village was selected for taking the responses against the statements of constraints perceived by them. The data were collected with the help of a well-structured and pretested interview schedule comprising the items for assessment of various constraints perceived by them. The constraints categorized into four viz. personal, educational, bank-SHG coordination and institutional constraints and impact of SHGs development on their livelihoods were computed with the help of statistical measures like frequency score, percentages, weighted mean score, and rank order were used to analyze the data to draw the tangible inferences from the study.

RESULTS AND DISCUSSION

The results along with relevant discussion have been presented in prime heads as reasons for the formation mechanism of SHGs, impact of SHGs on members, number of activities undertaken by the members, constraints perceived by the rural women of different self-help groups. The findings in Table 1 indicated that for the majority of the members local leaders (79.16%)

Table 1: Formation mechanism of SHGs (n=120)

S.No.	Statements	Yes (2)		No (1)	
		Frequency	Percentage	Frequency	Percentage
A.	Source of motivation for joining SHGs				
1.	Department of agriculture	00	00.00	120	100.00
2.	KVK's	00	00.00	120	00.00
3.	Banks	28	23.34	92	76.66
4.	Local leaders	95	79.16	25	20.84
5.	Friends /Relatives/ Neighbour's	40	33.34	80	66.66
6.	NGOs/ self and others	38	31.66	82	68.34
B.	Reasons for joining SHGs				
1.	Savings	120	100.00	00	00.00
2.	Facility of loans	120	100.00	00	00.00
3.	Income generation	120	100.00	00	00.00
4.	Exposure to social media	38	31.66	82	68.34
5.	Problem solving	88	73.34	32	26.66
6.	Getting training and knowledge for difficult activities	120	100.00	00	00.00
7.	Improving family conditions or others	65	54.16	55	45.84
C.	Willingness for joining SHGs				
1.	Self	98	81.66	22	18.34
2.	Family	75	62.50	45	37.50
3.	Others	69	57.50	51	42.50

were the main sources of motivation for joining the SHGs, followed by their friends/relatives/ neighborhoods (33.34%), NGOs/ self-motivation (31.66%) for joining the groups and some role also played by banks (23.34%) in this respectively. The results are in conformity with the earlier findings of Parihar *et al.* (2013) he studied the impact of self-help groups on rural women in Jammu district and his studies revealed that majority of women 84.8 per cent joined SHGs by getting motivated through NGOs followed by KVKs and department of agriculture followed by 48.00 and 42.00 per cent respectively.

Further table also elaborated the reasons for joining the SHGs by the members, A significant number of women members that is 100.00 per cent joined SHGs for savings , facilitation of loans, for income generation and getting trainings and acquiring knowledge for carrying out difficult activities, followed by 73.34 per cent for problem solving, 54.16 per cent for raising family standards and 31.66 per cent for exposure to social life. The results were found

in conformity with the findings of Parihar *et al.* (2013) his studies revealed that 99.20 per cent joined SHGs for the purpose of saving followed by income generation, facility of loan and exposure of social contacts i.e., 96.00, 92.00 and 92.00 per cent. The table also indicating the willingness of the members for joining the groups, the majority of the that is, 81.66 per cent joined for self, followed by for family and other purposes.

The data in Table 2 revealed that majority of the respondents with weighted mean score 1.82, ranked Ist among all adopting owned startup activities with help of their respective SHGs savings followed by trading activities (1.74), manufacturing activities (1.27) and providing services to others (1.19) and ranked IInd, IIIrd and IVth respectively. The findings were found in line with the study of Dhiman and Rani (2015) their study revealed that 93.20 per cent participants were engaged in various trading activities such as selling milk and selling clothes door to doors etc., while 05.41 per cent were

Table 2: Types of activities adopted by the members of SHGs (n=120)

S.No.	Categories	Frequency		TWS	WMS	Rank
		Yes (2)	No (1)			
1	Manufacturing activities	32 (26.66)	88 (73.34)	152	1.27	III
2	Trade related activities	89 (74.16)	31 (25.84)	209	1.74	II
3	Providing services	23 (19.16)	97 (80.84)	143	1.19	IV
4	Owned startups	102 (85.00)	18 (15.00)	219	1.82	I

Table 3: Impact of SHGs on developing decision-making power of members (n=120)

S. No.	Statements	Frequency		TWS	MWS	Rank
		Yes (2)	No (1)			
1.	Decisions for children's education	78 (65.00)	42 (35.00)	198	1.65	I
2.	Independently taking decisions for nutrition of the family	38 (31.70)	82 (68.30)	158	1.32	III
3.	Participating in decisions on purchasing of household materials	18 (15.00)	102 (85.00)	138	1.15	VII
4.	Decisions taken on any social customs	29 (24.20)	91 (75.80)	149	1.24	V
5.	Freedom for enjoying outside the home like market etc.	34 (28.30)	86 (71.70)	154	1.28	IV
6.	Taking independent decisions about family planning	28 (23.34)	92 (76.66)	148	1.24	V
7.	Participating in decisions of marriage of children's	71 (59.20)	49 (40.80)	191	1.59	II
8.	Participating in decision related to business or other activities in family	24 (20.00)	96 (80.00)	144	1.20	VI

involved in manufacturing activities, and 01.35 per cent were in services sector.

The data in Table 3 indicated that majority of the members now capable of making decision regarding their children's education ranked Ist with 1.65 mean weighted score, followed by their participation in decisions regarding marriage of their children's (1.59), taking decisions independently about health of their family (1.32), freedom for outside the home like markets etc. (1.28), decisions taken on social customs and taking independent decisions about family planning (1.24), Participating in decision related to business or other activities in family (1.20) and Participating in decisions on purchasing of household materials (1.15) with IInd, IIIrd, IVth, Vth, VIth and VIIth ranked respectively. This indicates relatively positive impacts of self help group development in rural areas which will empower women and they are now becoming capable for taking important decision's on family aspects. The study was found in similar lines with the results of Parihar *et al.* (2013) The respondents as SHGs members were able to take more decisions as compared to those

who were not members of SHGs because SHGs members could acquire more knowledge and more scientific information by mutual interactions, social gatherings and trainings conducted by different departments/agencies engaged in women empowerment.

Considering the constraints perceived by the respondents, an attempt was made to know about the forces which slowing down the activities or impedes the respondents. The constraints or the restrictions or limitations on the behaviour of the respondents which restrict them from doing a work smoothly. Table 4 elaborated that among the personal constraints the 'family responsibility' was the main constraints faced by the respondents (weighted mean 2.07), it may be due to women's in the villages unfavourably because they have responsibility to provide care for the family members and also due to assumptions made by the people about women, followed by lack of commitment among SHG members (weighted mean 2.05), lack of discipline (weighted mean 1.98), lack of experience (weighted mean 1.85), lack of confidence (weighted mean 1.82), lack of management

skills (weighted mean 1.82) and lack of education respectively. Similar findings were reported by Singh (2011) revealed that majority of respondents 92.00 per cent having family responsibilities as major constraints followed by education and management skills.

The data in the Table 4 further indicated that constraints namely, labour scarcity ranked at top with 2.14 weighted mean, followed by distant location of market and low price of products ranked at second and third with 2.10 and 2.00 weighted mean score respectively, Further, lack of technical training, it may be due to one unavailability or small number of trainers, second one is, if available engaged in other training programmes and third one member of SHGs unable to reach training site,

followed by don't have supportive network, similar results reported by, lack of transport facility, absence of marketing of SHG products, financial constraints, and no visit of SHG members to developed SHGs ranked least among all. Similarly, Ngemu (2010) in her study also mention that 'High cost of paid labour' is one of the major constraints faced by SHG members. Among the Bank-SHG's Co-ordination constraints, 'Lack of recovery' considered as the main constraints faced by the respondents having weighted mean 1.96, these results may be due to unawareness or lengthy procedure of loan sanction, and similar result cited by Sharma (2007) in his study, that the SHG movement has not successful in some north-eastern states because of some peculiarities prevailed in the region. The study observed that the

Table 4: Constraints perceived by the members of SHGs (n=120)

S.No.	Statements	Frequency			TWS	WMS	Rank
		Agree (3)	Undecided (2)	Disagree (1)			
A.	Personal Constraints						
1.	Family responsibilities	48	33	39	249	2.07	I
2.	Lack of commitment	17	92	11	246	2.05	II
3.	Lack of discipline	19	80	21	238	1.98	III
5.	Lack of experience	16	70	34	222	1.85	IV
6.	Lack of management skills	16	67	37	219	1.82	V
7.	Lack of confidence	14	70	36	218	1.82	VI
8.	Lack of education	23	73	24	239	1.20	VII
B.	Institutional Constraints						
1.	Labour problems	33	71	16	257	2.14	I
2.	Distant location of markets	38	56	26	252	2.10	II
3.	Low product prices	25	71	24	241	2.00	III
4.	Lack of trainings	19	79	22	237	1.98	IV
5.	Lack of supportive networks	26	62	32	234	1.95	V
6.	Lack of transportation facilities	36	38	46	230	1.91	VI
7.	Financial problems	15	66	45	210	1.75	VII
8.	No visit of SHG higher authorities	10	62	48	202	1.69	VIII
C.	Constraints related to Banks-SHG's						
1.	Lack of recovery	17	81	22	235	1.96	I
2.	Unfavourable attitude of bank officials	11	76	33	218	1.81	II
3.	Demand favour of money	16	60	44	212	1.77	III
4.	Over dependence on intermediaries	16	47	57	199	1.65	IV
5.	Delay in loan disbursement	05	61	54	191	1.60	V

banking constraints as a factor that hinders the quality of SHG in Northeast India. Followed by unfavourable attitude of bank officials (weighted mean 1.81), officials demand favour in terms of money, over dependence on intermediaries, and delay in loan disbursement with 1.77, 1.65 and 1.60 weighted means, respectively.

CONCLUSION

The results of the study pertaining to constraints perceived by the members found that among personal constraint family, among bank-SHG coordination constraints; poor perception of bank officials about SHGs, and among institutional constraints; marketing problems due to distant location of market were major constraint. Therefore, timely sanctioning of loan from the concerned financial institutions must be earned for better performance of SHG and individual activities. SHGs increased mobility and participation of rural women in the social activities indicated by the impact of SHGs on their decision making change. Self help groups have high impact on economic development of the respondents, followed by sociocultural, legal/political, infrastructure/educational, family/ interpersonal and psychological development. The SHGs could be used as an effective mechanism for technology dissemination to support the public extension system, social and mutual learning, institutionalized process of empowerment, conflict management, participatory extension and sustainable and equitable development.

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Assessment of Socio-Digital Approaches for Agricultural Extension in Shri Muktsar Sahib District of Punjab

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ABSTRACT

Electronic and print media has always played an important in transfer of technology. Now the social media has been becoming instrumental in bringing changes in behavior of people. Keeping in view the importance of social media, the Krishi Vigyan Kendra, Sri Muktsar Sahib started using social media for the purpose of agricultural extension. This centre has enrolled 799 farmers for spreading scientific technologies among farmers. To study the preference and constraints faced by farmers in using social media, a survey of 250 respondents was conducted during the year 2019. The majority (56.4%) of the respondents selected in the study were in the middle age group, medium level education and medium land holdings of size. The results revealed that social media has become a preferred source of information for farmers. Only 0.8 per cent of the farmers preferred radio as source of information, 7.2 per cent preferred television, while 70 per cent of the farmers preferred social media (WhatsApp) as source of information for latest agricultural technology. The preference for use of social media in agricultural extension had significant correlation with age, education, media exposure, economic motivation and socio-economic status. Fake and irrelevant messages were considered as major problem in communication through social media by majority of the farmers. Present study indicates the increasing importance of social media for transfer of technology to farmers.

Keywords: Preference, Social media and technology transfer, WhatsApp

INTRODUCTION

Social media are tools of electronic communication that allow users to interact with others individually or in groups for the purposes, sharing thoughts, information and opinions (Suchiradipta and Saravanan, 2016). Digital networks are used to share and discuss information – opinion through video, audio, and multimedia (Andres and Woodard, 2013). Merriam-Webster (2015) defines social media as ‘forms of electronic communication through which users can create online communities to share information, ideas, personal messages and other content’. Social media is basically digital technologies facilitating communication of user generated content through

constant interaction. Accessibility of social media through mobile phones and the scope of mass-personal and mass-self communication makes it a popular platform among the masses to share ideas and increase link ability and content sharing across multiple platforms. The unique experience of openness, conversation, community and connectedness makes social media an important tool of communication (Mayfield, 2008). Due to increasing popularity of social media the users are increasing day by day. Therefore, there is a vast scope to use social media as potential communication tool to reach out large number of farmers by extension workers. Furthermore, the reach of social media is constantly expanding into the rural areas making it easy and convenient for reaching

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out farmers and farm families. Sandhu *et al.* (2012) concluded that mobile based delivery ensures timeliness and is of great use to the farmers. Nain *et al.* (2019) concluded that most of the content shared was knowledge intensive with a mix of personal farming experiences. Public extension services had limited capacity and were reaching to only 6.8 per cent of the farmers (GFRAS, 2012). The fast growing use of social media and mobile technologies create opportunity for dissemination of technologies. Recent innovations in information technology can deliver agricultural information with high speed, to large number of people and with more accuracy (Goyal, 2011). The recent communication technologies are reviving agricultural extension services throughout the world (World Bank, 2016). Moreover, ICT interventions have received support from the Indian Ministry of Agriculture (ICAR, 2016) for agricultural extension purposes. In recent times two mobile based applications were launched on crop insurance and agri-market by government (GOI, 2015). Social media gives opportunities for creating content and promotes co-learning (Jackson *et al.*, 2009). The advantages of using social media are beyond cost effective ways of communication to empowerment (Neill *et al.*, 2011). Networking, engagement and community involvement through social media among farmers can be a good way for development (Stanley, 2013 and Mains, 2013). Thus, present study was conducted with the objective to know the preference of farmers towards social media for getting agricultural information and problems faced by farmers in getting information through social media.

METHODOLOGY

Present study was conducted during the year 2019 in Sri Muktsar Sahib district of Punjab. The Krishi Vigyan Kendra, Sri Muktsar Sahib has enrolled 799 farmers in different WhatsApp groups for sharing agriculture and allied field related information among farmers. The details of name of different WhatsApp groups, number of participants and type of information shared has been given in Table 1.

The data were collected from 250 randomly selected farmers who were actively engaged in agriculture and were member of one or the other social media group formed by KVK, Sri Muktsar Sahib. For the purpose of data collection a questionnaire was developed. The questionnaire contained three parts. Part I was developed to gather information regarding socio-personal characteristics of farmers, Part II dealt with the preference of farmers towards different media for receiving information related to agriculture and Part III dealt with constraints faced by farmers in using social media (WhatsApp). The data gathered was analyzed using frequencies, percentages and correlation between independent and dependent variable was also studied.

RESULTS AND DISCUSSION

In different social media groups formed by KVK, Sri Muktsar Sahib, information related to crop production, availability of different crop seeds, weed control, insect pest management, weather information, marketing related

Table 1: Details of WhatsApp groups operated by KVK, Sri Muktsar Sahib of Punjab

Socio-media group	Group Admin.	No. of members	Type of information shared
KVK Muktsar	KVK & Farmers	234	Crop production, seed availability, plant protection, IPM*, INM**, CRM***, marketing, agro-advisory, weather forecast and allied enterprises.
CRM Muktsar	KVK & Farmers	252	CRM, weather forecast, weed control and insect pest management
Beekeeping Muktsar	KVK & Farmers	78	Summer and winter management of honey bees, control of wax moth and varoa mite, marketing of honey etc.
Progressive young farmer	KVK & Farmers	170	Feedback on technology demonstrated, farmer problems and information sharing for quick dissemination of technology
Khumb Kheti Muktsar	KVK & Farmers	65	Mushroom production, span availability, marketing and value addition

*integrated pest management, ** integrated nutrient management, *** Crop residue management

information, information related to bee-keeping, mushroom farming, animal science, home science etc. was shared. Maximum numbers of farmers were enrolled in 'KVK, Muktsar' group followed by 'CRM Muktsar group' with 252 members and 'progressive young farmers group' with 170 members. Data reveals that social media has become preferred source for getting and sharing agricultural information and other social messages. The traditional electronic media viz.; Radio had least preference among print, electronic and social media. Radio was most-preferred media for only 0.8 per cent of the farmers and preferred media for 3.2 per cent of the farmers. Majority of the farmers (54.0%) reported it as not-preferred and 28.8 per cent as least preferred. Print media was most preferred for 8.8 per cent of the respondents and 31.2 per cent revealed it as somewhat preferred. Television was most preferred source of agricultural information for only 2.0 per cent of the farmers while 32.8 per cent and 32.0 per cent opined it as not-preferred and least preferred media. Social media (WhatsApp) was most preferred media for 28.0 per cent of the respondents. Total, 70.0 per cent of the farmers reported WhatsApp as preferred media for getting agricultural information. Social media was perceived as somewhat preferred by 8.0 per cent of the respondents and only 4.8 per cent reported it as least preferred (Table 2).

The socio-personal characteristics viz.; age, education, media exposure, extension contact and socio-economic status had bearing on preference towards use of social media for sharing agricultural information. The findings presented in Table 3 show the correlation ('r' value) between preferences towards social media and socio-personal characteristics of the respondents. It is quite evident from the findings that respondents' age had negative correlation (-0.28) as for preferences of

respondents for seeking information from social media is concerned. This means that young generation was more inclined towards social media as a source of information. While variables such as education, media exposure, extension contact, economic motivation and risk orientation were positively correlated with preference towards use of social media for seeking agricultural information.

There are certain factors which create noise in every communication channel. Attempt was made to study the problems faced by farmers in communication through social media (WhatsApp). The data given in Table 4 reveals that major problem faced by farmers was the spread of fake messages. Majority of the farmers (27.6%) revealed that fake messages shared by group members were annoying factor in communication through WhatsApp. This was followed by problem of irrelevant messages which was expressed as noise in communication by about one fifth (21.2%) of the farmers. Excessive message load especially during festival days was perceived as problem by 13.6 per cent of the group

Table 3: Relationship of socio-personal characteristics with preference towards social-media as tool for receiving agricultural information

Dependent variable 'y'	Independent variable 'x'	r value
Preference towards social media as tool for receiving agricultural information	Age	-0.28*
	Education	0.38*
	Land holding	0.17
	Extension contact	0.20
	Media exposure	0.39*
	Economic motivation	0.485*
	Risk orientation	0.38*
	Socio-economic status	0.14

*Significant at 0.05 level of significance

Table 2: Distribution of farmers according their preference for getting information through WhatsApp group (n=250)

Different media	Not preferred	Least Preferred	Somewhat preferred	Preferred	Most Preferred
Print media	50(20.0)	62(24.8)	78(31.2)	38(15.2)	22(8.8)
Radio	135(54.0)	72(28.8)	33(13.2)	08(3.2)	02(0.8)
Television	82(32.8)	80(32.0)	70(28.0)	13(5.2)	05(2.0)
Social media (WhatsApp)	43(17.2)	12(4.8)	20(8.0)	105(42.0)	70(28.0)

Figures in parenthesis are percentages

Table 4: Problems associated with communication through WhatsApp in Shri Muktsar Sahib district of Punjab

Problems	Frequency	Percentage
Connectivity problem	12	4.8
Irrelevant message	53	21.2
Excessive message load	34	13.6
Fake messages	69	27.6
Personal chat	14	5.6
Long duration of video content	19	7.6

members. Similarly, long duration videos (7.6%), personal chat (5.6%) and connectivity problem (4.8%) were other problems expressed by WhatsApp group members.

