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EDITORIAL

In concern to raising agricultural productivity per unit of land; reducing rural poverty through a socially inclusive strategy; agricultural growth corresponding to food security needs; and sustaining the environment the factors such as land tenancy, the system of ownership, size of holdings, availability of labour and capital, religion, level of technological development, accessibility to the market, irrigation facilities, agricultural research, and extension service, price incentives, government plans, and international policies have a close impact on agricultural activities. Agricultural extension has evolved as a holistic discipline of facilitating farmers' welfare and sustainable agricultural growth. Amidst the emerging dynamics, of the demand for more income from an existing piece of land, and the increased demands for value-added food commodities in the market; secondary agriculture may offer solutions to challenges in agriculture. The Indian Society of Extension Education (ISEE), New Delhi has planned its National Seminar 2023 on '*Evolving Extension Science Towards Secondary Agriculture for Sustainable Development*' to be held at the University of Agricultural Sciences, Bangalore during June 22-24, 2023. It will be a great occasion as the ISEE will be celebrating its 60th year of inception on the inaugural day of the National Seminar. The major themes planned around the secondary agriculture involve; historical footprints to modern practices and innovations; Enterprise diversification for enhancing productivity and farm income; policy initiatives and institutional role; global good management practices; leveraging social media and ICT interventions; innovative extension science methodologies; entrepreneurship development and human resource development; gender mainstreaming and FPOs, CBOs and other governmental initiatives. The details of the seminar, crucial dates, etc. can be accessed www.iseeiat.org/news/isee-national-seminar-2023/ or <http://www.iseeiari.org/news/isee-national-seminar-2023/>

The current issue (April-June, 2023) contains 32 manuscripts including four research tools, six research notes, and twenty-two full-length research papers from cross-sectional authors and content. The measuring tools include; women empowerment in aquaculture, farmers' knowledge on the management of parasitic infestation in dairy animals, the attitude of farmers toward conservation agriculture, and the attitude of farm families toward gender equity. The manuscripts on constraints in geographical indication authorized user registration and usage, climate change adaptation constraints among paddy farmers, wildlife conflict and prevention strategies adopted by farmers and forest officials, utilization pattern of ICT tools, analyzing the feedback from women dairy farmers, and constraints faced by tomato growers at production and marketing level made the 'Research Note' section. The determinants of ; Climate change adaptation, composite livelihood security, entrepreneurial climate and attributes of agripreneurs; Efficiency of Pineapple Production and FPOs performance; descriptive analysis of attitude towards students READY programme entrepreneurial competencies generated through ARYA; entrepreneurial aptitude of women of an aspirational district; CoVID-19 lockdown effect on the investment and profitability; agricultural credit utilization and repayment by farm households; personal behaviour influence on adoption of climate change mitigating measures; impact of ; climate resilient technological interventions, CFLDs on pigeon pea productivity and profitability; adoption behaviour of climate-resilient agricultural practices, economic analysis and resource use efficiency in cotton production, yield gaps and scaling up of sesame variety; experimental study on enhancing effectiveness of farm school through community wall magazine; gender- based variations in perception of flood impacts, farmers' awareness of agricultural schemes under *saansad adarsh gram yojana*; perception of KVK professionals on objectives of extension education, professional competence of extension personnel and finally application of nudge theory to document ICT initiatives of agricultural research institutions were covered in 'Research Article' section. As usual, the data is regularly being fed to international indexing agencies leading to the indexing of the Indian Journal of Extension Education at Index Copernicus International Journal Master list, CAB International; ICI; BASE; Google scholar; Scilit; Semantic Scholar; WorldCat; Science gate; Agricultural Science and Technology Information database of FAO and Crossref. From January 2023, the journal has been inducted into the UGC CARE List which has brought another responsibility to deal with unrelated submissions in glut.

I extend sincere thanks to all the expert members of the editorial board for their painstaking efforts. The reviewing contributions of not only the editorial team members but many willful contributors are sincerely acknowledged. I extend my sincere thanks to all the authors for making valuable contributions. The support extended by Executive Council is duly acknowledged. The editorial team also congratulates the President ISEE; Dr. U. S. Gautam on his taking over as Deputy Director General (Agricultural Extension at the Indian Council of Agricultural Research New Delhi.