CONCLUSION

Social media can be easily included for sharing information related to agriculture along with different other media. The social media has become a preferred media for receiving and further sharing information among all the stake holders. The direct participation of the all the stakeholders can be enhanced in agricultural development related discourses. It is easy to take follow up and receive feedback from the stakeholder with use of social media and even course correction can be done at monitoring of different extension programmes. Social media has been instrumental for open discussions on complex issues like crop residue management and foremost for two way communication.

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Effect on Growth of Practical Diet Formulation with Non conventional Animal Protein Sources on Freshwater Catfish (*Clarias magur*)

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ABSTRACT

The present study designed to evaluate the growth performance and survival of *Clarias magur* fed with non conventional animal protein sources. Four iso-nitrogenous experimental diets containing 35 per cent of protein level were prepared using ingredients such as Fish meal, Vermi meal, Chicken viscera, rice polish, wheat flour, vitamin and mineral mixture. Fishes fed with fishmeal based diet showed significantly higher final weight 204.93 g and the best specific growth rate 1.78. There was no significant difference for survival rate during the culture period with replacement of the fish meal component of practical diet with vermi meal and chicken viscera meal for magur. The study concluded that non-conventional animal protein like vermi meal and chicken viscera meal is an acceptable ingredient for the replacement of fish meal protein in practical diets of fishes

Keywords: Chicken viscera, Fish meal, Protein, Specific growth rate, Vermi meal

INTRODUCTION

The catfish (*Clarias magur*) is a highly valued fish in the Indian subcontinent. Most common English name used for this species is walking catfish as it has the capability of crawling long distances through moist, swampy and grassy areas. The magur has very high degree of consumer preference because of inviting taste and therapeutic qualities of its flesh. The magur is one of the popular fish species in fresh water aquaculture due to its omnivorous feeding habits, air-breathing characteristics, rapid growth and good market potential in North Eastern Region of India. However, the production of large quantities of magur seed and desired feed still remains a major bottleneck in popularization of its extensive and intensive culture. Dutta *et al.* (2019) reported that the fish farmers of North Eastern Region of India were not getting good quality seeds and feed which are major

problems in adoption of scientific fish farming. Protein is the main but expensive ingredient in the aqua feed formulation, the quality and quantity of which in fish feeds formulation plays a vital role in promoting fish growth Pandian *et al.* (2001). Fish meal is unsustainable both environmentally and financially as a protein source for fish feeds (Tacon and Nates, 2007). To achieve a good growth, catfish requires complete artificial feed of 35 per cent to 45 per cent protein level (Nyina Wamwiza *et al.*, 2010). Kaushik (1998) observed the catfish requires relatively high levels of dietary animal protein for rapid growth and hence fishmeal has traditionally been used as a major protein source. Very few information is available regarding the use of non-conventional animal protein sources in practical diet formulation for fresh water catfish. Giri *et al.* (2010) showed that dried chicken viscera can be incorporated up to 30 per cent in the diet for juveniles of *Clarias batrachus* without affecting

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nutrients digestibility and can be used as a replacer of expensive fishmeal in the diet. The price of fishmeal has increased greatly within the past decade due to the high demand which inhibits small scale aquaculture enterprises in rural areas from increasing their fish production by using higher quality feed inputs. Hardy (2010) felt the need to search for alternative for highly nutritious feed ingredients in aqua feeds. Considering the need of cheap diet for *Clarias magur* that can be easily adoptable by the farmers of the northeastern region of India, present study was designed to evaluate some non conventional animal protein sources for nursing and rearing of the fresh water catfish.

METHODOLOGY

The research work was conducted in the Department of Aquaculture, College of Fisheries Sciences, Assam Agricultural University, Raha, Nagaon, Assam. The specimens of magur were divided into four groups and each group was reared in triplicate separate tanks for 180 days, maintaining a stocking density @ 4 nos/m². The experimental tanks were provided with six inch of soil bed and water level was maintained at 50 ± 5 cm. Water from experimental tanks were analyzed for temperature, pH, DO, CO₂, alkalinity etc. on the day of stocking and thereafter at 30 days interval, following the standard methods of APHA (2005). Liming of the tanks was done to maintain water pH between 6.5 to 8.0.

Four iso-nitrogenous experimental diets containing 35 per cent of protein level were prepared using ingredients such as Fish Meal, Vermi meal, Chicken viscera, rice polish, wheat flour, vitamin and mineral mixture.

Table 1: Composition (%) of feed ingredients in experimental diets

Feed Ingredients	D-1	D-2	D-3	D-4
Vermi meal	60	-	28.5	-
Chicken viscera meal	-	53	28.5	-
Fish meal	-	-	-	50
Rice polish	22	31	26	25
Wheat flour	17	15	16	24
Agrimmin Forte*	1	1	1	1

*Feed Supplement of Vitamins and Minerals marketed by Virbac Animal Health India Pvt. Ltd.

Proximate analysis of the selected ingredients was carried out by standard methods of AOAC (2005). The Diet 1 (D1) was formulated by 100 per cent replacement of Fish Meal with Vermi Meal; Diet 2 (D2) was formulated by 100 per cent replacement of Fish Meal with Chicken Viscera Meal; Diet 3 (D3) was formulated by 100 per cent replacement of Fish Meal with mixture of Vermi Meal and Chicken Viscera meal and Diet 4 (D4) was Fish Meal based reference diet (Table 1). Each group having both the sexes of *Clarias magur* were fed @ 10-5 per cent body weight in two split doses daily once in the morning and next in the evening. The sampling was done at the day of stocking and every fortnight for growth study.

RESULTS AND DISCUSSION

The water temperature in the cemented tank system ranged between 22.1°C to 32.5°C (Table 2). Dissolved oxygen remained between 5.59 mg/l to 5.67 mg/l (Table 3). The water quality parameters like, DO, depth, pH,

Table 2: Water temperature of the tanks during culture period

Month	Temperature (°C) Treatment 1		Temperature (°C) Treatment 2		Temperature (°C) Treatment 3		Temperature (°C) Treatment 4	
	Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.
July	24.3 – 31.8	28.8	24.0 – 32.0	28.1	24.2 – 31.6	28.1	24.4 – 31.9	28.9
August	24.4 – 32.2	29.1	25.0 – 32.5	29.2	24.5 – 32.1	29.0	25.1 – 32.4	29.1
September	23.7 – 31.0	28.7	24.0 – 32.0	28.5	23.6 – 31.2	29.2	23.5 – 31.1	29.1
October	23.8 – 30.1	27.2	22.0 – 30.0	26.7	23.5 – 30.4	27.1	23.7 – 30.3	27.6
November	22.7 – 28.0	26.1	21.0 – 28.5	25.3	22.5 – 28.5	25.9	21.1 – 28.3	25.1
December	22.2 – 25.5	23.9	22.1 – 25.4	23.3	22.3 – 26.0	24.2	22.4 – 25.9	23.7

CO₂, total alkalinity, total hardness and ammonia did not recorded any marked trend in the treatments during the culture period (Table 3). All the water quality parameters varied insignificantly in treatments. It might be due to management practices done at regular interval of time i.e. liming and water exchange.

In order to formulate 04 different practical diets for catfish magur, some important biochemical parameters of feed ingredients used in the experiment were analysed (Table 4). The iso-nitrogenous feeds were designed to contain 35 per cent crude protein (Table 5). Similar type of studies was reported by Giri *et al.* (2010) where dried chicken viscera was used as a complete and superior substitute of marine by-catch fishmeal without adversely affecting the performances of *C. batrachus* fingerlings, when incorporated in a 500 g kg⁻¹ diet. Oke *et al.* (2016) recommended that up to 30 per cent of chicken viscera meal could be incorporated in the diets of *C. gariepinus* without negative effects on growth and whole body composition. In this study of replacement of the fish meal component of practical diet with vermi meal and chicken viscera meal for magur, it was inferred that there was no significant difference for survival rate during the culture

Table 5: Some important biochemical parameters of experimental diets

Parameters	D-1	D-2	D-3	D-4
Protein (%)	35	35	35	35
Lipid (%)	6.8	11.4	9.2	7.9
Fibre (%)	6.2	7	6.5	5.4
Ash (%)	13.7	7.4	10.4	10.1
NFE (%)	38.3	39	38.8	41.5
Dry matter (%)	90.0	90.3	90.2	90.2
Moisture (%)	10.0	9.7	9.8	9.8

Values are mean $\pm$ SD, n = 3

period (Table 7). Although the initial average weight of the fishes was same in all the treatment, fishes fed with fish meal based diet showed significantly highest final weight 204.93g (Table 6) and the best specific growth rate 1.78 (Table 7) compared to those 100 per cent replacement of Fish Meal with Vermi Meal, 100 per cent replacement of Fish Meal with Chicken Viscera Meal and 100 per cent replacement of Fish Meal with mixture of Vermi Meal and Chicken Viscera meal diet. These results are similar to those obtained by Cayen *et al.* (2016) in their study on replacement of fish meal with

Table 3: Water quality parameters observed during the culture period

Tanks	Sampling Details for Water Quality Parameters						
	Water depth (Meters)	D O (mg/l)	Water pH	CO ₂ (mg/l)	Total Alkalinity (mg/l)	Total Hardness (ppm)	Ammonia (ppm)
Treatment 1	0.52 $\pm$ 0.03	5.65 $\pm$ 0.17	7.83 $\pm$ 0.22	1.77 $\pm$ 0.30	233.69 $\pm$ 13.26	153.08 $\pm$ 16.75	0.02 $\pm$ 0.01
Treatment 2	0.52 $\pm$ 0.03	5.67 $\pm$ 0.17	7.82 $\pm$ 0.16	1.68 $\pm$ 0.25	236.97 $\pm$ 17.29	152.78 $\pm$ 15.79	0.02 $\pm$ 0.01
Treatment 3	0.52 $\pm$ 0.02	5.63 $\pm$ 0.21	7.78 $\pm$ 0.23	1.72 $\pm$ 0.23	240.75 $\pm$ 14.90	152.19 $\pm$ 18.31	0.03 $\pm$ 0.01
Treatment 4	0.52 $\pm$ 0.03	5.59 $\pm$ 0.19	7.84 $\pm$ 0.22	1.64 $\pm$ 0.20	238.94 $\pm$ 13.93	153.17 $\pm$ 17.05	0.02 $\pm$ 0.01

Values are mean $\pm$ SD, n = 12

Table 4: Some important biochemical parameters of feed ingredients used in the experimental diet preparation

Ingredients	Protein (%)	Lipid (%)	Fiber (%)	Ash (%)	NFE (%)	Dry matter (%)	Moisture (%)
Fish meal	59.0 $\pm$ 0.2	9.0 $\pm$ 0.2	1.0 $\pm$ 0.10	15.1 $\pm$ 0.1	15.8 $\pm$ 0.2	90.0 $\pm$ 0.6	10.0 $\pm$ 0.6
Vermi meal	51.0 $\pm$ 0.2	6.5 $\pm$ 0.1	3.2 $\pm$ 0.1	19.1 $\pm$ 0.1	20.2 $\pm$ 0.4	88.2 $\pm$ 0.1	11.8 $\pm$ 1.0
Chicken viscera Meal	58.0 $\pm$ 1.0	14.2 $\pm$ 0.9	1.9 $\pm$ 0.1	8.1 $\pm$ 0.2	17.7 $\pm$ 1.4	90.3 $\pm$ 0.8	9.7 $\pm$ 0.8
Rice polish	9.1 $\pm$ 0.2	12.0 $\pm$ 0.1	19.0 $\pm$ 0.2	10.2 $\pm$ 1.0	49.7 $\pm$ 1.2	89.7 $\pm$ 0.6	10.3 $\pm$ 0.6
Wheat flour	12 $\pm$ 0.5	1.7 $\pm$ 0.1	0.9 $\pm$ 0.01	0.6 $\pm$ 0.2	84.8 $\pm$ 0.7	89.2 $\pm$ 1.0	10.8 $\pm$ 1.0

Values are mean $\pm$ SD, n = 3

Table 6: Length- weight of *C. magur* reared using different experimental diet

Experimental group	Days of culture			
	1 st day		180 th day	
	Average length (cm)	Average weight (g)	Average length (cm)	Average weight (g)
Group fed with Diet-1	6.92 ± 0.8	8.69 ± 1.3	23.30 ± 2.0	181.30 ± 22.8
Group fed with Diet-2	6.87 ± 1.16	8.67 ± 1.48	23.24 ± 1.37	200.81 ± 22.42
Group fed with Diet-3	6.90 ± 1.18	8.29 ± 1.60	23.33 ± 1.35	190.32 ± 30.05
Group fed with Diet-4	6.81 ± 0.66	8.30 ± 0.80	23.52 ± 1.29	204.93 ± 21.98

Values are mean ± SD, n = 90

Table 7: Percentage weight gain, SGR, FCR and PER

Days of culture	Group fed with Diet-1	Group fed with Diet-2	Group fed with Diet-3	Group fed with Diet-4
Percent Survival	100	100	100	100
Percent Weight Gain	1986.3	2216.1	2195.8	2369.0
SGR	1.69	1.75	1.74	1.78
FCR	1.71	1.54	1.62	1.50
PER	1.67	1.86	1.76	1.90

broiler chicken viscera on growth of catfish *Clarias gariepinus*. The food conversion ratio (FCR) was found better in diet 4 followed by diet 2, diet 3 and diet 1 (Table 7). Samad *et al.* (2014) also reported a FCR 2.02 where the *Clarias batrachus* was fed with formulated diet of 30 per cent protein containing poultry viscera, mustard oil cake and rice polish.

CONCLUSION

The results of the earlier researcher's studies as well as outcome from the present study indicated that non-conventional animal protein like vermi meal and chicken viscera meal is an acceptable ingredient for the replacement of fish meal protein in practical diets of fishes but still a lot of improvement is required in strategy and technology of culturing of *Clarias magur* to make it more successful and adoptable at farmers' level. The work on evaluation of some non-conventional animal protein sources in practical diet formulation for fresh water cat fish magur and its effect on growth will definitely benefit the farming community.

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Extent of Knowledge of Beekeepers in Relation to Improved Apiculture Practices in Jammu Province

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ABSTRACT

The study was conducted to ascertain the knowledge level of beekeepers of Jammu region with respect to the improved beekeeping practices. Four districts were purposively selected for the study which includes Jammu, Kathua, Rajouri and Ramban, due to the maximum number of the beekeepers in these four districts in the Jammu province. The proportionate sampling plan was adopted to select 210 beekeepers. Data was collected with a knowledge test comprising seven improved beekeeping practices. All the districts revealed a significant knowledge gap in all the improved beekeeping practices especially in bee biology, bee enemies, bee breeding and disease management. The marginal beekeepers possessed a low level knowledge regarding these practices. However, the pooled data revealed maximum mean knowledge score with respect to general information followed by management of boxes. The minimum mean knowledge score was recorded in case of knowledge about bee enemies and bee biology. It is concluded that beekeepers of Jammu region had a significant level of knowledge about general beekeeping practices but they were lacking knowledge in some important areas like bee breeding, queen management, bee enemies/disease management and production of other bee products which are important for flourishing the apiculture industry.

Keywords: Bee, Beekeeping, Honey production, Knowledge, Management

INTRODUCTION

Considerable changes have been brought about in traditional agriculture during recent years in the country through various enterprises involving use of modern inputs and knowledge about new and improved technologies. Knowledge is one of the important components of behaviour and plays an important role in covert and overt behaviour of an individual. Knowledge is generally understood as an intimate acquaintance of an individual

with facts. It is defined as, behaviour and test situations which emphasize the remembering, either by recognition or recall of ideas, material or phenomenon (Bloom, 1979). Beekeeping has established itself as an economic activity and a commercial enterprise worldwide which not only promote agricultural and horticultural development but also has a great potential for upliftment of the rural economy of the country. It provides employment, new sources of income generation, food and nutritional

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security and improves rural economy. Beekeeping has naturally emerged as one of the important agri-based rural industry having potential to generate large scale employment. In addition beekeeping is low investment and high profit giving enterprise. It is a multipronged employment generating enterprise providing gainful employment opportunity to both rural and urban people, as income in this profession comes from several bee products and services. The increase in knowledge and adoption of scientific beekeeping practices offers a means to increase the honey production and generate income and employment for the rural youth.

The State of Jammu and Kashmir is endowed with high diversity of bee flora and favourable ecological conditions and is one of the leading honey producing states in India. The Jammu region particularly the districts of Jammu, Ramban, Rajouri and Kathua contribute a major share in honey production in the state. The present study was conducted to know the extent of knowledge of the beekeepers of the region with respect to improved apiculture practices because knowledge is considered one of the most important components of human behaviour for successful adoption.

METHODOLOGY

The study was conducted in the Jammu region of Jammu & Kashmir during 2017. Four districts were purposively selected for the study as the maximum number of the beekeepers fall in these four districts in the Jammu province which include Jammu, Kathua, Rajouri and Ramban. They were selected on the basis of census of beekeepers carried out by department of Agriculture during 2011. A list of registered beekeepers of the selected districts was obtained and accordingly the number of beekeepers was selected randomly in each district, based on the proportionate random sampling method. A total sample of 210 beekeepers was selected in all the four districts which included 126 from Ramban, 22 from Rajouri, 43 from Kathua and 19 from Jammu. The selected beekeepers were interviewed regarding the extent of knowledge about seven beekeeping practices, on the basis of a well structured questionnaire involving eighty items about these practices. Knowledge was measured in terms of correct responses given by the

beekeepers for all the practices under consideration. A score of '1' for correct answer and a score of 'zero' for incorrect answer was awarded. The frequency score of beekeepers for each practice was further converted into percentage in each district and the pooled mean scores was worked out for all the seven practices in the region (Kaur *et al.*, 2020).

The tool measuring knowledge level of different beekeeping practices involved seven major subjects and the number of test items included in each subject is given in Table 1.

Table 1: Major subjects of Knowledge test and number of items

Bee keeping practices	No. of objects involved
General aspects	21
Management of boxes	19
Bee biology	04
Production of honey	09
Bee flora	09
Bee enemies	08
Bee breeding	10
Total	80

RESULT AND DISCUSSION

The respondent beekeepers were enquired to express their extent of knowledge about different beekeeping practices involving different objects regarding these practices.

The results depicted in Table 2 reveals that the knowledge level of beekeepers of different districts in general aspects of beekeeping. The results revealed that majority of the respondent beekeepers in all the four districts possessed a significant knowledge about major portion of the general aspects of beekeeping which recorded an overall percentage of knowledgeable beekeepers' from 51.90 to 100 per cent in the region. However, only a meagre percentage of beekeepers i.e. 15.23 and 20.47 per cent possessed the knowledge about the types and morphology of honey bees respectively. The data further reveals that majority of the respondent beekeepers in all the districts were well versed about the

Table 2: District wise percentage of beekeepers' knowledge about different aspects of beekeeping (n=210)

Aspects	District-wise percentage of beekeepers				Overall
	Kathua (n = 43)	Rajouri (n= 22)	Jammu (n = 19)	Ramban (n= 126)	%tage of beekeepers (n = 210)
a) General Aspects					
Body parts of honey bees	23.25	22.72	42.10	15.87	20.47
Types of honey bees	11.62	9.09	36.84	14.28	15.23
Preference of domestic bees for comb making	83.72	77.27	42.10	58.73	64.28
Italian honey bees	100.00	100.00	100.00	99.20	99.52
Identification of queen bee	100.00	95.45	100.00	98.41	98.57
Number of queen bees in a colony	93.02	4.54	89.47	40.47	51.90
Collection of pollen by worker bees	97.67	100.00	100.00	100.00	99.52
Guarding of boxes by workers bees	100.00	100.00	89.47	100.00	98.57
Monsoon season for bees	76.74	63.63	63.15	85.71	79.52
Season for increasing of boxes	88.37	95.45	94.73	97.61	95.23
Collection of honey by the bees	39.53	45.45	47.36	44.44	43.80
Indian honey bees	93.02	100.00	94.73	97.61	87.14
Italian bees recommended for domestication	100.00	100.00	100.00	98.41	99.04
Drone bees are fatter than worker bees	100.00	100.00	100.00	99.20	99.52
Worker bee is sharp	100.00	100.00	100.00	100.00	100.00
Drone bee do not have sting	100.00	90.90	57.89	96.82	93.33
Importance of water for bees	100.00	100.00	84.21	99.20	98.09
Swarming of bees during April	95.34	95.45	94.73	93.65	94.28
Sugars present in honey	97.67	95.45	94.73	99.20	98.09
Age of worker bees	83.72	59.09	36.84	42.06	51.90
Identification of drones	65.11	36.36	42.10	50.79	51.42
b) Management Aspects					
Optimum time to start beekeeping	90.69	95.45	100.00	82.53	87.14
Box to box distance	37.20	50	42.10	24.60	31.42
Row to row distance	62.79	40.90	42.10	26.19	36.66
Sugar syrup feeding to boxes	100.00	100.00	100.00	96.82	98.09
Giving feed to boxes during off season	69.76	72.72	63.15	56.34	61.42
Time to giving feed to colonies	34.88	100.00	57.89	72.22	66.19
Optimum number of boxes to start beekeeping	62.79	63.63	36.84	44.44	49.52
Placement of boxes during winter	9.30	0.00	31.57	4.76	7.61
Checking of boxes during winter	93.02	95.45	84.21	88.88	90.00
Checking of boxes during summer	93.02	100.00	94.73	100.00	98.09
Method used to decrease the population of drones	65.11	90.90	31.57	49.20	55.23
Robbing during rainy season	55.81	9.09	26.31	10.31	20.95
Protection of boxes from robbing	97.67	100.00	89.47	91.26	93.80
Packing of boxes during winter	100.00	100.00	94.73	100.00	99.52

Table 2 contd...

Aspects	District-wise percentage of beekeepers				Overall %tage of beekeepers (n = 210)
	Kathua (n = 43)	Rajouri (n= 22)	Jammu (n = 19)	Ramban (n= 126)	
Robbing problem	93.02	90.90	100.00	100.00	97.61
Swarming of bees	74.41	90.90	94.73	81.74	82.38
Best season for bees	100.00	86.36	94.73	84.12	88.57
Hive tool	100.00	95.45	84.21	96.03	95.71
Benefits of winter packing	97.67	100.00	94.73	100.00	99.04
c) Bee biology Aspects					
Life cycle of honey bee	13.95	22.72	42.10	2.38	10.47
Rearing of queen from eggs	37.20	4.54	21.05	7.14	14.28
Rearing of drone from eggs	13.95	0.00	0.00	0.00	2.85
Rearing of worker bee from eggs	13.95	0.00	0.00	0.00	2.85
d) Honey production aspects					
Consumption of honey by bees for production of wax	30.23	18.18	52.63	9.52	14.28
Purity of honey	41.86	18.18	57.89	19.04	27.14
Extraction of honey	100.00	95.45	94.73	97.61	97.61
Freezing of honey	97.67	86.36	31.57	96.03	89.52
Maturity of honey	10.00	95.45	94.73	100.00	99.04
Wax production	51.16	50	84.21	43.65	49.52
Queen excluder	30.23	81.81	94.73	59.52	59.04
Benefits of queen excluder	32.55	13.63	63.15	44.44	40.47
Production of honey	93.02	68.18	89.47	54.76	67.14
e) Bee flora aspects					
Things collected by bee from flowers	97.67	100.00	100.00	97.61	98.09
Migration of boxes	100.00	100.00	100.00	100.00	100.00
Whether bees destroy the flowers	100.00	100.00	100.00	99.20	99.52
Availability of bee flora during March-April	100.00	100.00	100.00	98.41	99.04
During January, honey bees collect enough nector	13.80	90.90	89.47	74.60	76.19
Importance of pollen for bees	100.00	95.45	100.00	99.20	99.04
Maize as a good source of flora	100.00	100.00	94.73	99.20	99.04
Pollen collected by worker bees	97.67	90.90	94.73	99.20	97.61
Which crop produce more honey	93.02	81.81	84.21	76.98	81.42
f) Bee enemies aspect					
Damage of wax moth	100.00	100.00	9.73	97.61	98.09
Damage of green sparrow	95.34	100.00	9.73	97.61	97.14
Incidence of wax moth	60.46	4.54	36.84	17.46	26.66
Season of incidence of wax moth	69.76	81.81	63.15	67.46	69.04
Thai sac brood disease of bees	0.00	0.00	0.00	0.00	0.00
Protection of bees from ants	100.00	100.00	100.00	100.00	100.00

Table 2 contd...

Aspects	District-wise percentage of beekeepers				Overall
	Kathua (n = 43)	Rajouri (n= 22)	Jammu (n = 19)	Ramban (n= 126)	%tage of beekeepers (n = 210)
Damage of varroa mite	95.34	100.00	84.21	68.25	78.57
Control measures for varroa mite	53.48	50.00	78.94	22.22	36.66
g) Bee breeding aspects					
Maximum number of eggs laid by queen bees	58.13	4.54	0.00	16.66	22.38
Laying of eggs by queen bee	93.02	100.00	84.21	97.61	95.71
Method of queen rearing	41.86	4.54	10.52	32.53	29.52
Number of eggs queen lays per cell	100.00	100.00	84.21	98.41	97.61
Purchasing of bees and young mated queen	81.39	100.00	100.00	68.25	77.14
Swarming by young queen	100.00	100.00	94.73	96.82	97.61
Young queen lay more number of eggs than old queen	100.00	100.00	100.00	100.00	100.00
Mating of queen bee by drones	65.11	68.18	89.47	74.60	73.33
Age of queen bee	79.06	25.58	84.21	45.23	54.76
Laying worker bees	93.02	44.18	78.94	51.58	66.19

major management issues of boxes among beekeeping practices. However, they were less aware about the placement of boxes in an apiary, robbing during rainy season and also their placement during winter. This was observed as the data revealed a low percentage of respondent beekeepers i.e. 7.61, 20.95, 31.42 and 36.66 per cent respondent beekeepers recorded knowledgeable in respect of placement of boxes during winter, robbing during rainy season, box to box distance and row to row distance, respectively.

The respondent beekeepers in different districts were also observed to possess a very low knowledge about biology aspects of honey bee. The data reveals an overall a very low percentage of knowledgeable beekeepers about life cycle (10.47%) and rearing of queen (14.28%), drone (2.85%) and worker bees (2.85%). Regarding level of knowledge of the respondent beekeepers in different districts about the practices involved in production of honey the result are depicted in Table 2. The data revealed that beekeepers, in general, in all the districts were less aware about the practice of consumption of honey by bees for wax production and knowledge about the benefits of queen excluder. A low percentage of respondent beekeepers i.e. 14.28 and 40.47 per cent were recorded

aware about consumption of honey by bees for wax production and the benefits of queen excluder, respectively. However, majority of the respondent beekeepers in all districts were observed to possess a significant level of knowledge about all other practices involved in production of honey. Similarly the data collected with respect to the awareness of respondent beekeepers about the distribution and diversity of bee flora and its role in honey production reveals that majority of the respondent beekeepers in all the districts possessed a highly significant degree of knowledge with respect to the different aspects of bee flora which include its availability in different seasons, role of pollen and nectar and their composition in different bee flora, etc.

The extent of knowledge of respondent beekeepers of all the districts about different bee enemies like incidence of wax moth, damage by green sparrow, Thai sac brood disease, and protection of bees from ants, *Varroa* mite and its management shows that majority of the respondent beekeepers of the districts possessed a significant level of knowledge about the damage caused due to incidence of wax moth, *Varroa* mite and its management and also the damage caused by green sparrow and wasps and bumble bees. But the respondent

Table 3: District wise extent of knowledge of beekeepers about different aspect of beekeeping in the Jammu region (n =210)

Aspect	District-wise mean knowledge score				Overall mean knowledge score (n =210)	Maximum obtainable score	Difference	Difference (%)	t-value
	Kathua (n = 43)	Jammu (n = 19)	Rajouri (n = 22)	Ramban (n = 126)					
Bee breeding	8.14	7.26	7.14	6.83	7.17	10.00	2.83	28.3	27.10
Bee biology	0.79	0.63	0.27	0.09	0.30	4.00	3.7	92.5	81.38
Bee enemies	5.53	5.52	5.36	4.69	5.01	8.00	2.99	37.37	40.98
General information	17.51	16.10	15.90	16.17	16.41	21.00	4.59	21.85	36.18
Management of boxes	14.37	13.68	14.82	12.67	13.33	19.00	5.67	29.84	37.34
Production of honey	6.51	6.53	5.27	5.28	5.64	9.00	3.36	37.33	33.30
Bee flora	8.56	8.63	8.59	8.43	8.49	9.00	0.51	5.66	11.22
Total	61.41	58.35	57.35	54.16	56.35	80	-	-	-

beekeepers in all the districts were observed to lack knowledge about different diseases like Thia sac brood disease which caused a heavy damage to the beehives after incidence. Further, an overall less percentage of respondent beekeepers (26.66%) in all the districts were observed aware about incidence of wax moth.

The pooled data with regard to the extent of knowledge of different bee keeping practices in the entire Jammu region is presented in Table 3. The data revealed that there was a significant difference in extent of desired knowledge score of the respondents for these beekeeping practices. The knowledge gap related to bee breeding, bee biology, bee enemies, general information, management of boxes, production of honey and bee flora was significant. The knowledge gap was quantified by subtracting the actual knowledge score from the desired knowledge score. The maximum mean knowledge score of 16.41 per cent was recorded in case of general information about beekeeping followed by management of boxes (13.33%) and bee flora (8.49%). The minimum mean knowledge score of 0.30 per cent was recorded in case of bee biology followed by bee enemies (5.01%), production of honey (5.64%) and bee breeding (7.17%). The maximum score related to general aspects of beekeeping practices was 17.51, 16.17, 16.10, 15.90 per cent and minimum mean knowledge score related to bee biology was 0.79, 0.63, 0.27 and 0.09, in case of Kathua, Ramban, Jammu and Rajouri districts, respectively. The general aspects of beekeeping recorded an overall maximum mean knowledge score of 16.41 per cent and bee biology observed an overall minimum mean knowledge score of 0.03 in the entire Jammu province.

CONCLUSION

Based on the results it may be concluded that the respondent beekeepers possessed a significant level of knowledge about the major important beekeeping practices. Beekeepers were observed to have good knowledge about general aspects, management of boxes and bee flora but had a low level of knowledge about bee biology, bee enemies, production of honey and bee breeding. The study recorded a total knowledge score in case of respondent beekeepers at 56.88 per cent with maximum knowledge score at 78.14 per cent and

minimum mean knowledge score at 7.5 per cent. The mean knowledge of beekeepers was 61.41, 58.35, 57.35 and 54.16 out of 80 in Kathua, Jammu, Rajouri and Ramban districts respectively. The difference of 18.60, 21.65, 22.65 and 25.84 was significant in all the four districts. Finally, it is concluded that although beekeepers of Jammu have a significant level of knowledge about different beekeeping practices but they are lacking knowledge in some important areas like bee breeding, queen management, bee enemies and disease management and production of other bee products which are important for booming the apiculture industry. Therefore, the concerned agencies like Jammu and Kashmir agriculture department, KVKs of the districts and other NGOs should guide the beekeepers and conduct more and more skill development training programs for beekeepers so as to overcome these lacunae.

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Adoption Status of Rice Residue Management Technologies in South-Western Punjab

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ABSTRACT

The present study was conducted during 2019-20 in south-western Mansa district of Punjab. The study aimed to investigate the adoption status of different rice residue management (RRM) technologies. Data were collected from randomly selected 100 farmers, custom hiring centers (CHCs) and co-operative societies of the district. The total area under study was 5350 ± 49.9 ha. Among the studied villages maximum area under RRM (404.0 ± 12.6 ha) was in village Biro KeKalan of Budhlada block which constituted ~ 30 per cent of the total area under study. The least area under RRM (28.4 ± 3.1 ha) was in village Kallhon of Mansa block which was only 4.6 per cent of the total area. The results of the study revealed that rice residue over about 43 per cent area was managed by farmers through different RRM technologies like mulching, incorporation and residue removal. The rice residue was either managed without burning or partial burning in case of very heavy straw load. Farmers preferred rice residue removal over other technologies of the total area managed, the area under rice residue removal was ~ 37 per cent which was accomplished by using either rectangular baler or manual labor. Area under residue mulching using happy seeder (HS) technology was ~ 31 per cent followed by rotavator (RT) ($\sim 14\%$) and super seeder (SS) technology ($\sim 7.7\%$). The manual removal of loose straw comprised only 2.3 per cent area. A number of constraints were faced by the farmers in RRM including yellowing of leaves, attack of pink stem borer, water stagnation and straw loading etc. The constraints reported by CHCs and co-operative societies in RRM were lack of high HP tractor among farmers and lack of skill to use new technology. Based on the results of the study it was concluded that there is significant increase in area under RRM, however, various constraints faced by farmers need to be addressed to further enhance area under RRM.

Keywords: Adoption, Happy seeder, Mulching and incorporation, Rice residue management

INTRODUCTION

Rice-wheat cropping system (RWCS) occupies ~ 4.1 Mha area in north-western states of India comprising Punjab, Haryana, Uttarakhand and western Uttar Pradesh. These states produce ~ 34 Mt of rice residue, of which Punjab alone contributes ~ 20 million tones. The mechanized harvesting of rice using combine harvesters has been a common practice followed in more than 90 per cent of the area in the state. As a result huge quantity of loose straw is left behind by these harvesters in the

fields. To manage this quantum of left-over straw through *in-situ* incorporation is not only energy intensive but also costlier and time consuming affair (Singh *et al.*, 2010; Singh *et al.*, 2020). Of the total rice straw produced, ~ 5 Mt is managed by different ways, while the remaining ~ 15 Mt is burnt *in-situ*. Rice residue burning contributes towards emission of greenhouse gases (Gujral *et al.*, 2010; Lohan *et al.*, 2013) with serious environmental implications. Nonetheless, residue burning is not a viable option as it leaves high carbon (C) footprints and lowers C sustainability of world's largest cropping system (Singh

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et al., 2020). Besides GHGs emissions, residue burning causes nutrient loss of 100% C, 90% N, 60% S and 25% each of P and K. (Dobermann and Fairhurst, 2002). Estimates revealed that burning of one Mg of rice straw leads to a loss of ~400 kg of organic C, 5.5 kg of N, 2.3 kg of P_2O_5 , 25 kg of K_2O , 1.2 kg of S and 50-70 per cent of micro-nutrients, which costs more than Rs. 200 crores (Sidhu *et al.*, 2007). In the last two decades, significant progress has been made by the State Agricultural University to evolve and disseminate number of technologies for *in-situ* management of loose rice straw using different technologies like straw management system (SMS) on combine harvesters, zero till drill, (ZTD), happy seeder (HS, a modified ZT), super seeder (SS), reversible mouldboard plough (RMBP), rotavator tillage (RT), rice straw chopper and cutter-cum-shredder etc. The Government of India (GOI) has undertaken several initiatives to curb the menace of residue burning by providing crop residue management (CRM) machinery to the cooperative societies, farmers' groups and individual farmers on 50-80 per cent subsidy. The GOI outlaid Rs. 6,950/- millions under a project 'Agricultural mechanization for *in-situ* management of crop residues for the year 2018-19 and 2019-20. The project focused on capacity building and awareness creation among farmers. Besides, numbers of CRM machines were supplied to farmers through cooperatives as well as on individual basis. During the past two years, a significant reduction in farm fires has been observed and farmers are coming forward for the adoption of these RRM technologies. Till date there is no information available regarding the adoption status of different RRM technologies in the study region. The present study was therefore conducted to assess the adoption status of different RRM technologies, their contribution towards the management of total rice residue produced and the advantages and constraints faced by farmers in Mansa district of south-western Punjab.

METHODOLOGY

Mansa district in south-western Punjab has five administrative blocks viz. Mansa, Budhlada, Jhunir, Sardulgarh and Bhikhi comprises of 243 villages. The district lies between 29.6'-36.3' north and 75.2'-34.9' east, and has a total geographical area of ~2.19 thousand ha.

Rice-wheat and cotton-wheat are the two major cropping systems prevalent in the district. Wheat dominates the cereal acreage with ~170 thousand ha area, while rice occupied 119 thousand ha area in the district during 2019 (DOA&FW, Mansa). The data were collected from randomly selected 100 farmers, 16 custom hiring centers (CHCs) and 10 cooperative societies during the year 2019-20. The data were collected using stratified random sampling from all five administrative blocks of the district. Within each administrative block, two villages were selected and within each village ten farmers were randomly selected. The survey thus comprised a total of 100 farmers. The data from CHCs and cooperative societies of these selected villages was also collected to study the present adoption status of RRM techniques, their contribution towards the management of rice residue and to study the advantages and constraints faced by farmers. The data were collected through personal interviews of farmers, in-charges of CHCs and inspectors of cooperative societies. For the purpose of data collection, an open ended interview schedule was developed. The data regarding area under various RRM techniques during current (2019) and previous year (2018) was recorded for comparison. Similarly, data regarding area covered by CRM machinery available with CHCs and the cooperative society was also collected. In addition, the advantages and the constraints faced by farmers regarding different CRM technologies was recorded. The rice area under different RRM techniques viz. HS, RT, ZTD, baler technology, SS, RMBP and disc-harrow was recorded during these interviews.