Special thanks are extended to the President, ISEE; Dr. U.S. Gautam, Secretary ISEE; Dr. Rashmi Singh, Treasurer, ISEE; Dr. B. K. Singh and Joint Secretary, ISEE; Dr. J. S. Malik for providing insightful thoughts and guidance in bringing out this issue. Dr. Bhanu P. Mishra, Vice President (Central Zone) deserves special thanks for making committed efforts at all stages of ISEE matters.



(Manjeet Singh Nain)
Chief Editor

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Determinants of Performance and Constraints Faced by Farmer Producer Organizations (FPOs) in India

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ABSTRACT

Farmer Producer Organization (FPO) is believed to improve the livelihood of farmers by collectivizing them for input purchase and providing forward linkage. In order to understand the determinants of performance and the constraints faced by them, the study was undertaken by surveying 125 FPOs of Andhra Pradesh, Madhya Pradesh, Telangana, Maharashtra and Uttar Pradesh during April-August 2022. It was found that most of the FPOs are engaged in input supply followed by produce aggregation. The FPOs with more number of enterprising activities were able to achieve higher turnover and better net profit. Multiple regression was used to identify the determinants of paid-up capital and turnover of FPO. Members number, BOD size and years of existence were found to be the determinants of paid-up capital of FPO. Paid-up capital was found to be significant predictor of turnover of FPO. Capital requirement was found to be the biggest constraint faced by FPO in achieving better performance. It was concluded that for increasing the turnover, the FPO should focus on increasing the paid-up capital as paid-up capital can be used for scaling up and expanding the business. Extending capital loan as well as working capital loan to FPO should be made easy.

INTRODUCTION

Farmer Producer Organization (FPO) is considered to be an institution which has provision for sharing of profits/ benefits among the members (Adhikari et al., 2021). It is found to improve the livelihood of farmers by collectivizing them for input purchase and providing forward linkage. Hence, the number of FPO is increasing over the year. By participating in FPO, farmers experience advantages like avoiding market risk; access to extension and technical knowhow, improved inputs, credit, storage and processing facilities (Singh & Vatta, 2019). FPO success, however, depends on the farmers' commitment to the organization (Sawairam, 2015). Backward linkage having provision for seeds, fertilizer, pesticide, extension and other advisory service, credit and insurance; and forward linkage having provision for collective marketing, processing, and market-led agriculture production are the basic

purpose envisioned for the FPO. It means more the number of farmers mobilized, better will be the performance of FPO. Additionally, the members will have increase in income as they will have access to better advisory services, machinery and input at lower cost (Rathour, 2022).

FPOs are promoted by various agencies. NABARD and SFAC are playing lead role with maximum number of FPOs promoted by them. Several state governments are also promoting FPOs. FPOs have been promoted under National Cooperative Development Corporation (NCDC) and National Rural Livelihood Mission (NRLM) also. The total number of FPO (registered under companies act) till August 2022 stands at 22,605 with Maharashtra leading in the list with 8,261 FPO followed by Uttar Pradesh with 3,106 FPO (MCA, n.d.).

FPO achieves high turnover and profit when it diversifies its activity to aggregation and provide a collective market for produce,

and FPOs who deal with high value commodity (pulses, fruits like grapes and pomegranate; less perishable vegetable like onions) attain high turnover in lesser time as compared to the FPOs dealing only with input selling (Partiban et al., 2015; Badatya et al., 2018; Kumari et al., 2022). It has also been found that integrity and quality of the leadership, its acceptance within the community, as well as the market environment are the most crucial factors for a successful production company are (Sawairam, 2015). Attitude towards the FPO, cooperation, members' duties and responsibilities as well as entrepreneurial characteristics of the member farmers are found to be important factors contributing towards the stability of FPO (Gorai, 2022; Singh, 2022). Studies show that major hurdles for better performance of Producer Organizations are poor professional management, shortage of working capital, inability to access loan from financial institutions, awareness of producer-members, insufficient directions and visions from Board of Directors and poor infrastructure facilities (Govil et al., 2020). With the above backdrop, the study was undertaken with the objectives of assessing the performance and the constraints faced by those FPOs for survival and growth in India.

METHODOLOGY

In order to achieve the objective of study, sample survey approach for data collection was used. For sample frame, FPOs listed on the website of Ministry of Corporate Affairs' (MCA) was used. The MCA hosts list of all the companies registered under companies act. The data pertaining to total number of companies registered during January 1, 2016 and August 31, 2022 were collected. There were 7,53,203 companies registered during the period. In order to get farmer producer company, companies whose names end with "producer company limited" were selected. Among the producer companies, all those which are involved in agriculture and allied activities were finally selected. Finally, 22,605 Farmer Producer Companies (FPOs registered under the Companies Act) were found. The FPO mentioned throughout the paper pertains to FPO registered under companies act.