RESULTS AND DISCUSSION

The results of the study revealed that a total of 5350 ± 49.9 ha area was under rice cultivation in the selected villages. Maximum area under RRM was 404.0 ± 12.6 ha in village *Biro KeKalan* of *Budhlada* block followed by 116 ± 4.3 ha in *Karandi* village of *Sardulgarh* block. However, maximum proportion of area was in *Anupgarh* village (35.5%) of *Bhikhi* block followed by *Biro KeKalan* village (30.4%) of *Budhlada* block. Minimum area under CRM (28.4 ± 3.1 , 4.6%) was in *Kallhon* village of Mansa block. Thus, a total of 1098.4 ± 15.2 ha i.e. 20.5 per cent of the total area under rice cultivation was managed through different RRM

practices viz; incorporation, mulching or removal during 2019-20, while 1209.1±29.6 ha area was managed with partial residue burning in the district (Table 1). The total area under RRM in the district was ~43 per cent while area under rice residue burning was 56.9 per cent. Among the various RRM practices, the highest proportion of rice residue (37.4%) was managed through manual removal or mechanical removal using rectangular baler technology. The proportion of rice residue incorporation with RT, MBP, disc-harrows and the SS technology was ~32 per cent, while the proportion of area where rice residue was managed as surface mulch with the use of HS technology was ~31.0 per cent.

The data regarding area covered by different RRM techniques revealed that maximum area (~35%) was covered by rectangular baler technology as farmers preferred removal of rice residue over other strategies for fine seed bed preparation in order to facilitate sowing of ensuing wheat crop. Singh *et al.* (2017) reported baler as socially and environmentally feasible technology in

managing loose paddy straw from combine harvested rice crop fields. Next preferred technology was HS and the area under this technology was ~31 per cent. Farmers operated HS in full load of rice residue after one operation of mulcher or chopper or in partial burnt rice straw fields. The area under RT technology was ~14 per cent (13.7%) which was involved both wet and dry incorporation of rice residue. Newly introduced SS technology and RMBP covered an area of 7.7 and 7.6 per cent, respectively. Both the technologies were used for *in-situ* incorporation of loose straw. The incorporation of loose straw using conventional disc-harrows was only 2.7 per cent, however, the incorporation by disc harrows resulted in enhanced cost of cultivation due to high diesel fuel consumption on extra tillage operations required to incorporate heavy paddy straw load. Earlier, Gajri *et al.* (2002) had reported that in Punjab ~25 per cent of farmers had to perform more than five tillage operations for incorporation of rice residues, while, ~50 per cent of farmers used more than five tillage operations to

Table 1: Village wise description of RRM in selected area

Administrative block	Village	Total area under rice cultivation (ha)	Total area under RRM (ha)	Total area with <i>in situ</i> open field rice burning (ha)	
				Partial	Complete
Budladha	Ralli	792±25.9†	145.4±13.5 (18.4)¶	246.0±37.1 (31.1)	400.6±56.2 (50.6)
	BeeroKeKalan	1330±35.2	404.0±12.6 (30.4)	292.0±24.4 (22.0)	634.0±49.4 (47.7)
	Budladha pooled data	2122±34.9	549.4±12.9 (25.9)	538.0±30.4 (25.4)	1034.6±53.9 (48.8)
Mansa	BurjRathi	640±9.9	60.0±4.9 (9.4)	51.4±4.4 (8.0)	528.6±13.3 (82.6)
	Kallhon	620±8.9	28.4±3.1 (4.6)	120.0±14.3 (19.4)	471.6±20.0 (76.1)
	Mansa pooled data	1260±11.7	88.4±5.1 (7.0)	171.4±7.9 (13.6)	1000.2±17.6 (79.4)
Bhikhi	AtlaKhurd	410±13.1	104.8±4.3 (25.6)	19.6±3.9 (4.8)	285.6±14.5 (69.7)
	Anupgarh	282±8.7	100.2±4.0 (35.5)	60.0±4.9 (21.3)	121.8±9.6 (43.2)
	Bhikhi pooled data	692±8.9	205.0±4.0 (29.6)	79.6±5.4 (11.5)	407.4±12.4 (58.9)
Sardulgarh	Krandi	420±8.9	116.0±12.6 (27.6)	230.0±15.0 (54.8)	74.0±23.7 (17.6)
	Tibbi Hari Singh	260±6.7	64.0±4.8 (24.6)	97.0±4.7 (37.3)	99.0±9.0 (38.1)
	Sardulgarh pooled data	680±10.1	180.0±5.4 (26.5)	327.0±10.4 (48.1)	173.0±15.7 (25.4)
Jhunir	Talwandi Aklia	332±5.3	33.8±3.4 (10.2)	57.0±4.2 (17.2)	241.2±6.4 (72.7)
	Khiali ChehlanWali	264±15.7	41.8±2.8 (15.8)	35.0±4.2 (13.3)	187.2±19.0 (70.9)
	Jhunir pooled data	596±10.1	75.6±3.1 (12.7)	72.0±6.9 (15.4)	448.0±23.1 (71.9)
District	—	5350±49.9	1098.4±15.2 (20.5)	1209.1±29.6 (22.6)	3043.6±67.4 (56.9)

†Values indicate standard error (S.E.) of mean; ¶Values in the parenthesis indicate percent of total area under rice cultivation

incorporate loose straw after partial burning. Manual removal of loose straw used as dry fodder for animals was only 2.3 per cent. This small proportion under manual removal of paddy straw was due to heavy involvement of labor, which is already scarce and costly in the study area. Moreover, manual removal of loose straw was mostly in case of basmati rice which is used as animal fodder.

Area under different RRM techniques in comparison to previous year

There was significant increase in area under RRM management techniques during 2019-20 as compared to 2018-19 (Table 2). Area under HS mulching technology increased from 358.5 hectare to 713.4 thousand hectare an increase of ~100.0 per cent. Similarly, area under baler technology which is used for mechanical removal of rice residue increased from 491.3 hectare to 809.4 hectare with an increase ~65 per cent. SS technology for rice residue management was introduced for the first time in study area during 2019-20 and area under this technology was 176.2 hectare. Area under RT used for paddy straw incorporation increased to 256.5 to 315.4 hectare and area under disc harrows for straw incorporation increased from 55.4 to 61.6 hectare an increase of 23.0 per cent and ~11 per cent, respectively. Manual removal of basmati rice straw was also adopted by farmers for using as fodder for dairy animals and manual removal witnessed increase of 41.4 per cent from 37.5 hectare to 53 hectare. The overall increase in area under RRM was from 1249.2 ha during 2018-19 to 2305.9 thousand hectare during 2019-20, by ~85 per cent.

Contribution of individual farmer, CHCs and co-operative societies in RRM

The CHCs established by farmer groups played an important role in rice residue management. More than half of the total area (~55%) under RRM was covered by CHCs followed by individual farmers. The contribution of co-operative society in RRM was small (~6%) but significant (Table 3). The contribution of CHCs in management of rice residue using RMBP technology was ~81 per cent while individual farmer's contribution was ~19.0 per cent. The individual farmer's contribution in RRM using RT was ~83 per cent as majority of the medium and large farmers owned RT which is preferred by farmers in the study area for fine seed bed preparation. The co-operative societies' contribution in RRM was ~17.0 per cent as small and marginal farmers hired RT from co-operative societies for tillage operations and rice residue incorporation.

Opinion of farmers' about different RRM techniques

Farmers reported various advantage of surface retention of paddy straw using HS technology over conventional sowing. Majority of the farmers reported less diesel consumption requirement (4-7 per ha) for sowing wheat using HS technology. Farmers also reported that wheat sowing using HS is completed in single operation after combine harvested paddy field, which saves time. Similarly, farmers also reported advantages of labor saving, irrigation water saving (1-2 irrigation),

Table 2: Increase in area under various rice residue management (RRM) technologies, Punjab.

RRM technology	Area (000' ha)		Difference (A-B)	% Increase in area over 2018-19
	2018-19	2019-20		
Happy seeder (HS)	358.5	713.4	354.9	99.0
Baler technology + zero tillage (ZTD)	491.3	809.4	318.1	64.7
Super seeder (SS)	0.0	176.2	176.2	
Mould board plough (MBP)	50.0	176.9	126.9	253.7
Rotavator tillage (RT)	256.5	315.4	59.0	23.0
Disk harrow	55.4	61.6	6.2	11.1
Manual removal	37.5	53.0	15.5	41.4
Overall	1249.2	2305.9	1056.7	84.6

Table 3: Percent contribution of individual farmers, CHCs and Co-operative societies in RRM in Mansa district

RRM technology	Individual farmers	CHCs	Co-Societies
Happy seeder (HS)	33.1	60.7	6.2
Baler technology+ zero tillage (ZT)	22.3	70.7	7.0
Mould board plough (MBP)	19.1	81.0	0.0
Rotavator tillage (RT)	83.1	-	16.9
Others (Super seeder (SS) and mulcher etc.)	37.5	62.5	0.0
Overall contribution (%)	39.0	55.0	6.0

increase in soil fertility and less weed infestation. HS technology also ensured early sowing of wheat which also helped in checking the *gullidanda* (*Phalaris minor* Retz.) weed infestation. Malik *et al.* (2004) has also reported that earlier sowing improves the ability of wheat to compete against its major weed *Phalaris minor*, which was responsible for lower wheat yield and herbicide resistance. Increase in wheat as well as rice yield in next season due to residual effect of straw was also reported by the farmers.

It has been reported that surfaced retained crop residues decompose slowly on the surface, increasing the organic carbon and total N in the top 5-15 cm of soil, while protecting the surface soil from erosion (Rasmussen and Collines, 1991). Retention of residues on the surface increased soil NO_3^- concentration by 46 per cent, N uptake by 29 per cent, and yield by 37 per cent compared to burning (Bacon *et al.*, 1987; Bacon *et al.*, 1985a; Bacon *et al.*, 1985b).

Sowing of wheat was also performed after removal of rice residue using baler technology. After removal of loose rice straw sowing was done using ZTD. Like HS, ZTD is also zero till technology yet there is no surface retention of loose paddy straw, however, the farmers reported similar advantage of ZTD, yet, they did not report an increase in soil fertility and yield advantage in next season rice crop. No tillage technology for wheat after rice proved better in terms of saving of fuel, cost of cultivation and advancing sowing time than RT and conventional tillage (Chuhan *et al.*, 2000). In an estimate, it has been found that adoption of no-tillage in 5 million ha would represent a saving of 5 billion cubic meter of water each year. In addition annual diesel fuel savings would come to 0.5 billion liters equivalent to a reduction

in CO_2 emissions by nearly 1.3 million ton per year (Mehla *et al.*, 2000).

The farmers following straw incorporation do not reported advantage of less diesel consumption, water saving and reduction in weed infestation, however, they reported increase in soil fertility due to addition of organic matter in soil. It has been reported that unlike removal or burning, incorporation of straw increases SOM and soil N, P and K contents (Mandal *et al.* 2004). The farmers in this study also reported an increase in yield where straw was incorporated using RT, Disc-harrow or RMBP. It has been reported earlier also that in contrast, rice straw incorporation gave significantly higher wheat yields of 3.5 t ha^{-1} compared to 2.91 t ha^{-1} with straw removal (RWC-CIMMYT, 2003). Being adopted for the first time, the farmers did not report any yield advantage or disadvantage in SS technology.

Constraints faced in adoption of RRM techniques

The major disadvantage in adoption of RRM techniques was attack of pink stem borer which resulted in mortality of plants leading to yield loss. The attack of pink stem borer was reported in all RRM techniques except in RMBP perhaps due to very small area under this technology during study year. While lodging of wheat crop was reported in RT techniques, poor wheat yield was reported in HS, ZTD and RT sowing techniques. Yellowing of plants due to N deficiency was reported by farmers in HS, RT and SS techniques. It has been reported that immobilization of inorganic N occurs due to incorporation of straw and it results in N-deficiency among the plants. Incorporation of rice straw into the soil after its harvest leads to slow down the decomposition and soil nitrate is immobilized (Bacon, 1987), reducing

the N uptake and yield of subsequent wheat crops by about 40 per cent (Bacon 1987, Sidhu and Beri 1989). Poor seed germination was reported in HS sown fields where there was heavy straw load of long duration rice varieties and also in fields where loose straw could not be uniformly spread out due to lack of SMS fitted combine harvesters. Chocking of seed drill was also reported in HS and SS techniques in fields where straw load was more. The large volumes of crop residue on the soil surface often lead to machinery failures, thus affecting sowing of seeds of the following crop (Mandal *et al.*, 2004). Wider row spacing in HS techniques (22.5 cm as compared to 16-20 cm in ZTD and conventional drills) was also a constraint in adoption as reported by farmers. Farmers reported that seed rate need to be enhanced in HS, ZTD, RT and SS for ensuring proper plant stand. All the RRM techniques required high HP (>45 HP) tractor and therefore, it was common constraint in adoption of all RRM techniques as majority of the farmers were small and marginal. Poor wheat yield in HS and RT also reported by farmers due to attack of pink stem borer, poor crop stand and yellowing of wheat.

The constraints faced by co-operative society involved lack of high HP tractors among farmers, lack of tractor drivers in societies and low paying capacity of the farmers or delayed payments by farmers. They also reported more wear and tear of machinery due to lack of knowledge about maintenance of RRM machinery among farmers. As a short term constraint, the CHCs and co-operatives society also reported late receipt of purchased RRM machinery during sowing season. They also reported that some farmers did not show interest in managing crop residue due to lack of awareness.

CONCLUSION

Farmers need to be made more aware regarding the importance of *in-situ* rice residue management and ill effects of straw burning. Majority farmers preferred removal of loose straw over incorporation and mulching due to various constraints in residue incorporation as well as mulching. Being a new technology, the area under super seeder technology may increase in the coming years. Farmers need to be trained in operations of RRM techniques, insect pest management, rodent control and

fertilizer application to ameliorate nutrient deficiency. The area under RRM can be enhanced if the constraints faced by farmers, CHCs and co-operatives societies are addressed in time. So, it can be concluded that there was significant increase in adoption of RRM technologies in comparison to 2018-19. However, RRM required both short term as well as long term measures for its sustainable solution.

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Perceived Use of Computer in Extension Activities by the Extension Officials

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ABSTRACT

Continued rapid developments in computer based information technology are probably the biggest factor for the change in extension system. The computer based technologies provide numerous opportunities to obtain a variety of information for successful attainment of the role of extension professionals which largely depend on their operational competency of these computer based Information communication technological equipment. The study conducted with 40 KVK scientists and 174 extension officials from 11 districts covering all the 10 Agro-climatic zones in Odisha during 2019 revealed that computer use increases self-productivity, easy to learn and operate, useful in job performance as it saves time, easy to document data, collect and transfer of information. Extension officials need facilities to use computer, ensuring power supply, training and guidance, other related infrastructural facilities and fund allocation which may bring computer use in extension activities at a higher level. Place of service, communication channels used, education, age and computer devices used had exhibited significant influence in use of the computer.

Keywords: Computer use, Extension officials, Extension system

INTRODUCTION

Development of agriculture though largely depends on a number of interactive factors, the roles of agricultural extension professionals remains fundamental in making agriculture amenable to a given agro-climatic situation. Information and Communication Technologies (ICT) offers, the advantage of providing up-to-date information required by the extension officers quickly and increases the efficiency of the extension services (Bheenick and Brizmohan, 2003). Application of ICT has been found as the best method for bridging the information gap for rural farmers on innovative practices, technologies, Government policies, credit facilities and market (Chilimo and Sanga, 2006). Developing the capability of agro-based rural communities through cyber extension with the use

of information and communication technology would create the opportunities of growth and prosperity along with creating a more efficient information and knowledge networks (Ahuja, 2011). Therefore, computer and internet use in agriculture especially in extension services had increased tremendously because of the advancement made in information technology (Gregg and Irani, 2004). The usage of ICT tools and services by the extension personnel in dissemination of agriculture information was positive and significantly correlated with the availability ICT services (Shashidhara, 2020). Computer could play an integral role in achieving much needed improvements in agronomic practices such as precision farming, crop scheduling, support traceability of the product, inputs management, transport and distribution system as well as disaster loss reduction (Bilbao *et al.*, 2013). It was

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also found that successful attainment of the role of extension professionals largely depend on their operational competency of production equipments. Application of Information and communication technology (ICT) also support, improve, and optimize the delivery of information in different systems (Kumar *et al.*, 2019). A research was therefore designed to study the extent of perceived computer use by professionals in their various extension activities.

METHODOLOGY

The study was undertaken in Odisha during 2019. A sample size of 174 extension professionals of state government and 40 KVK scientists from 11 districts covering all the 10 agro-climatic zones of Odisha were selected randomly as the respondents for the study. A questionnaire was developed after pilot study and was pre-tested. The questionnaire was mailed to all the extension professionals working in the department of Agriculture, Horticulture, Soil Conservation (Watershed Mission) as well as KVK scientists working in the districts of Balasore, Baragarh, Bhadrak, Bolangir, Cuttack, Kalahandi, Kendrapara, Keonjhar, Mayurbhanja, Nabarangpur, and Sambalpur. After repeated follow-up, 174 extension professionals and 40 KVK scientists responded and send the filled questionnaire. Usefulness of computer, operational mechanism, extension activities undertaken with computer, advantages of computer in job performance and extent of support required were selected as the variables for the study. The perception of extension personnel was measured with a scale strongly agree, agree and disagree with scoring 3, 2 and 1 respectively over the framed statements. Statistical tools such as mean score, critical ratio, gap percentage and path analysis were employed to reveal the results.

RESULTS AND DISCUSSION

Computer based technologies offer wide range of capabilities that can be used for diversified applications, functional interactions, providing services to a mass, being used at the convenience as well as to meet challenges imposed upon the extension system.

Table 1 reveals that the respondents had better opinion about the usefulness of the computer particularly

usefulness in job performance. It increase self-productivity, job performance becomes easier, better organizing job work, enhance professional image and help in better decision making.

Knowledge and skill competency on computer operational mechanism are very much required for effective use of computer for extension activities. Both the KVK scientists and extension functionaries agreed for easy to operate computer. Though, they had favorably opinion for easy to learn computer and acquired skills, flexibility to interact with others and mistakes easily detected. Comparatively low mean score value indicated for further enrichment of knowledge and skills. Computers have suitable applications in agriculture particularly accounting and financial information, book keeping and enterprise recording, pay roll and budgeting, farm automation, decision support system, production monitoring and control, information management and dissemination as well as data bases etc. The data on extension activities undertaken revealed that the respondents had positively opined for the storing of official information, preparation of official reports and to some extent collecting latest technological information, storing of personal information as well as database for operational area. Though, KVK scientist responded positively for the designing extension materials, preparation of scientific extension presentation, preparation of scientific and popular articles, the responses of the extension functionaries were not encouraging. Therefore, further training and exposure are necessary to develop their competency to undertake various extension activities with the computer.

Computer has the benefits of acquisition, storage, recovery, transfer, manipulation and delivery of data, sound and graphics including video. The respondents prioritised the advantages of computer in job performance such as storing information for future use, easy to document data, saving time, easy to collect information, easy to transfer information and to some extent guiding in day-to-day activities. It indicate that both KVK scientists and KVK functionaries had good understanding and realized the benefits of computer use for their better job performance which may be helpful in effective implementation of computer assisted extension system.

Table 1: Opinion about usefulness of the computer

Usefulness	Mean Score		Pooled mean score (n = 214)	Gap (%)
	KVK scientists (n = 40)	Extension functionary (n = 174)		
Opinion about usefulness of the computer				
Useful in job performance	2.70	2.68	2.68	10.67
Increase self-productivity	2.70	2.62	2.64	12.00
Job performance become easier	2.65	2.60	2.61	13.00
Work done related information	2.65	2.51	2.54	15.33
Help in better decision making	2.35	2.41	2.40	20.00
Enhance professional image	2.48	2.47	2.47	17.67
Better organisingjob work	2.50	2.49	2.49	17.00
Doubt operational mechanism				
Easy to operate	2.55	2.43	2.45	15.00
Easy to learn computer	2.30	2.32	2.31	23.00
Easy to acquired skills	2.25	2.36	2.34	22.00
Flexibility to interact with others	2.28	2.22	2.23	25.67
Mistakes easily pointed	2.28	2.24	2.24	25.33
Extension activities undertaken with computer				
Data base for operational area	2.48	2.32	2.35	21.67
Preparation of scientific extension presentation	2.43	2.29	2.31	23.00
Designing extension materials	2.48	2.26	2.30	23.33
Collecting up to date technological information	2.43	2.35	2.37	21.00
Preparation of official reports	2.43	2.44	2.44	18.67
Preparation of scientific and popular articles	2.43	2.21	2.25	25.00
Storing of official information	2.43	2.47	2.46	18.00
Storing of personal information	2.38	2.37	2.37	21.00
Advantages of computer in job performance				
Save time	2.45	2.56	2.54	15.33
Easy to document data	2.58	2.55	2.56	14.67
Storing information for future use	2.50	2.60	2.58	14.00
Easy to collect information	2.45	2.54	2.52	16.00
Easy to transfer information	2.45	2.53	2.51	16.33
Guide in doing day to day activities	2.40	2.39	2.39	20.33
Support received for effective use of computer				
All cooperation from superiors	1.90	2.09	2.06	31.33
Scope for outside training	2.0	1.91	1.93	35.67
Recognition and encouragement for expertise	1.98	1.93	1.94	35.33
Providing funds for repair and maintenance	1.80	1.86	1.85	38.33
Ensure power supply and other facilities	1.88	2.05	2.02	32.67
Providing facilities to use computer in extension work	2.13	2.10	2.11	29.67

(Maximum obtainable score – 3)

Successful implementation of computer assisted extension system require effective extension system, organizational environment, qualities of the information materials provided and cost effective technologies used in extension. The extension officials therefore need facilities like; computer with accessories, ensuring power supply, fund allocation for; stationaries, repair and maintenance, cooperation among colleagues, supervising officers and top level management for successful transfer of the technologies. But, the respondents had very poor opinion about all these supports. However, the respondents had agreed for the facilities to use computer in extension work.

Comparative analysis revealed that (Table 2) the opinion of the KVK scientists and extension functionaries were at par as significant differences were not observed through critical ratio (CR) value. The respondents need more support on facilities to use computer in extension work, all cooperation from colleagues and superiors as well as ensuring power supply and other facilities. Necessary supports are to be provided to use computer by the extension personnel for transmitting technological information to the users easily and timely. Since, extension works are mostly off time in nature, power supply to be ensured all the time to meet the queries of the farmers immediately. They need all cooperation from colleagues

Table 2: Comparative analysis of different aspects of computer use in extension activities

Use	Max. score	Mean Score		Diff (%)	C.R. value	Pooled mean score (n=214)	Gap (%)
		KVK Scientist (n=40)	Extension Functionary (n=174)				
Usefulness of computer	3	2.58	2.54	1.55	0.022	2.55	15.00
Operational mechanism	3	2.33	2.31	0.86	0.012	2.31	23.00
Support extended	3	1.95	1.99	2.01	0.028	1.99	33.67
Activities undertaken	3	2.44	2.34	4.10	0.057	2.36	21.33
Advantages in job performance	3	2.47	2.53	2.37	0.033	2.52	16.00
Time spent on computer use	6	5.25	4.70	10.48	0.146	4.80	20.00
Frequency of computer use	6	5.58	5.16	7.53	0.105	5.23	12.83
Support required	3	2.47	2.49	0.80	0.011	2.49	17.00
Benefits of computer	3	2.66	2.49	6.39	0.089	2.52	16.00

Table 3: Path analysis of socio-economic attributes influencing computer use

S.No.	Attribute	Total effect	Total direct effect	Total indirect effect	Substantial effect		
					I	II	III
X ₁	Age	-0.158	-0.205	0.047	0.119X ₂	0.087X ₄	0.023X ₆
X ₂	Education	0.095	-0.129	0.224	-0.234X ₈	0.115X ₆	-0.006X ₉₄
X ₃	Annual income	-0.039	0.085	-0.124	-0.145X ₁	0.103X ₇	0.084X ₉
X ₄	Experience	-0.133	-0.139	0.006	0.092X ₄	0.077X ₅	-0.036X ₂
X ₅	Extension activities undertaken	-0.205	-0.091	-0.114	-0.155X ₃	-0.122X ₉	-0.091X ₅
X ₆	Places of service	-0.059	0.216	0.275	0.212X ₅	0.104X ₇	-0.074X ₈
X ₇	Hours work on each day	0.058	-0.042	0.100	-0.145X ₉	0.103X ₁	0.084 X ₃
X ₈	Computer devices used	0.370	0.300	0.070	0.136X ₄	0.075X ₂	-0.028X ₆
X ₉	Communication channel used	0.344	0.274	0.070	-0.159X ₆	0.140X ₃	0.088X ₄

Residual effect: 0.022, Highest indirect effect: Place of service

and superiors for information sharing and immediate problem solving. These facilities are most essential for effective dissemination of technologies.

Path analysis was made to decompose the socio-economic attributes of the respondents into direct, indirect and residual effect. It is observed (Table 3) that computer devices used had the highest direct effect followed by communication channels used. Similarly, places served by the respondents exhibited highest indirect effect followed by educational status. The variable places of service had association with communication channels used, education, age and computer devices used. Hence, the variable place of service, channelized through communication channels used, education, age and computer devices used had exhibited significant influence in use of the computer. The residual effect being 0.022 inferred that 2.20 per cent of the variation in this relation could not be explained.

CONCLUSION

The respondents opined that computer use increased self-productivity, useful and easier in job performance as well as easy to learn and operate. They had used computer for database of the operational area, collecting latest technological information, storing of information and preparation of all kinds of reports. It saved time, easy to document data, collect and transfer information. However, they need all facilities to use computer, ensuring power supply and all cooperation from colleagues and superiors for effective use of computer. The findings therefore conclude that despite inadequate infrastructure; extension personnel use computer at a reasonable level. Adequate organisational support particularly training, guidance,

computer facilities and fund allocation can bring computer use in extension activities at a higher level.

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On-farm Participatory Assessment of Short and Medium Duration Rice Genotypes in South-western Punjab

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ABSTRACT

The study reports the performance of short and medium duration rice genotypes (viz. PR-126, PR-122 and PR-124) via front line demonstrations (FLDs) on low fertility soils irrigated with poor quality underground water in south-western Punjab, India. A total of 550 FLDs were conducted during two consecutive years (*kharif* 2018 and 2019) at farmers' fields in different villages. The average rice grain yield of PR-122 was significantly higher by ~11.1 and 14.5 per cent, compared with PR-126 and PR-124, respectively. The mean net returns (MNRs) were significantly higher for PR-122 by Rs.12,778/- ha⁻¹ and Rs. 16,818/- ha⁻¹, compared with PR-126 and PR-124, respectively. PR-122 had significantly higher B:C, compared with the other two genotypes in the south-western Punjab. The yield gap assessed from average yield potential was higher for PR-124 and the lowest for PR-126, while for PR-122 in between. However, the production efficiency of 54.5 kg ha⁻¹ day⁻¹ was higher for PR-126, compared with PR-124 (50.0 kg ha⁻¹ day⁻¹) and PR-122 (50.6 kg ha⁻¹ day⁻¹). The economic efficiency of PR-124 was lower by ~ Rs. 111.9 ha⁻¹ day⁻¹ and Rs. 43.6 ha⁻¹ day⁻¹ than the PR-126 and PR-122, respectively. The water use efficiency was higher for PR-126, compared with other two genotypes. The extension gap varied between -0.59 and -1.21 Mg ha⁻¹ for three genotypes; with highest gap for PR-126 and the lowest for PR-124. The technology index varied between 5.6 and 14.8 per cent, and was the highest for PR-124 and the lowest for PR-122.

Keywords: Economic analysis, Production efficiency, Short duration rice varieties, Technology index, Water use efficiency, Yield gaps

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the major cereal crops for approximately half of the global population (Godfray *et al.*, 2010). Rice is cultivated after wheat in an annual rice-wheat cropping system occupying ~10 million ha (Mha) in Indian Indo-Gangetic Plains (IGPs) (Saharawat *et al.*, 2012) that has been a lifeline for millions of food producers and consumers, contributing ~85 per cent towards country's cereal production (Timsina and Connor, 2001). Rice is highly energy intensive crop (Singh *et al.*, 2019) under rice-wheat

system that has been considered responsible for serious environmental and sustainability implications due to rapid groundwater depletion (Hira *et al.*, 2004), soil health degradation, reduced C sustainability due to open field rice residue burning and emission of greenhouse gases (Singh *et al.*, 2020). Notwithstanding these sustainability issues, rice production has been expected to increase by ~40 per cent by the end of 2030 to meet the rising demand from the ever-increasing population (FAO, 2009).

Among different sustainability issues, the problem of rapidly declining ground water table has been the most

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debatable issues (Hira *et al.*, 2004). Several water saving technologies have been developed and advocated for rice cultivation in north-western India including matric potential based irrigation scheduling, direct seeding of rice, cultivation on beds, laser land leveling, intermittent irrigation etc. Another approach is to use short duration rice varieties (Campbell *et al.*, 2016). The researchers develop varieties which mature in less time and are insensitive to day length, making possible more crops each year in the same land (Bagchi *et al.*, 2012). The traditional rice varieties matures in 160-200 days (De Datta, 1981), and are therefore are highly susceptible to climatic events. According to Hasan (2014) cultivation of short duration rice varieties is important for water saving while mitigating greenhouse gases emissions. Rice varieties with crop duration of 95-105 days can escape drought in rainfed ecosystems (Ohno *et al.*, 2018) and allow more intense cultivation by taking advantage of the residual moisture in soil after the rice harvest (Haefele *et al.*, 2016). The short duration varieties also had advantage of less risk of lodging and pest damage varieties over longer growth duration (Xu *et al.*, 2018). In irrigated rice ecosystems, many farmers prefer short duration varieties as they often face serious water shortages late in the dry season. Previously researchers remained focused on the development of medium duration varieties (Peng and Khush, 2003) due to their higher yield potential than that of short duration varieties under optimal conditions (Tirol-Padre *et al.*, 1996). The higher grain yield of medium duration varieties has been related to higher crop biomass and the associated ability to capture resources such as solar radiation, nutrients, water that increases growth duration (Kropff *et al.*, 1994). In the south-western Punjab, the soils are salt affected and had poor quality underground waters. The cultivation of long duration rice varieties with high water requirement in this are with water shortage and poor quality underground water is not a viable option. Therefore, we investigated the yield potential, yield gaps, economics and efficiency indices (water use efficiency and nitrogen use efficiency) of short and medium duration rice genotypes viz. PR-126, PR-122 and PR-124 in the south-western Punjab, India to identify the economically and sustainably viable rice genotype for the region.

METHODOLOGY

The study area (south-western alluvial plain agro-eco-sub region; longitudes of 29° 59' and latitude of 75° 23') in Mansa district falls in a south-western Punjab, India and is characterized by hot, typic arid with hot and dry summers and cold winters, with mean annual temperature ranges between 24°C and 27° C, mean annual precipitation ranges between 300-450 mm, covering 15-24 per cent of potential evapo-transpiration (Kumar *et al.*, 2006). Soils are generally coarse loamy to fine loamy, and are classified as *Ustic Haplocambids*, *Ustic Torripsamments*, and *Ustic Haplocambids*. A total of 550 FLDs on three rice varieties (short and medium duration) were conducted during two years (*kharif* 2018 and 2019) at farmer's field under irrigated conditions on sandy loam to loamy sand soils (Table 1). The crop was established through seedling transplanting in puddle (wet tillage) fields. About 25-30 days old rice seedlings were manually transplanted in the field. Weeds in rice crops were mainly controlled by the application of herbicides. Nitrogen is applied through urea (46% N). Phosphorus is mainly applied through diammonium phosphate (DAP; 18% N, 46% P₂O₅) and potassium is applied as muriate of potash (60% K₂O). Zinc is applied as zinc sulphate heptahydrate (21% Zn). For plant protection measures, chemical insecticides were used by the farmers. The canal and the under-groundwater used for irrigation to crops is extracted using electric motors. The harvesting of rice was done mechanically with combine harvesters. The information regarding quantity of fertilizers applied, number of irrigation applied, chemicals used for weed and insect-pest control etc. were recorded from the farmers in the structured interview schedule. Besides, the information regarding human labor and diesel fuel consumption for different farm operations was recorded for the estimation of economic indices for rice cultivation.

Economic indices of rice cultivation

The economics of short and medium duration rice varieties cultivated in south-western Punjab, India was assessed through mean total cost of cash inputs in rice cultivation (MCC), mean gross returns (MGRs), mean net returns (MNRs) and the benefit-cost ratio (B-C ratio) based on the data collected at farmers' fields during

personal interviews. The data were recorded in structured interview schedule. The MCC for rice cultivation were estimated as sum of cost incurred for the purchase of various inputs and the deployment of human labor. The MGRs were calculated as a product of rice grain yield and the minimum support price (MSP) decided by the Government of India (GOI) during the study period (Eq. 1). The MNRs were calculated by subtracting the MCC from MGR (Eq. 2). The B-C was calculated as a ratio of MGR and MCC (Eq. 3).

$$\text{MGRs (Rs. ha}^{-1}\text{)} = \text{Rice grain yield} \times \text{MSP} \quad \dots (1)$$

$$\text{MNRs (Rs. ha}^{-1}\text{)} = \text{MGRs} - \text{MCC} \quad \dots (2)$$

$$\text{B:C} = \text{MGR} / \text{MCC} \quad \dots (3)$$

Production and economic efficiency

The production efficiency was estimated as a ratio of rice grain yield (kg ha^{-1}) and the average crop duration (in days). The average crop duration of 123, 130 and 147 days were considered for estimating the production efficiency of PR-126, PR-124 and PR-122, respectively using Eq. 4.

$$\text{Production efficiency (kg ha}^{-1} \text{ day}^{-1}\text{)} = \frac{\text{Rice grain yield (kg ha}^{-1}\text{)}}{\text{Avg. crop duration (day}^{-1}\text{)}} \quad \dots (4)$$

The economic efficiency of rice cultivation was estimated as a ratio of MGRs and average crop duration (days) (Eq. 5).

$$\text{Economic efficiency (Rs. ha}^{-1} \text{ day}^{-1}\text{)} = \frac{\text{MGR (Rs. ha}^{-1}\text{)}}{\text{Avg. crop duration (day}^{-1}\text{)}} \quad \dots (5)$$

Water use and nitrogen use efficiency

The water use efficiency for three different short and medium duration rice genotypes was estimated based on number of irrigations applied by the farmers. The average grain yield was divided by the total cm of water applied and expressed as $\text{kg ha}^{-1} \text{ cm}^{-1}$. The fertilizer-N use efficiency (kg kg^{-1}) was estimated as a ratio of grain yield (kg ha^{-1}) and the amount of fertilizer-N applied (kg ha^{-1}).

Assessment of yield gaps and technology index

The crop yield gaps for rice cultivation were assessed using Eq. 6-9 (Samui *et al.*, 2000; Singh *et al.*, 2018).

Yield gap was assessed from average yield potential (Eq. 6), national average (Eq. 7), state average (Eq. 8) and district average (Eq. 9). The technology gap was estimated as a difference between average potential yield and the demonstration yield (Eq. 11). The extension gap was calculated as a difference between average yield and the lowest yield obtained in the demonstration plots (Eq. 11). The technology index (Eq. 12) was estimated as a ratio of difference between average yield potential and farmers' yield to that of average potential yield, according to the following equation.

$$\text{Yield gap}_{(\text{Av. yield potential})} = \text{Average yield potential} - \text{Farmers' yield} \quad \dots (6)$$

$$\text{Yield gap}_{(\text{National average})} = \text{National average yield} - \text{Farmers' yield} \quad \dots (7)$$

$$\text{Yield gap}_{(\text{State average})} = \text{State average yield} - \text{Farmers' yield} \quad \dots (8)$$

$$\text{Yield gap}_{(\text{District average})} = \text{District average yield} - \text{Farmers' yield} \quad \dots (9)$$

$$\text{Technology gap} = \text{Avg. potential yield} - \text{Demonstration yield} \quad \dots (10)$$

$$\text{Extension gap} = \text{Average demo. yield} - \text{lowest demo. yield} \quad \dots (11)$$

$$\text{Technology gap index (\%)} = \frac{\text{Av. yield potential} - \text{farmers' yield}}{\text{Av. yield potential}} \times 100 \quad \dots (12)$$

Statistical analysis

The statistical analysis of seed cotton yield was carried out by analysis of variance in randomized block design, RBD (Cochran and Cox, 1950). Mean separation for different treatments was performed using least significant difference (LSD) test at $p < 0.05$. Statistical analysis was performed with SPSS for Windows 16.0 (SPSS Inc., Chicago, USA).