Primary data were collected during the period April-August 2022 from 125 FPOs from leading states in terms of number of FPOs through telephonic survey. The list of FPOs obtained from the Ministry of Corporate affairs has been used as the sampling frame for the study. The leading states in terms of number of FPOs identified for the study were Andhra Pradesh, Madhya Pradesh, Telangana, Maharashtra, and Uttar Pradesh. The sample FPOs were distributed among the states as 17 from Andhra Pradesh, 28 from Madhya Pradesh, 32 from Maharashtra, 13 from Telangana and 35 from Uttar Pradesh. The CEOs of these FPOs were interviewed telephonically for eliciting the required information. The data so obtained were subjected to descriptive analysis. Net Profit and Profit Margin during preceding the year of study, i.e., April 2021-March 2022 were estimated for assessing the performance of FPOs.

Net profit, also known as bottom line, represents the financial standing of an FPO after all its expenses have been paid off from the revenue.

$$\text{Net Profit} = \text{Total Annual Revenue} - \text{Total Annual Cost}$$

Profit Margin is a good indicator of an FPO's financial health and is calculated by using the following formula:

$$\text{Profit Margin} = \frac{\text{Net Profit}}{\text{Total Annual Revenue}} \times 100\%$$

Multiple linear regression was used to determine the explanatory variables for paid-up capital amount and turnover of the FPO. Multiple linear regression also known as multiple regression is an extension of ordinary least-squares (OLS) regression because it involves more than one explanatory variable. Formula used:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_p x_{ip} + \epsilon$$

Where, for i : n observations, y_i : Dependent variable, x_i : Explanatory variables, β_0 : y -intercept (constant term), β_p : Slope coefficients for each explanatory variable, ϵ : model's error term (also known as the residuals)

In order to determine the predictors for Paid-up capital of FPO, the independent variables considered were size of Board of Directors (BOD), villages covered by FPO, number of enterprising activities, numbers of farmer members and number of years of existence of FPO. For determining the predictors of turnover, the independent variables considered were size of BOD, villages covered by FPO, number of enterprising activities, numbers of farmer members, number of years of existence of FPO and paid-up capital of FPO.

RESULTS AND DISCUSSION

Enterprising activities of the FPO

For its survival and growth, FPO should yield net profit from the activities it carries out. Accordingly, it engages into many enterprising activities. The sample FPOs were found to be engaged in one or other enterprising activities. Majority of the FPOs were found to be engaged in input supply business (65%), followed by produce aggregation (35%) (Table 1). The FPOs which were in input supply business may be having other activities too. It was found that 10 per cent FPO are engaged in only input supply as major enterprising activity, and 41 per cent were involved in input supply along with some other activities like advisory service, nursery, maintaining cold storage, poultry and cattle feed, primary processing, dairy farming, etc. Majority of the sample FPOs were established in 2016 and approximately 60 per cent were promoted by NABARD and rest by SFAC. Input supply is considered to have assured income due to stable and predicted number of

Table 1. Enterprising activities undertaken by sample FPO

Enterprising Activity	Percent FPO
Input Supply	65
Aggregation	35
Retailing	10
Custom hiring centre	2
Others*	65

*Other enterprising activities include one or more activities among advisory service, nursery, maintaining cold storage, poultry and cattle feed, primary processing, dairy farming

customers. The FPO assumes that at least the member farmers will purchase the inputs from its outlet. Many FPOs provide small discount to the member farmers to motivate others for membership. Though FPOs face lot of challenges in acquiring dealership of fertilizers, pesticide dealership is acquired with relatively less effort. Aggregation is not so lucrative for many, though 35 per cent were aggregating and selling to the traders. Some were retailing too (10%). Very few, only 2 per cent FPOs were providing custom hiring service.

The FPOs start with one or 2 villages in the beginning and gradually expand their presence in nearby villages with an objective to mobilize more and more farmers for membership which will increase the equity capital for the FPO and thus the business can be scaled up. It was found that most of the FPOs could be able to reach 20-40 villages. Few FPOs have more than 100 villages in their catchment. But detailed probing revealed membership of less than 500 farmers with 2-3 enterprising activities undertaken. The number of villages covered was more or less same in both NABARD and SFAC promoted FPOs. The average number of villages was estimated to be 20.83 villages per FPO. FPOs always strive hard to increase membership so that more equity capital will be there which will help in increasing the business. It was found that 40 per cent of the sample FPOs have membership of less than 500 farmers. 34.5 per cent of the FPOs have membership between 500 to 1000. One-fourth of the sample FPOs have membership more than 1000. It is believed that membership size of 700-1000 is optimal for FPO (NABARD, 2015).