RESULTS AND DISCUSSION

Mean grain yield of PR-126 varied between 5.50 and 7.60 Mg ha^{-1} with mean yield of $6.70 \pm 0.22 \text{ Mg ha}^{-1}$ at farmers' field in south-western Punjab (Table 1). The grain yield of PR-122 varied between 6.85 and 7.62 Mg ha^{-1} , with a mean value of $7.44 \pm 0.20 \text{ Mg ha}^{-1}$. However, the grain yield of PR-124 showed large variation (5.50-8.00 Mg ha^{-1}) at different study sites. The average rice grain yield of PR-122 was significantly higher by ~11.1 and 14.5%, compared with PR-126 and PR-124, respectively. The mean rice grain yield of PR-126 and PR-124 did not differ significantly in south-western Punjab. Earlier, Singh *et al.*, (2018) reported lower yield of medium duration rice varieties, compared with long

Table 1: Rice grain yield in demonstration at farmers' fields

Variety	Cropping system/ irrigation source/ soil type	Rice grain yield (Mg ha ⁻¹)			
		Max.	Min.	Mean	S.E.
PR-126	Rice-wheat/irrigated/canal and	7.60	5.50	6.70 ^a	0.22
PR-122	under-ground water/Sandy loam	7.62	6.85	7.44 ^b	0.20
PR-124	to loamy sand	8.00	5.50	6.50 ^a	0.31
Mean		7.74	5.95	6.88	0.24

Mean values followed by different letters at significantly different by least significant difference (LSD) test at $p < 0.05$.

duration rice varieties. These results revealed that MCC for three rice genotypes did not differ significantly (Table 2). However, the MGRs were significantly lower for PR-126 and PR-124 genotypes, compared with PR-122. The MNRs were significantly higher for PR-122 by Rs.12,778/- ha⁻¹ and Rs. 16,818/- ha⁻¹, compared with PR-126 and PR-124, respectively. These results revealed that PR-122 had significantly higher B:C, compared with the other two genotypes in the south-western Punjab.

The average yield potential of three rice cultivars viz. PR-126, PR-122 and PR-124 was 7.50, 7.88 and 7.63 Mg ha⁻¹, respectively (Table 3). The yield gap assessed from average yield potential was higher for PR-124 and the lowest for PR-126, while for PR-122 in between. The yield gap for PR-126 and PR-124 was due to poor plant population, early sowing, delayed application of fertilizer-N and transplanting of matured nursery seedlings (> 30 days old). The average yield of these genotypes was however higher by ~4.10, 4.90 and 3.91 Mg ha⁻¹, respectively when compared with the national average. However, compared with the state average, the average grain yield of PR-126, PR-122 and PR-124 was higher by 0.60, 1.30 and 0.40 Mg ha⁻¹, respectively. These results showed that yield gap for these

three rice genotypes varied between 0.30 and 0.50 Mg ha⁻¹ for PR-126 and PR-124.

The production efficiency of 54.5 kg ha⁻¹ day⁻¹ was higher for PR-126, compared with PR-124 (50.0 kg ha⁻¹ day⁻¹) and PR-122 (50.6 kg ha⁻¹ day⁻¹) (Figure 1). The higher production efficiency of PR-126 was due to its short duration of only 123 days, while for PR-122 was due to its higher productivity under poor quality irrigation water conditions. Similarly, the economic efficiency was higher for PR-126 than the other two compared genotypes. The economic efficiency of PR-124 was lower by Rs. 111.9 ha⁻¹ day⁻¹ and Rs. 43.6 ha⁻¹ day⁻¹ than the PR-126 and PR-122, respectively. These results showed that water use efficiency was higher for PR-126 and the lowest for PR-124, while PR-122 in-between (Table 4). The higher water use efficiency of PR-126 was due to its short duration and therefore, less number of irrigations is required. Basha and Sarma (2016) reported significantly higher water use efficiency of aerobic rice (81.3 kg ha⁻¹

Table 2: Mean cost of cultivation, mean gross returns, mean net returns and benefit: cost (B: C) of rice

Economic indicators	PR-126	PR-122	PR-124
MCC (Rs. ha ⁻¹)	36,900 ^a	37,200 ^a	37,400 ^a
MGR (Rs. ha ⁻¹)	1,18,590 ^a	1,31,668 ^b	1,15,050 ^a
MNR (Rs. ha ⁻¹)	81,690 ^a	94,468 ^b	77,650 ^a
B:C	3.2 ^a	3.5 ^b	3.1 ^a

Mean values followed by different letters at significantly different by least significant difference (LSD) test at $p < 0.05$.

Table 3: Yield gap analysis

Grain yield (Mg ha ⁻¹)	PR-126	PR-122	PR-124
Actual yield*	6.70	7.44	6.50
Average yield potential	7.50	7.88	7.63
National average yield	2.57	—	—
State average yield	6.12	—	—
District average yield	7.00	—	—
Yield gap (Mg ha⁻¹) from			
Average yield potential	-0.80	-0.44	-1.13
National average	+4.10	+4.90	+3.91
State average	+0.60	+1.30	+0.40
District average	-0.30	+0.44	-0.50

*Values indicate average grain yield

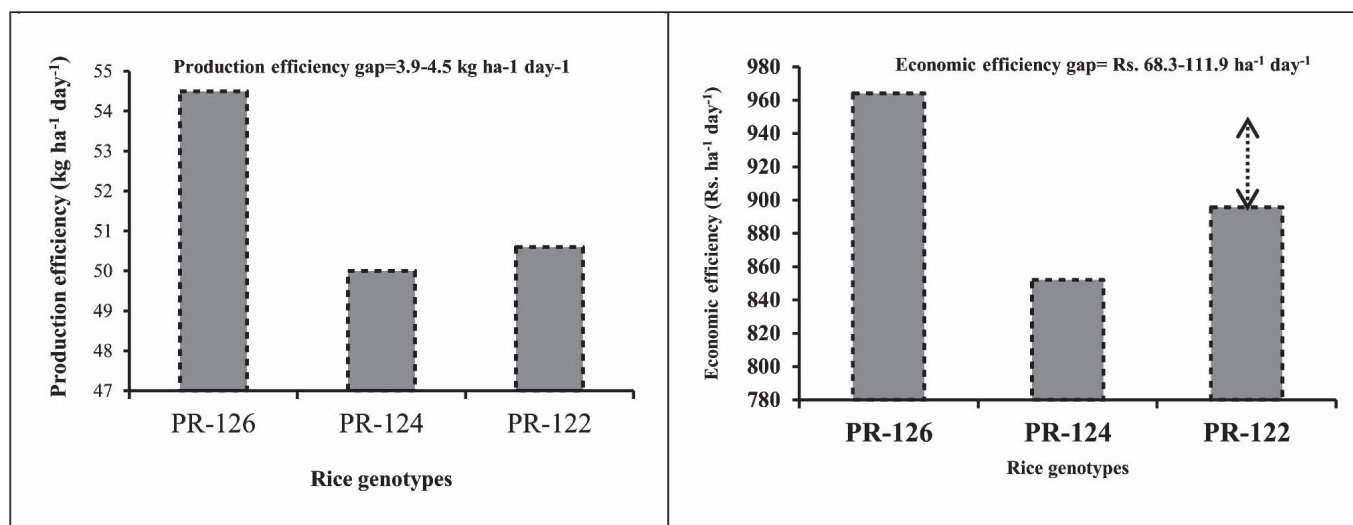


Figure 1 and 2: The production and economic efficiency of different rice genotypes in south-western Punjab, India

Table 4: Water use efficiency, fertilizer use efficiency and the technology and extension gaps of short and medium duration rice genotypes in south western, Punjab, India

Parameter	PR-126	PR-124	PR-122
Water use efficiency (kg ha ⁻¹ cm ⁻¹)	49.1	32.5	46.4
Nitrogen use efficiency (kg kg ⁻¹)	44.7	43.3	49.6
Technology gap (Mg ha ⁻¹)	-0.81	-1.13	-0.44
Extension gap (Mg ha ⁻¹)	-1.21	-0.59	-1.01
Technology index (%)	10.7	14.8	5.6

cm⁻¹) as compared to transplanted rice (36.1 kg ha⁻¹ cm⁻¹) due to higher water requirement of transplanted rice. The amount of rice grains produced per kg of fertilizer-N applied (nitrogen use efficiency) varied between 43.3 and 49.6 kg kg⁻¹ and was higher for PR-122 than the other two compared genotypes. Thompson *et al.* (2005) compared the two irrigation layouts by water management treatments of most interest (water maintained in the furrows; fully ponded flat) and reported that water use efficiency ranged from 7.1 to 8.1 kg ha⁻¹ mm⁻¹ of water used by the crop. Sarkar *et al.* (2017) reported a water use efficiency of 36 kg ha⁻¹ cm⁻¹ for rice under continuously flooded field conditions, compared with 226 kg ha⁻¹ cm⁻¹ under alternate wetting and drying regimes.

The extension gap varied between -0.59 and -1.21 Mg ha⁻¹ for three genotypes; with highest gap for PR-126 and the lowest for PR-124 (Table 4). Extension gap of 1.3-1.8 Mg ha⁻¹ in rice production has been reported in West Bengal (Sagar and Chandra, 2012). Singh *et al.*

(2018) reported that extension gap suggests advantage of technology demonstration and need for motivation of farmers for adoption of scientific technology. The technology gaps for rice cultivation varied between -0.44 and -1.13 Mg ha⁻¹; with the highest gap for PR-124 and the lowest for PR-122. The technology index varied between 5.6 and 14.8 per cent, and was the highest for PR-124 and the lowest for PR-122. Sagar and Chandra (2003) reported that technology index range of 2-10 per cent and reported that this index indicates that technology is feasible for the reason.

CONCLUSION

Rice genotype PR-122 had significantly higher grain yield compared with other two genotypes (PR-126 and PR-124). Mean grain yield of PR-124 and PR-126 did not differ significantly. Although the MNRs and B-C ration were higher for PR-122, yet production efficiency of PR-126 and PR-124 was higher than the PR-122. This

indicates that farmers may enhance area under PR-122 under poor quality irrigation underground water conditions. The economic efficiency and water use efficiency were higher for PR-126, compared with other two genotypes. It showed that this variety is suitable for saving irrigation water due to its short duration. These results suggested that more intensified extension efforts are required to create awareness among the farmers in the south-western Punjab for the wide spread adoption of short duration PR-126 genotype to conserve underground irrigation water. The farmers should be aware about recommended crop production and management practices for PR-126 cultivation to reduce the extension gap and yield maximization for increased economic returns.

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Impact of Training and Development on Employees' Performance and Productivity

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ABSTRACT

The study was undertaken at DCM Textiles. The main purpose of this study was to check the impact of training and development on employees' performance and productivity. Primary data was collected from 100 employees (working in morning, evening and night shift) of DCM Textiles, Hisar, through questionnaire. Questionnaire was divided into two parts; first part included demographic profiles whereas second part contained items relating to work feasibility, work environment, performance appraisal, organizational commitment cultural analysis, performance monitoring, employees' satisfaction and improved productivity, personal factor and company ethics. Most of the respondents confirmed the important role of training and development on their performance and productivity. Factor analysis and Discriminant analysis showed that all the factors were contributing towards productivity and the variation in percentage were 12.359, 9.889, 8.990, 7.655, 7.228, 6.532, 6.005, 4.650 and 4.399 per cent respectively. As per factor analysis, factor1 to factor 9 were of most importance for the effective training, and the Cronbach alpha values were 0.691, 0.757, 0.705, 0.476, 0.616, 0.531, 0.409, 0.472 and 0.569, respectively. It can be concluded that working environment contribute the most followed by performance appraisal.

Keywords: Commitment, Ethics, Performance, Productivity, Variation, Work feasibility

INTRODUCTION

During 1970s, efforts for training and development were mainly concerned for young employees who have a high potential for work. It was in practice in the organizations to make plan for future and provide training and development programs to the fresh employees with the help of which they will be able to improve their efficiency. Now-a-days, each and every organization is facing competition because of new technologies, business environment, political factors, etc. Needs and demands of customers are changing on daily basis and for survival in the market, different training and development programs are organized by the organizations for its employees at regular basis. Training and development

programs are recognized to have a great effect in developing different aptitudes, work abilities, skills to perform allotted tasks, responsibilities in the employees and assumed that more the training and development programs by the organization more will be productivity. An organization has to prove itself superior in the market rather than others for the purpose of survival. The essential objectives of training and development programs relate to employees' satisfaction, growth of market, organisational performance, reduction in employees' turnover, competition advantage, better decision making, etc.

Under different studies, it is shown that one training and development program has different central roles in

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human resource management. Significant difference in scores was observed between trained employees and untrained employees in employees performance (Alnawfleh, 2020). Work environment, training-development and management are important determinants for organizational performance and organizational culture (Elona Cera, 2020). Continuous training can cure all the differences and help the companies in rising from the current problems caused by COVID 19 (Kumaran and Azam, 2020). It cannot be deemed that training and development programs are only for growth of the organisation instead, it is an overall return of the organisation from the investment in form of benefits to the organisation along with the employees. For the organisation, training and development programs lead to improved productivity and performance of the employees. For individual, these programs help in gaining knowledge relating to specific topic and identifying and attaining the organisational objectives as well.

METHODOLOGY

For the current study, a survey was conducted on the blue collar employees at DCM Textiles, Hisar. For this, a questionnaire was framed and individual interviewing at the campus of DCM Textiles were conducted. Questionnaire was divided into two parts: Part 1 was comprised of demographic profile of the employees. Part 2 covers statements relating to work feasibility (Factor 1), working environment (Factor 2), performance appraisal (Factor 3), organizational commitment (Factor 4), cultural analysis (Factor 5), performance monitoring (Factor 6), employees' satisfaction and improved productivity (Factor 7), personal factor (Factor 8) and company ethics (Factor 9). Data. Primary data was collected between January to March 2020 from 100 employees of DCM Textiles, Hisar who were having experience of work and have joined different training and development programs. Convenience sampling was used as questionnaires were filled at the campus of company. For statistical analysis, SPSS13 software was used by which reliability analysis, factor analysis, and discriminant analysis were found.

RESULTS AND DISCUSSION

Majority of the respondents belonged from age group of 25-32 years followed by above 32 years and 18-25

Table 1: Demographic Profile of the respondents

Parameter	Frequency (%)
1. Age	
18-25 years	22
25-32 years	46
Above 32 years	32
2. Sex	
Male	55
Female	45
3. Marital Status	
Single	19
Married	72
Divorced	9
4. Years of Experience	
0-3 years	29
3-6 years	50
More than 6 years	21
5. First organisation	
Yes	61
No	39
6. Training & Development Program organised by company	
Yes	77
No	23
7. Needs of Training identified by Company	
Yes	68
No	32
8. Time taken by Training & Development Program	
One Month	36
Two Months	49
Three Months	15
9. Training Programs in past year	
One	26
Two	57
Three	17
10. Training Programs in coming financial year	
Yes	75
No	25
11. Feedback taken by Management	
Yes	73
No	27

years. Most of the respondents were males, married, having experience between 3-6 years and their very first organisation. 77 per cent employees were saying that company organises training programs on time to time basis and 68 % favoured identification of training needs. Training and development program takes two months (49%) followed by one month (36%) and three month (15%). Two to three training programs were organised by the company in past year and company was planned to organise training program in coming financial year. Employees viewed that the management takes feedback from the employees time to time.

Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy were used evaluating the reliability of the sample. The Kaiser-Meyer-Olkin (KMO) and the Bartlett's Test of Sphericity values were 0.524 and 788.854, respectively, depicted from Table 2, found it significant. However, overall Cronbach alpha value (0.661) was also significant.

The data from the study has been analysed with factor analysis to compile the 26 statements relating to work feasibility, working environment, performance appraisal, organizational commitment, cultural analysis, performance monitoring, employees' satisfaction and improved productivity, personal factor and company ethics. Firstly, data was checked through rotated component matrix, where 26 statements were reduced to nine factors through

rotated component varimax shown in Table 5. Here, factors having eigen value greater than one was considered.

Nine factors have been taken, which contributed for 67.706 per cent variation. The variations by factors 1 to 9 were 12.359, 9.889, 8.990, 7.655, 7.228, 6.532, 6.005, 4.650, 4.399 per cent, respectively. Table 4 shows eigen values and percentage of variance explained.

Cronbach alpha values (Table 5) for the mined aspects extending from 0.409 to 0.757 show a rational to excellent inner evenness between the items of each dimension. All the nine factors have been allotted suitable labels permitting to the characteristics of the statements allotted on each factor. The nine factors were: work feasibility (Factor 1), working environment (Factor 2), performance appraisal (Factor 3), organizational commitment (Factor 4), cultural analysis (Factor 5), performance monitoring (Factor 6), employees' satisfaction and improved productivity (Factor 7), personal factor (Factor 8) and company ethics (Factor 9).

Work Feasibility (Factor 1) was the most significant having the highest variance of 12.359 per cent. Out of the 26 statements, five statements were considered under this factor related to the work feasibility. Statements loaded on this factor like- performing a job that matches skills, given ample flexibility to perform job, work you do has appropriate task variety, variety of training & development programs are offered to improve skills, part of a supportive and productive team. Here, it can be concluded that company mostly concentrate on work feasibility because it contributes the most. Working Environment (Factor 2) also played an important role having second highest variance 9.889 per cent. Two statements like; organization has created professional, attractive work area that is functional and promotes productivity, organization has created professional,

Table 2: KMO and Bartlett's Test Measure for Sampling Adequacy

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.524
Bartlett's Test of Sphericity	Approx. χ^2	788.854
	df	325
	Sig.	.000
Cronbach's Alpha		.661
No of Items		26

Table 3: Total Variance Explained

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9
Eigen Value	3.213	2.571	2.337	1.990	1.879	1.698	1.561	1.209	1.144
% Variance	12.359	9.889	8.990	7.655	7.228	6.532	6.005	4.650	4.399
Cumulative	12.359	22.248	31.238	38.893	46.121	52.652	58.657	63.307	67.706

Table 4: Rotated Component Matrix (a)

Items	Component								
	1	2	3	4	5	6	7	8	9
You are performing a job that matches your skills.	.817	-.143	.105	-.063	-.110	.083	.029	-.159	-.013
You are given ample flexibility to perform your job.	.793	-.202	.113	-.057	.143	.100	-.072	.070	.156
The work you do has appropriate task variety.	.729	.128	.157	.111	-.135	.093	.113	-.149	.105
A variety of training & development programs are offered to improve skills.	.441	.339	-.361	.161	.244	-.126	.011	.052	-.426
Your organization has created professional, attractive work area that is functional and promotes productivity	-.006	.839	.092	-.001	-.017	.188	-.015	.154	.056
You feel comfortable working with your team members.	-.196	.798	.220	.043	.088	.020	.076	-.087	.084
Performance is appropriately rewarded with raises, incentives, rewards and recognition.	.140	.029	.834	.102	.106	.025	.019	.059	-.045
Performance measures are mutually agreed on discussed by both the employee & supervisor.	.102	.160	.741	.100	-.014	.151	.190	.041	-.084
Performance measurement is used as criteria for promotions	.245	.316	.576	-.121	.126	-.141	-.292	.049	-.148
You feel attached with your company team & other employees.	.282	.289	-.364	.267	.285	-.262	.194	-.059	.052
You have a supervisor who is respectful and one who inspires you.	.079	.260	-.026	.689	.158	-.194	-.220	.162	.113
You know what is expected of you at work	.057	-.167	.129	.677	.052	-.057	.237	-.077	.194
You are satisfy with organizational training and development programme.	-.171	.031	.006	.594	-.100	.237	-.283	.071	-.247
The organization clarifies how its culture evident through employee behaviour	.029	-.178	.114	.129	.822	.078	-.112	.017	.098
The organization rewards or recognizes such	-.121	.287	.033	-.051	.795	.032	.033	.023	.041
Performance is regularly tracked and measured.	.151	.062	.298	-.047	.169	.716	.108	-.033	.160
Performance goals are behavioural , result-oriented	.161	.207	-.153	.020	.014	.648	-.207	-.081	.041
You are a part of a supportive and productive team.	.409	.391	-.080	.124	.063	-.477	.007	-.117	-.182
You have the materials and Equipment that you need to do your everyday work.	.391	.023	.106	.390	-.035	.402	.050	.062	-.117
You are offered economically feasible employee	.004	.103	.030	.065	-.006	-.139	.765	-.001	.053
Your salary is fair, equitable and competitive.	.104	-.074	.068	-.254	-.107	.105	.702	.351	.065
Your work interferes with your personal relationships & family responsibilities.	-.176	-.112	.160	.129	.117	-.066	.189	.695	.035
The company provides you a safe work environment	-.073	.325	-.144	-.059	.046	.122	.158	.694	-.213
Rewards in your organization are immediate and appropriate and achievable	.008	.047	-.162	-.087	.273	.195	.355	-.574	-.265
You have the opportunity to grow and prosper with the organization.	.136	.078	-.075	-.040	.196	.053	.127	-.102	.769
You work in a trusting and ethical environment.	.037	.103	-.333	.310	-.041	.194	-.029	.206	.662