The members pay on the basis of share value at the time of joining FPO which may range from Rs. 10 to Rs. 1000. The most common share value is Rs. 100 per share. The share money so collected builds the paid-up capital for the FPO, though authorized capital could be much more. The paid-up capital is considered to be the easiest source of money required by the FPO. It was found that the average paid-up capital of the sample FPO was Rs. 6.14 lakhs. Majority have paid-up capital less than Rs. 5 lakhs. Though, some FPOs were able to get grants under government schemes. The General Body of FPO elects Board of Director (BOD) under whose direction the day-to-day operation of FPO is carried out by the professionals. The Board can have minimum 5 to maximum 15 Directors. Among the sample FPO, 39 per cent have BOD size of 5 followed by 10 in 32 per cent FPOs.

It was found that input supply and produce aggregation are the two most common enterprising activities of FPO. There were FPOs engaged in only one enterprising activity and others were engaged in several activities. It has been found that 27 per cent FPO were engaged in only one enterprising activity (Table 1).

Majority (81%) have two enterprising activities. It has been attempted to assess the performance of these FPO in terms of turnover, net profit and profit margin. The FPO with only one enterprising activity are able to achieve an annual turnover of per cent 36.4 lakhs and a net profit of per cent 1.2 lakhs (Table 2). These FPOs achieve a profit margin of per cent 4.7 per cent. The average turnover was found to be maximum where 3 enterprising activities were carried out by FPO (Rs. 55.2 lakhs). The average net profit of approximately Rs. 2.5 lakhs with a profit margin of 6 per cent is achieved by these FPOs. It can be inferred here that profit margin increased with increase in activity. It could be because of more value adding activity resulting into better margin for FPO.

In order to identify the determinants of paid-up capital of FPO, multiple linear regression was used. The paid-up capital was the dependent variable here. The independent variables or predictors considered were size of BOD, villages covered by FPO, number of enterprising activities, numbers of farmer members and number of years of existence of FPO.

It was hypothesized that these predictors influence the paid-up capital amount of an FPO. The independent variables were checked for multicollinearity before performing multiple linear regression. The independent variables were not found to be multicollinear ($VIF < 5$ in all cases) (Table 3). The result revealed that number of members in the FPO, years of existence of FPO and BOD size significantly predict the paid-up capital amount of an FPO, $F(5, 94) = 10.543$, $p < .0005$. The unstandardized coefficient, B, for membership number was equal to 502.460. This means that for each one number member increase, there was an increase in paid-up capital of Rs. 503. It clearly indicates that for increasing the paid-up or equity capital, the FPO needs to increase the number of members. Again, the unstandardized coefficient, B, for size of BOD was equal to -32404.243. This means that for each one number increase in size of BOD, there was a decrease in paid-up capital of Rs. 32,404. It infers that more number of BOD may hinder in the growth and expansion of the FPO. Lesser number with focussed approach of BOD would be beneficial for the FPO in long run. Similarly, the unstandardized coefficient, B, for years of existence of FPO was equal to -56696.468. This means that for each one-year increase in existence of FPO, there was a decrease in paid-up capital of Rs. 56,697. It indicates that the FPO which were incorporated early could not be much active and not able to increase the paid-up capital. Those FPO which came up later could be more active and thereby have more paid-up capital.

It was also attempted to identify the determinants of turnover of FPO for which multiple linear regression was used again (Table 4). The turnover of FPO was the dependent variable here. The independent variables considered were size of BOD, villages covered by FPO, number of enterprising activities, numbers of farmer members, number of years of existence of FPO and paid-up capital of FPO. It was hypothesized that these predictors influence the turnover of an FPO. The independent variables were not found to be multicollinear ($VIF < 5$ in all cases). The result revealed that paid-up capital of FPO significantly predict its turnover, $F(6, 74) = 2.004$, $p < .05$. The unstandardized coefficient, B1, for paid-up capital was equal to 3.77. This means that for each one rupee

Table 2. Performance of sample FPO, 2020-21

No. of enterprising activity	Average turnover (Rs. lakh)	Average net profit (Rs. lakh)	Profit margin (%)
1	36.4	1.2	4.7
2	41.5	2.2	6.5
3	55.2	2.5	6.0
4	51.2	3.3	8.5
5	44.4	2.9	12.3

Table 3. Multiple linear regression result for explaining paid-up capital of FPO

Model summary					
R	R square	Adjusted R square		Std. error of the estimate	
0.599	0.359	0.325		3.9×10 ⁵	
ANOVA					
	Sum of squares	df	Mean square	F	Sig.
Regression	8.1×10 ¹²	5	1.63×10 ¹²	10.543	.000
Residual	1.45 ×10 ¹³	94	1.54×10 ¹¹		
Total	2.26×10 ¹³	99			
Coefficients and collinearity statistics					
Independent variable	Unstandardized coefficient (B)		Sig.	Collinearity statistics (VIF)	
BOD size	-32404.24		.035	1.011	
No. of villages	1126.52		.554	1.061	
No. of enterprising activities	52598.50		.148	1.082	
Membership no.	502.46		.000	1.189	
Age of FPO	-56696.47		.030	1.082	

Table 4. Multiple linear regression result for explaining turnover of FPO

Model summary					
R	R square	Adjusted R square		Std. error of the estimate	
.374	.140	.070		4.39×10 ⁶	
ANOVA					
	Sum of squares	df	Mean square	F	Sig.
Regression	2.31×10 ¹⁴	6	3.85×10 ¹³	2.004	.046
Residual	1.42×10 ¹⁵	74	1.92×10 ¹³		
Total	1.65×10 ¹⁵	80			
Coefficients and collinearity statistics					
Independent variable	Unstandardized coefficient (B)		Sig.	Collinearity statistics (VIF)	
BOD size	86299.38		.856	.943	
No. of villages	-8868.978		.655	.939	
No. of enterprising activities	-22796.10		.708	.904	
Membership no.	-648.98		.960	.616	
Age of FPO	479532.52		.603	.879	
Paid-up capital	3.78		.149	.641	

increase in paid-up capital, there was an increase in turnover of Rs. 3.77. It can be concluded that for increasing the turnover, the FPO should focus on increasing the paid-up capital as paid-up capital can be used for scaling up and expanding the business.

Constraints in achieving better performance

The FPOs face many constraints in achieving better performance and confronted with many challenges. Literature shows that poor capitalization, managerial capability, control over business, regulatory compliances, well defined business plan and many other challenges were impeding the growth of FPOs (Trebbin, 2014; Nikam, 2019; Kumar et al., 2021). The list of identified challenges are rated on a scale of 1 to 5 (1 being least affecting, 5 most affecting). The average rating of all the challenges is presented in Table 5. It was found that capital requirement was the biggest constraint for the FPO. FPOs were not able to get

sufficient fund to run the business. Poor equity capital coupled with tough-access to formal loan from financial institution affects the FPO performance badly. Banks ask for comprehensive business plan which most of the FPO lacks, thereby hindering access to loan. Banks also don't find the loan product to FPO as lucrative

Table 5. Constraints faced by sample FPO

Challenge	Average rating	Ranking
Capital requirement	4.03	1
Mobilization of farmer	3.08	2
Marketing problem	3.04	3
Competition in business	2.79	4
Lack of experience	2.62	5
Manpower issues	2.18	6
Government support	2.03	7
Business efficiency	1.76	8

business. Mobilizing farmers for membership was found to be second most affecting constraint with overall rating of 3.08. It has already been found that majority of FPOs didn't have large number of members. Even if number was more, active members were less. It means, the FPOs need more of active members so that the business, be it input sale or produce purchase both can be at higher level resulting into better business performance. Marketing problem is pervasive in nature in agribusiness and so is for FPO. FPOs were not having any differentiated product and the enterprising activity undertaken by them is common in nature. That was the reason, the FPOs feel competition in business. Lack of experience is rated least affecting with a score of 2.62. Reason being, few FPOs which have diversified into number of activities perceive lack of experience as one of the challenges. FPOs which didn't have much aspiration didn't see experience as big challenge.

CONCLUSION

Most of the FPOs were engaged in input supply as the only enterprising activity. More number of enterprising activities helps the FPO to achieve higher turnover and in turn better net profit. Hence, FPO should diversify into more number of business activities. With the objective of surviving and eventually growing and scaling -up, FPOs need to increase business turnover. Members number is found to be significantly affecting the paid-up capital of FPO which in turn affects the turnover of FPO. It indicates FPO should continue membership drive to bring more farmers into its fold as active members. Capital requirement is found to be the biggest constraint faced by FPO. Hence, extending capital loan as well as working capital loan to FPO should be made easy.