Table 5: Factors and their Eigen values

Factor Name	Statements	Eigen value	Cronbach Alpha Value	Percentage Variance
Work Feasibility (Factor 1)	You are performing a job that matches your skills.	.817	.691	12.359
	You are given ample flexibility to perform your job.	.793		
	The work you do has appropriate task variety.	.729		
	A variety of training & development programs are offered to improve skills.	.441		
	You are a part of a supportive and productive team.	.409		
Working Environment (Factor 2)	Your organization has created professional, attractive work area that is functional and promotes productivity	.839	.757	9.889
	You feel comfortable working with your team members.	.798		
Performance Appraisal (Factor 3)	Performance is appropriately rewarded with raises, incentives, rewards and recognition.	.834	.705	8.990
	Performance measures are mutually agreed on discussed by both the employee & supervisor.	.741		
	Performance measurement is used as criteria for promotions	.576		
Organizational Commitment (Factor 4)	You feel attached with your company team & other employees.	.267	.476	7.655
	You have a supervisor who is respectful and one who inspires you.	.689		
	You know what is expected of you at work	.677		
	You are satisfy with organizational training and development programme.	.594		
Cultural Analysis (Factor 5)	The organization clarifies how its culture evident through employee behaviour	.822	.616	7.228
	The organization rewards or recognizes such	.795		
Performance Monitoring (Factor 6)	Performance is regularly tracked and measured.	.716	.531	6.532
	Performance goals are behavioural, result-oriented	.648		
	You have the materials and Equipment that you need to do your everyday work.	.402		
Employees' Satisfaction and Improved Productivity (Factor 7)	You are offered economically feasible employee	.765	.409	6.005
	Your salary is fair, equitable and competitive.	.702		
	Rewards in your organization are immediate and appropriate and achievable	.355		
Personal Factor (Factor 8)	Your work interferes with your personal relationships & family responsibilities.	.695	.472	4.650
	The company provides you a safe work environment	.694		
Company Ethics (Factor 9)	You have the opportunity to grow and prosper with the organization.	.769	.569	4.399
	You work in a trusting and ethical environment.	.662		

attractive work area that is functional and promotes productivity. Working environment was significant factor because, by providing good working environment, a company can increase its productivity as well as employees' performance. Third factor, Performance Appraisal was having variance 8.990 per cent. Organizational Commitment (Factor 4) was deemed significant having variance 7.655 per cent. Hence, it can be stated that employees feel more attached when organisation was fulfilling its commitments. Cultural Analysis (Factor 5) was having variance value of 7.228 per cent with two statements allotted to it. The organization clarifies how its culture evident through employee behaviour, organization rewards or recognizes such. When an organisation is maintaining its culture, it affects its employees positively, which will help in productivity and leads to enhanced performance.

Performance Monitoring (Factor 6) could be taken as brick of building for the employees having variance value 6.532 per cent. and was allotted three statements. Here, it can be said that performance is monitored in each and every organisation for fulfilling its target along with capability of individual employee. Seventh factor Employees' Satisfaction and Improved Productivity contributed significant role having variance value 6.005 per cent along with three loaded statements. Employees' satisfaction is very important factor in any organisation because along with satisfaction, it is also connected with the productivity of organisation. Personal Factor (Factor 8) affected work life of an employee having variance 4.650 per cent. Two statements were considered under personal factor. Finally, Company Ethics (Factor 9) was having variance 4.399 per cent. Two statements were studied under this factor along with their significance. When a company is following proper ethics than its impact is directly on performance and productivity of employees.

CONCLUSION

The analysis revealed that how appropriate HR Practices of an organization can improve the satisfaction level and strengthen the commitment of the employees. This will help in developing their ability to convert business tactics into action, challenge recognition and defining organizational structure in overcoming such challenges.

The significant factors showing impact of training and development on employees' performance and productivity were work feasibility, working environment, performance appraisal, organizational commitment, cultural analysis, performance monitoring, employees' satisfaction and improved productivity, personal factor and company ethics with Cronbach alpha value of 0.691, 0.757, 0.705, 0.476, 0.616, 0.531, 0.409, 0.472, 0.569, respectively. All the factors can be used for making training and development programs more effective. It can be concluded that working environment along with performance appraisal contribute the most followed by work feasibility. Organisations must concentrate on maintaining working environment as well as performance appraisal. Ignorance of the above factors may lead to higher attrition ratio in an organisation.

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Research Note

Evaluation of Cluster Frontline Demonstration on Urd for Enhancing Productivity

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ABSTRACT

Urd or Black gram (*Vigna mungo* L.) is an important pulse crop cultivated in Erode district of Tamil Nadu but due to improper adoption of improved technologies the productivity is far below (680 kg/ha) against the average productivity of the state (861 kg/ha). Attempts were made to improve the productivity of black gram through KVK, Myrada and conducted cluster frontline demonstration with improved production technologies in 25 farmers' field during *rabi* 2019-2020. The improved production technologies comprising of high yielding variety namely Vamban 6 (VBN 6), seed treatment with bio-fertilizers and bio agents, integrated pest management technologies and foliar application of micronutrients. By adopting these technologies, the farmers harvested an average yield of 7.79 q/ha with a yield advantage of 19.85 per cent over the farmer practices. The improved practices gave higher net return of Rs. 23134.5/ha and benefit cost ratio of 2.03 where as benefit cost ratio of 1.65 was observed in farmer practices. The average extension gap, technology gap and technology index were 1.29 q/ha, 0.79 q/ha, and 8.35 per cent respectively. The results indicated that, adoption of improved production technologies minimizes the yield gap and provided higher return to the farming community.

Keywords: Cluster demonstration, Economics, Yield, Urd

INTRODUCTION

Pulses are important to low income countries where the major sources of protein are non-animal products. It is cultivated mostly on the marginal lands, under rain-fed situations. Many times pulses are cultivated as a mixed / intercrops and the productivity of black gram is very low when compared to the yield potential of the crop. Important reason for low productivity is biotic stresses, uncertainty of rainfall and poor fertility levels of the soil. The problem is compounded by the fact that the majority of the farmers in the rain-fed regions lack of awareness on new and high yielding varieties, resource poor with low risk bearing capacity and they generally do not apply recommended practices. Policy attention to fit the pulse

crops in new and non-conventional cropping systems along with provision and assurance of support prices are some of the key areas of intervention (Nain *et al.*, 2015). The productivity of black gram per unit area could be increased by adopting improved practices in a systematic manner along with high yielding varieties (Rai *et al.*, 2015). Frontline demonstration is the key concept of field demonstration evolved by Indian council of Agricultural Research, New Delhi with the main objectives of demonstrating new varieties or technologies and its management practices in the farmers' field. The constraints faced by the farmers in obtaining higher productivity are being documented and the frontline demonstrations are designed to overcome the problems in a scientific way in order to show the worth of the new

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variety and improved practices for enhancing productivity and same is true for the black gram.

METHODOLOGY

The study was carried out in Erode District of Tamil Nadu during *rabi* 2019-20. The variety Vamban 6 (VBN 6) was selected for conducting the demonstrations. The special features of the selected variety are resistant to yellow mosaic virus diseases, synchronized maturity and duration of 65-70 days with the production potential of 850 kg/ha. Before starting of the demonstrations, the farmers were trained on scientific cultivation practices. Each demonstration was laid out in an area of 0.4 ha area and adjacent to the farmers' fields in which the crop was cultivated with farmers' practice/variety. Scientific interventions under frontline demonstrations were taken as recommended by Tamil Nadu Agricultural University, Coimbatore.

To study the impact of frontline demonstrations, data from FLD and farmers' practices were analyzed. The extension gap, technology gap and technology index were calculated using the formula suggested by Samui *et al.* (2000) as :

$$\text{Extension gap } \left(\frac{\text{qtl}}{\text{ha}} \right) = \text{DY (q/ha)} - \text{LY (q/ha)}$$

$$\text{Technology gap } \left(\frac{\text{qtl}}{\text{ha}} \right) = \text{PY (q/ha)} - \text{DY (q/ha)}$$

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

Where,

DY = Demonstration yield, LY = local check yield, PY = Potential yield of variety

The fields were regularly monitored and periodically observed by the scientists of KVK. At the time of harvest, yield data were collected from both the demonstrated plots as well as from the farmers' practice. The cost of cultivation and profit details of both the systems were collected from the farmers for working out the benefit cost ratio.

RESULTS AND DISCUSSION

The results of the demonstrations conducted in the farmers' field are presented in Table 1. The data depicted that the productivity of high yielding black gram variety with improved practices recorded the yield ranges from 870 kg/ha to 665 kg/ha with the mean yield of 779 kg/ha with yield advantage of 19.85 per cent over the existing variety. The findings of the present study are in line with Kumar *et al.* (2010); Kumbhare *et al.* (2014) and Rai *et al.* (2015). From these results it is evident that the performance of improved variety along with improved practices was found better than the local check under local conditions.

Table 1: Grain yield of black gram as influenced by improved and local practices

Demonstration plot yield	
Maximum yield (q/ha)	8.70
Minimum yield (q/ha)	6.65
Average yield (q/ha)	7.79
Farmers practice yield (q/ha)	6.50
Additional yield over farmers practice (q/ha)	1.29
Percent yield increase over farmers practice	19.85

Yield of frontline demonstration trials and potential yield of the crop was compared to estimate the yield gap, further, it was categorized into extension gap, technology gap and technology index. The extension gap shows the gap between the demonstration yield and local yield and it was 129 kg/ha. The technology gap shows the gap of the potential yield of the crop over demonstrated yield and it was 71 kg/ha. The observed extension gap and technology gap may be attributed to dissimilarities in soil fertility levels, pest and disease incidence, improper usage of manures and fertilizers in this region. Hence, to narrow down the yield gaps location specific technologies needs to be adopted. Technology index shows the feasibility of the variety at the farmers' field. The lower the value of the technology index more is the feasibility. Table 2 reveals that the technology index values were 8.35 per cent. The findings of the present study are in line with the findings of Hiremath and Nagaraju (2009) and Dhaka *et al.* (2010).

Table 2: Yield, Extension gap, Technology gap and Technology index of the demonstration

Variables	Yield (q/ha)	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
Farmers practice	6.50			
Improved practices	7.79	1.29	0.71	8.35

Table 3: Cost of cultivation, Gross return, Net return and Benefit cost ratio as influenced by improved and local practices

Economic attributes	Improved practices	Farmers practice
Cost of cultivation (Rs./ha)	22413.00	23474.00
Gross Return (Rs./ha)	45547.50	38620.10
Net Return (Rs./ha)	23134.50	15146.10
BCR	2.03	1.65

The economic feasibility of improved practices over farmers' practices was calculated depending upon the prevailing prices of inputs and output cost were presented in Table 3. It was found that the cost of production of black gram under improved practices comes to Rs. 22413.00/ha and an average of Rs. 23474.00/ha in farmers practice. Economic analysis of yield performance revealed that frontline demonstrations recorded the higher gross return of Rs. 45547.50/ha and net return of Rs. 23134.50/ha with the benefit cost ratio of 2.03 over local checks. The results are in line with the findings of Sreelakshmi *et al.* (2012).

CONCLUSION

The results from the present study clearly indicated that the combination of high yielding varieties along with adoption of improved practices enhanced the black gram production and economic gain of the farming community. Hence, improved production technologies in black gram have the broader scope for increasing the productivity per unit area.

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Research Note

Predictors of Variation in Role Performance of Scientists Working in KVKs

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ABSTRACT

Role performance is in reality not influenced by any of the independent variable singly. It is found to be influenced by more than one of these independent attributes jointly through their reciprocal and interactive relationship. The study on scientists working in KVKs (Krishi Vigyan Kendra) of Gujarat was carried out considering all 30 KVKs in the state. A total of 97 responses were collected through mailed questionnaire which includes 11 independent variables. Achievement motivation, job stress and training received were predicted to account for more variation in their role performance.

Keywords: Extent of variation, KVKs scientists, Role performance

INTRODUCTION

Technology transfer work is carried out by various KVKs, NGOs SAUs and from the government of Gujarat. But the farming community does not get benefit from available farm technology at the desired rate and level. Knowing the contribution of farm scientists to the transfer of farm technology and understanding the various factors associated with this process was the main objective of present study. Scientists working in KVKs play an important role in transferring technology to farmers in their respective areas. Despite having so many technologies for the development of farmers, they are unable to meet the expected productivity and production of the required target in order to meet the demand of the fast-growing second largest populated countries in the world. This is because there is inappropriate connection between the researchers-extension agents-farmers. As such scientific evaluation was conducted to find out extent of variation in role assessment of scientists working in Gujarat KVKs and to understand the various disadvantages of the system which may help connect

the missing links between scientists and farmers in technology transfer to the farming community.

METHODOLOGY

All 30 KVKs from all over Gujarat state made the population for the study. An exploratory design as suggested by Kerlinger (1976) was used for the study. From each KVKs 3-4 scientists were randomly selected based on their availability from which 97 responded to the standardized questionnaire via Google form and personal contacts with the nearby KVKs. A scale developed by Kumar and Kaur (2014) with due modifications was used to evaluate the role assessment of scientists working in KVKs. The data was collected via mailed questionnaire using Google forms as a platform for easy access to the answers. The statistical tools used were step wise regression value, and multiple regression value. The step-wise regression (multiple regressions) analysis was employed to predict the dependent variables and consequences by independent variables. In the stepwise method, the regression analysis was started with

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regression of Y and $X_1, \dots, \dots, X_k$ taken singly. The variable giving the highest accountability in the sum of squares of Y is first selected. Then the bivariate regression in which X_1 appeared was worked out. The variate, which gives the highest additional accountability in the sum of squares in Y after fitting X_1 variable, was selected. All the tri-variate regression that includes both X_1 and X_2 were computed. The analysis was continued till the last variate of which additional contribution was the least of all variables. The prediction equation used as:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + \dots, \dots, \dots, b_{kXk}$$

Where,

Y = Dependent variable

a = Intercept

$b_1, \dots, \dots, b_k$ = Partial regression coefficients of respective independent variables

$X_1, \dots, \dots, X_k$ = Independent variables

“F” test was used to test the significance of the partial regression coefficient.

RESULTS AND DISCUSSION

Results observed from the Table 1 represent that 49.60 per cent of the total variation in the level of role performance was explained through 11 variables

considered for the regression equation. The unexplained variation was 50.40 per cent, which may be due to extraneous factors. From the regression analysis, it was concluded that out of 11 variables, three variables namely achievement motivation, job stress, and in-service training had a significant effect on role performance of scientists working in KVKs of Gujarat. Regression coefficient indicated that one-unit change in age would affect 0.296 units change in role performance, one unit change in job satisfaction would lead to 0.403 change in role performance and a unit change in job stress would lead to change in 0.365 role performance of scientists working in KVKs. Results further revealed that 49.60 per cent of the total variation in the level of role performance was explained through 11 variables considered for the regression equation. The unexplained variation was 50.40 per cent, which may be due to extraneous factors. From the regression analysis, it was concluded that out of 11 variables, three variables namely achievement motivation, job stress, and training received had a significant effect on role performance of scientists working in KVKs.

The relationship between the independent and dependent variable was expressed in terms of correlation co-efficient (‘r’) derived. The co-efficient of multiple determinations (R^2) gives the average amount of change in the dependent variable when all independent variables were taken together and were tested with the ‘F’ test

Table 1: Role performance of scientists with respect to independent variables working in KVKs

S.No.	Independent variables	Role performance index		
		Standardized coefficient(b)	‘t’ value	Sig.
X_1	Age	0.296*	2.134	0.036
X_2	Educational qualification	0.076	0.785	0.435
X_3	Cadre	0.152	1.300	0.197
X_4	working experience in	0.114	0.888	0.377
X_5	In-service training	0.183	1.898	0.061
X_6	Organizational Participation	0.126	1.586	0.116
X_7	Publication behavior	0.014	0.143	0.887
X_8	Interpersonal communication	0.029	0.348	0.729
X_9	Job satisfaction	0.087	0.808	0.421
X_{10}	Achievement motivation	0.403**	4.114	0.000
X_{11}	Job stress	0.365**	3.599	0.001

* Significant at the 0.05 level; ** Significant at the 0.01 level; $R^2 = 0.496$

Table 2: Step-wise multiple regression analysis of Role performance index of KVK scientists with independent variables

Model	Independent variables	Multiple correlation coefficient (R)	Coefficient of Determination (R ²)	Partial regression coefficient (b)	Standard partial regression coefficient (SPRC)	Rank
	Constant			62.36	-	-
1	Achievement motivation	0.483	0.233	1.07	0.48	1 st
2	Job stress + Achievement motivation	0.642	0.413	0.33	0.43	2 nd
3	Training + Job stress + Achievement motivation	0.664	0.441	0.14	0.17	3 rd

for their significance. Partial regression co-efficient (b) represents the change in dependent variable for a unit change in the independent variable and it was tested with 't' test for its significance. The various independent variables had their own units of measurement which did not permit a comparison of the partial 'b' values. To facilitate the comparison, the partial 'b' values were converted into standard partial 'b' values which were free from the units of measurements. The independent variables were then ranked on the basis of standard partial 'b' values to find out their relative importance in predicting the dependent variable. It can be inferred that 23.3 per cent variation is explained by achievement motivation towards role performance. However, achievement motivation and job stress together accounts 41.30 per cent towards role performance; Achievement motivation, job stress and in-service training accounted for 44.10 per cent change in role performance. The R² values at each stage of step up regression were found to be significant at 0.01 level of significance. The partial 'b' values of these three variables were converted in to standard partial 'b' values which were 0.483 for achievement motivation, 0.426 for job stress, and 0.174 for training received. The 't' values or partial 'b' values were significant in case of all the three independent variables. It can be inferred from the above results that the variables viz., achievement motivation, job stress, and in-service training together contributed 66.40. Standard regression coefficient was observed from Table 1 that 0.48 for achievement motivation, -0.43 for job stress and 0.17 for training received were arranged sequentially and ranked. The following model was applied to explain the relative importance of independent variable in explaining the role performance.

$$Y = 62.36 + 1.07 X_{10} - 0.34X_{11} + 0.14X_5$$

Where, Y is Role performance, X₁₀ is Achievement motivation, X₁₁ is Job stress and X₅ is Training received

CONCLUSION

Achievement motivation, job stress and training received were predicted to account for more variation in their role performance. The probable reason for considering these three variables as the most important among all the 11 independent variables to have better role performance may be that the scientists belonged to young to middle age group had high very less work experience and it is necessary for scientists to undergo various trainings in order to increase their professional skills which obviously motivates KVKs scientists to perform better role to increase their academic score and career advancement. At the same time it is observed from the Table 1 that KVKs scientists perform better when they are stress free, therefore it can be inferred that scientists have to be given proper guidance by authorities, providing required facilities and through proper channel can reduce the stress condition.

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Research Note

Adaptation Strategies being followed by Paddy Growers towards Climate Change in Punjab State

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ABSTRACT

The study was conducted in five agro climatic zones of Punjab. One district from each zone, three blocks from each district and further one village from each block and finally 10 farmers per village having experience of minimum fifteen years of paddy cultivation were selected randomly. Data was collected by using the interview schedule. Majority (91.21%) had adopted short duration crop varieties and 82.43 per cent farmers were availing weather forecasting services. More than three fourth of the respondents opined that by using laser land management practices like leaser leveler they mitigate the effect of climate change during paddy production, while 26.35 per cent by using resource conservation technologies, 28.37 per cent by adopting soil moisture conservation methods, 11.48 per cent by stopping the burning of crop residue and only 10.81 per cent by using insect pest management techniques mitigate the effect of climate on paddy production. More than half of the respondents suggested that resistance varieties to insects-pest and diseases should be developed.

Keywords: Adaptation strategies, Climate change, Paddy growers

INTRODUCTION

The global climate change which has attracted attention of thinkers from almost all fields is threatening to have significant and far reaching impacts on the human society. Agriculture is the one of sensitive areas upon which society depends for the food, feed and fiber that enables sustainable livelihoods. It is one of the sectors that are most vulnerable to climate change. In agriculture, climate can reasonably be considered as a resource and climate change can lead to changes in agricultural productivity of a region (Darwin, 2004). Climate change is expected to influence crop production, hydrological balance, input supplies and other components of agricultural systems. However, the nature of these bio-physical effects and human responses to them are complex and uncertain. Due to its sensitivity, any change

in the climate can have significant alterations in the crop yields (Rosezwerig and Parry, 2007). The recognition that climate change related threats to agriculture also represent threats to quality of life on a global scale which has led to an increasing amount of attention to adaptation and mitigation strategies for agriculture by the farmers (Howden *et al.*, 2007). Adaptation and mitigation are two basic solutions to avoid the ill effects of climate change, but with distinctly different responses. Farmer attitudes toward these two general responses to climate change must be understood. Adaptation to climate change involves changes in agricultural management practices in response to changes in climate conditions. It often involves a combination of various individual responses at the farm-level and assumes that farmers have access to alternative practices and technologies available in the region. To adapt to the climate change, farmers are

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required first to notice that climate has altered and then identify potential useful adaptation measures and implement them. To enhance policy towards tackling the challenges that climate change poses to farmers, it is important to have knowledge of farmers' adaptation measures (Benedicta *et al.*, 2010). With unpredictable weather, the farmers keep changing crop management practices by growing resistant varieties and are prepared for constant change in the farming practices.

METHODOLOGY

The study was conducted in Punjab state. Five agro-climatic zones were selected, one district was selected from each zone, three blocks were selected from each district and further one village from each block was selected randomly. From each village, ten farmers having experience of fifteen year in paddy cultivation were selected randomly. Thus, a total of 150 farmers were selected but two farmers didn't suppose that climate change is happening so the sample consisted of 148 farmers. The data was collected through personal interview method through structured interview schedule.

Statistical tools like frequency and percentage and z-test were used to analysis the data.

RESULT AND DISCUSSION

The adaptation strategies of the farmers to reduce the effect of climate change on paddy production are presented in Table 1. The Table revealed majority of the farmers (82.43%) were availing weather forecast they mitigate the effect of climate change in paddy production. More than three fourth (76.35%) of the respondents opined that by using laser land management practices like leaser leveler they mitigate the effect of climate change during paddy production. While 26.35 per cent by using resource conservation technologies, 28.37 per cent by adopting soil moisture conservation methods, 11.48 per cent by stopping the burning of crop residue and only 10.81 per cent by using insect pest management techniques they mitigate the effect of climate on paddy production.

The data in Table 1 also reveal that 23.64 per cent of the farmers mitigate the effect of climate change by using

Table 1: Distribution of respondents according to adaptation strategies adopted by farmers keeping in view the climate change (n=148)

Adopted strategies	Frequency*	Percentage	Mean	SD	Z value
Use of resource conservation technologies	39	26.35	0.26	0.442	1.565(NS)
Organic farming (Basmati)	0	0.00	0.00	0.000	0(NS)
Adopting rain harvesting methods	1	00.67	0.01	0.082	46.672*
Adopting soil moisture conservation methods	42	28.37	0.28	0.452	0.981(NS)
Site specific nutrient management	35	23.64	0.24	0.426	2.399(NS)
Using short duration crop varieties	135	91.21	0.91	0.284	25.535*
Fallowing integrated farming system	67	45.21	0.45	0.499	3.254*
Changing planting dates	71	47.97	0.48	0.501	3.903*
Changing the cropping pattern	9	06.08	0.06	0.240	13.238*
Land management practices	113	76.35	0.76	0.426	12.740*
Using insect pest management	16	10.81	0.11	0.312	8.329*
Availing weather forecast service	122	82.43	0.82	0.382	16.176*
Stop burning of crop residue	17	11.48	0.11	0.320	7.853*
Reducing tillage practices	18	12.16	0.12	0.328	7.408*
Reducing usage of chemical fertilizers	13	08.78	0.09	0.284	10.011*
Water management and conservation techniques	57	38.58	0.39	0.488	1.634(NS)

Multiple responses, NS=Non-Significant, *Significant at 0.01 level, **Significant at 0.05 level of significance

site specific nutrient management and 45.21 per cent responded that by fallowing integrated farming system they can mitigate the effect of climate change. Use of short duration varieties (91.21%) and by reducing tillage practices (12.16%) were the other strategies that were adopted by farmers to mitigate the effect of climate change on paddy production. While very few i.e. 6.08 per cent, 0.67 per cent and 8.78 per cent opined that by changing cropping pattern, by adopting rain harvesting methods and reducing the use of chemical fertilizers they mitigate the effect of climate change on paddy production. 38.58 per cent opined to use water management and conservation techniques and near about half (47.97%) opined to change the planting dates to mitigate the effect of climate change. No one opined to practice organic farming to mitigate the effect of climate change. The findings were in agreement with Dobermann *et al.* (2002); Shugart *et al.* (2003); Smithers and Smith (1997); Roncoli *et al.* (2002) and Brar *et al.* (2017).

Data further depict that the five items i.e. use of resource conservation technologies, Organic farming, Adopting soil moisture conservation methods, Site specific nutrient management, Water management and conservation techniques with mean score 0.26, 0.00, 0.28 and 0.39 were found to be non-significant with the strategies towards climate change and Site specific nutrient management with mean score 0.24 were significant at 0.05 level of significance whereas the rest of the statements i.e. adopting rain harvesting methods, using short duration crop varieties, fallowing integrated farming system, changing planting dates, changing the cropping pattern, land management practices, using insect pest management, availing weather forecast service, stop

burning of crop residue, reducing tillage practices, reducing usage of chemical fertilizers, water management and conservation techniques were having mean score 0.01, 0.91, 0.45, 0.48, 0.06, 0.76, 0.11, 0.82, 0.11, 0.12 and 0.09, respectively had significant relation with the adaptation strategies towards climate change.

Suggestion of the farmers regarding mitigation of climate change effects was taken and the same has been presented in Table 2 reveals that more than half of the respondents (52.70%) suggested that there should be varieties that are resistant to various insect-pest and weeds followed by 45.27 per cent respondent those suggested that varieties resistant to lodging should be developed. While 29.05 per cent of respondents suggested to develop varieties that can withstand in adverse weather conditions. 26.35 per cent of respondent suggested promoting techniques like direct seeded rice (DSR) to stable water Table. Very few farmers (8.78%) suggested that government should make policies for paddy straw management and provide subsidies on machinery to mitigate the effect of climate change.

CONCLUSION

The results showed that climate change is leading the farmers to adapt the mitigation strategies but stress tolerant varieties should be developed, resource conservation technologies like Direct Seeded Rice should be promoted, and enhance farmer capability and improve resilience in response to climate change. Although many useful steps have been taken in the direction of ensuring adequate adaptation in developing countries, much work still remains to fully understand the drivers of past adaptation efforts, the need for future adaptation.

Table 2: Distribution of respondents according to suggestions to mitigate the effect of climate change

Suggestions	Frequency*	Percentage
Resistance varieties to insect-pest and diseases should be developed	78	52.70
Varieties resistance to temperature and water stress should be developed	43	29.05
Varieties resistance to lodging should be developed	67	45.27
Techniques like Direct seeded rice (DSR) should be promoted to control decline in water Table	39	26.35
Government should make policies for paddy straw management providing subsidy on recommended machinery	13	08.78

*Multiple responses

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Research Note

Relationship Between Empowerment Level and Profile of Farm Women Attending Vocational Training Programme

Neha Singh^{1*}, Neelam Bhardwaj², Amardeep³ and Sudha Jukaria⁴

ABSTRACT

Empowering women and reducing gender inequalities are one of the major components of development objectives. The present study was conducted in Bhimtal district of Nainital to study the, profile characteristic of farm women and its relationship with empowerment level as a result of vocational training programme. The findings of the study showed that, empowerment level was found to be influenced by their profile characteristics. Variables like age, land holding and annual income etc. showed non-significant association with empowerment level in both beneficiaries and non beneficiaries. The result also shows that empowerment had significant association with selected independent variables such as scientific orientation, and risk orientation. Therefore, the concerned organizations and personnel may manipulate those characteristics for improving the psychological, social and economic empowerment of farmwomen.

Keywords: Attributes, Empowerment, Training, Women

INTRODUCTION

In Uttarakhand, agriculture is the main source of livelihood. Women in Uttarakhand devote 62.17 per cent of their time for outdoor activities, 21.11 per cent for indoor activities and 8.72 per cent for recreational activities and 29.35 per cent of her time to agriculture and livestock (Sharma and Prasad, 2011). In spite of their major contribution women still are in the grip of economic dependence, social neglect and political ignorance and are not in a position to attain the due place in society. The government schemes and laws have been formulated and designed to meet the path of women empowerment. Government role along with different institutions like State Agriculture Universities and NGOs are found crucial to develop women capabilities and skills through its training programme and other initiatives. According to the mandates Krishi Vigyan Kendra, Jeolikote in Uttarakhand

organizes different kinds of training courses for the farmers, farm women and youth in different subjects. The different vocational trainings that were organized for farm women like: tailoring, knitting and handicraft, mushroom cultivation, post harvest technology, poultry management, candle making and food processing. There are some latent factors inside the human which largely affects his/her behaviour that is reflected as acceptance or rejection. These variables are age, education, annual income, land holding, material possession, risk orientation, scientific orientation etc. These variables influence the adoption behaviour and also influence the factors which affect the adoption behaviour. The findings of profile characteristic and its relationship with empowerment may provide valuable information to all public and private extension agents, researchers and policy makers to orient their efforts for rural needs. Keeping all these in view an

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attempt was made to know the profile of respondents and their relationship with economic and psychological empowerment in some adopted village of KVK Jeolikote.

METHODOLOGY

The present study was conducted in Uttarakhand state. Out of thirteen districts of the state, Nainital district and Bhimtal block was selected purposively for the present study as Krishi Vigyan Kendra; Jeolikote has been working in this district and maximum numbers of vocational trainings are organized by KVK in this particular block. Selection of three villages was done randomly. A complete list of trainees who had undergone trainings during (2017-18) conducted by KVK Jeolikote in the villages were obtained. Equal numbers of beneficiaries and non-beneficiaries were selected from the villages by using proportional allocation method. Thus, constituting the total sample size of 90 women in which 45 were beneficiaries and 45 were non beneficiaries. Interview schedule was administered to generate data and the collected data was statistically analyzed through frequency and percentages, inferential statistics were used to analyse the data, on the different aspects of the study. The data were analyzed with the help of SPSS software. The categories of low, medium and high were computed on the basis of frequency and percentage. The chi square of independence test was used to see the association between selected characteristics with empowerment and Z two sample test was applied to the sample to check the difference between the beneficiaries and non beneficiaries in terms of empowerment. The Chi-Square distribution calculates the p value results, and if the calculated value of 'p' was greater than the table value of p at 0.01 or 0.05 level of probability, the association was considered to be significant. The chi square test of independence was used to see association between the two characteristic.

RESULT AND DISCUSSION

The profile characteristic of beneficiaries and non-beneficiaries was studied; that includes socio-psychoeconomical and communicational characteristics of the farmwomen. Almost equal number of beneficiaries and non beneficiaries belonged to the young and middle age

group whereas majority of respondents in both beneficiaries (51.11%) and non beneficiaries (53.33%) were educated up to high school respectively. 73.33 per cent of beneficiaries and 88.88 per cent of non-beneficiaries had small size of land holding, majority of the non-beneficiaries (71.11%) and 44.44% of beneficiaries belonged to low income level and nearly half (51%) of the respondents from beneficiaries group attended more than two trainings, showing their active involvement in the development process. The findings of the present study are in line with Kurbetta (2017). They received trainings related to candle making, food processing, knitting woolen garments and macramé activities from the KVK trainers. The duration of training mostly varied from 2-3 days. It was found that 46.67 per cent of beneficiaries started making decorative candles and 35.56 per cent of beneficiaries started knitting woolen garments as venture due to high demand in nearby Nainital market, which is being a tourist place. Majority 86.67 per cent of respondents started their venture individually as it provided them flexibility in working hours. The place of selection for raw material was based on the ease of nearness, convenience and cost of material available. Therefore majority of the respondents 67 per cent purchased their raw material from Haldwani market. Most of the respondents' monthly income ranged between Rs. 1600 to 3350 after receiving vocational trainings, however, it was also found that most of the respondents sold their products in local market. Majority of respondents (77.77%) 'never' sought information from friends and relatives. Among personal localite sources, it was found that respondents 'never' visited local leaders for any kind of information, 50 per cent of the respondents 'always' received information from KVK staff. In the non-beneficiaries category most of the respondents had medium level (48.88%) of information seeking behaviour, followed by low level (33.33%) whereas only (17.77%) were found in high level of information seeking behaviour. Majority of respondents in both the categories had medium level followed by low level of information seeking behaviour.

Table 1 indicates that majority (73.33%) of the beneficiaries and only about seven per cent of non beneficiaries had high level of risk orientation. This might

be due to support and exposure provided through KVK resulted in high risk orientation. KVK trainers enabled them to take risk and helped them to move ahead. The findings of the study are in line with the study conducted by Sharatmol (2006) who also found that respondents had medium to high level of risk orientation. Majority of the non-beneficiaries (77.77%) had low level of scientific orientation and only 17.77 per cent of beneficiaries were found to have high level of scientific orientation. It is Both categories of respondents had low scientific orientation it might be because respondents had no exposure to mass media or other sources of information therefore they lagged behind in scientific orientation. The majority of beneficiaries (77.77%) and about 71 per cent of non-beneficiaries were found to be in medium level of

achievement motivation respectively. While, about 29 per cent of non-beneficiaries and none of the beneficiaries had low level of achievement motivation and only about 22 per cent of beneficiaries were found to be high on achievement motivation. The reason why one third of beneficiaries were high on achievement motivation might be due to their continuous contact with KVK personnel which instilled in them the quality to be more achievement oriented.

Association among selected independent variables with empowerment was calculated by using Chi square test. The results are presented in Table 2, shows that empowerment had significant association with selected independent variables such as scientific orientation, and

Table 1: Distribution of respondents according to Psychological attributes (n=90)

Category	Beneficiaries (n ₁ =45)		Non beneficiaries (n ₂ =45)	
	Frequency	Percentage	Frequency	Percentage
Risk orientation				
Distribution of respondents according to risk orientation				
Low (Less than 12)	0	0	18	40
Medium (12-15)	12	26.66	24	53.33
High (above 15)	33	73.33	3	6.66
Distribution of respondents according to Scientific orientation				
Low (less than 20)	19	42.22	35	77.77
Medium (20-24)	18	40	6	13.33
High (above 24)	8	17.77	4	8.82
Distribution of respondents according to Achievement motivation				
Low (less than 14)	0	0	13	28.88
Medium (14-16)	35	77.77	32	71.11
High (more than 16)	10	22.22	00	0

Table 2: Chi square values for association of selected variables with empowerment

Variables	df	Beneficiaries	df	Non beneficiaries
Age	2	.721ns	4	5.06
Education	4	2.173ns	8	5.58
Total family income	2	3.068ns	2	1.17
Total land holding	2	2.735ns	4	6.67
Information seeking behaviour	4	4.69ns	4	.887
Risk orientation	2	10.73*	4	2.49
Scientific orientation	4	32.54*	2	5.65
Achievement motivation	2	2.29	2	.45

*significant at 5% level of probability, ns- Non significant, df- degree of freedom

risk orientation at 0.05 level of significance. Independent variables like age, education, total family income, total land holding, information seeking behaviour and achievement motivation had no significant association with empowerment. The significant associations between risk orientation and scientific orientation with empowerment were due to the reason that psychological characteristics had improved the awareness about different schemes, understanding, marketing skills decision making power and led to empowerment of farm women. Z two sample test was applied to the sample to check the difference between the beneficiaries and non beneficiaries in terms of empowerment. The result of the test was significant, $Z=13.73$, $p < 0.001$. Beneficiaries were significantly empowered than non beneficiaries. The results of the present result is supported by study conducted by Nashine (2014) who also reported that significant difference was found between empowerment of beneficiaries and non beneficiaries group.

CONCLUSION

Profile characteristics of both categories of respondents varied in respect of their risk orientation, scientific orientation and achievement motivation. The findings of this study provide valuable information to all institution and agencies regarding respondents' socio economic level and their relationship with empowerment, so that they can orient their policies and training according

to their need. From the results it is also concluded that, the relationship between the profile characteristics of beneficiaries with empowerment level was positive and significant in terms of scientific orientation, and risk orientation at 0.05% of significance. However, majority of trained respondents suggested the need for community training center, financial facilities as well as subsidy facilities to start any of the small enterprises.

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