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Determinants of Climate Change Adaptation Strategies in Bundelkhand Region, India

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ABSTRACT

The study attempted examining climate change adaptation strategies in the most backward regions of India, i.e., the Bundelkhand region. Data were collected from 200 farmers during April and May of 2017, and a binary logistic regression model was used to analyze the data. The farmers were most likely to improve irrigation facilities if they have access to institutional credit, information about the weather, and have taken crop insurance. Also, farmers perceived that an increase in temperature, a decline in rainfall, and a decline in water tables motivate and influence farmers to change their cropping pattern from wheat (a water-intensive crop) to chickpea (a less water-intensive crop) to cope with the changing climate. Hence, the present study recommends that since water table is declining continuously and creating water crisis even in the rainy season for agriculture and domestic consumption, community participation in the conservation of water-bodies is vital. Further, the adoption of crop varieties that require less water, are drought tolerant and mature early will help increase farm productivity and reduce cultivation costs. Lastly, an advance regional weather forecasting system capable of providing farmers with accurate information that will enable them to change cropping patterns and adjust farming practices are required.

INTRODUCTION

For marginal wheat growers in India, climate change has become a major socio-ecological concern in recent decades (Singh, 2020a). Climate change is thought to have negative effects on agriculture overall and on marginal farmers in particular (Singh and Sanatan, 2014; Singh, 2020c). Appropriate weather conditions are still important to improve agricultural productivity, despite major technical developments (Singh & Sanatan, 2018; Singh, 2019). Because of the changing climate conditions at different intensities around the world, wheat farming is under serious pressure (Sanghi & Mendelsohn, 2008). Further, shifting climate patterns have a severe impact on crop farming in developed and low-income countries, leading to a sharp drop in crop yields (Singh & Sanatan, 2021). Climate change affects rural subsistence in developing

countries (Ravindera and Singh, 2020) and increases the insecurity of rural populations (Dupdal et al., 2021; Letha et al., 2021). Productivity losses in rainfed areas, such as Bundelkhand, are mostly attributable to the rapid rate of land degradation and the increased frequency and severity of droughts that are a result of climate change (Singh, 2020b). While farmers have used the recommended amounts of input and crop management strategies, variation in seasonal temperatures and stress have adversely affected crop yields (Singh, 2020a), in particular the yield of wheat (Singh & Sanatan, 2021). Efforts to tackle the negative effects of climate change, especially on small farmers and agriculture in general, are therefore essential (Singh, 2020b). Most modelling and observational studies have shown that climate change is more likely to affect rain-fed farmers (Sanghi & Mendelsohn, 2008; Singh, 2021).

The Bundelkhand region is historically more vulnerable to climate change. The region had experienced drought once every 16 years during the 18th and 19th centuries, whereas it increased to three times during 1968–1992, and now it is a recurrent annual phenomenon (GoI, 2017). The average annual rainfall of the region continued to be below average during 2004–2022 (GoI, 2022). The severity of the low rainfall was such that 40 per cent of the net sown area remained fallow, which resulted in 30 per cent less food grain production (NRAA, 2018). Apart from drought, variations in temperature are also a cause of household vulnerability (Singh, 2020b). The average temperature has been increased by 0.28°C during 1969–2017 compared with 1960–90 (Singh, 2020b). A rise in temperature leads to high evapotranspiration, causing a loss of soil moisture and reductions in groundwater recharge and surface water. In light of the above, the present study made an attempt to identify the key determinants that influence and motivate farmers to adopt a rational, cost-effective, and climate-smart adaptation strategy in Jhansi and Jalaun districts of the Bundelkhand region.

METHODOLOGY

The present study was carried out in the Bundelkhand region of India. In the region, wheat is the main food grain crop. The field survey was carried out in the months of April and May of 2017, at the end of Rabi harvesting season. Further, a multi-stage sampling technique was opted for in the sample selection. In first step, two districts (one developed, Jhansi, and one developing, Jalaun) were chosen from a total of 13 in the Bundelkhand region based on various hydrological, climatic, soil, and agricultural parameters. There are five sub-divisions (i.e., tehsils) in each of the selected districts, and at second stage, all five tehsils from each district were chosen. In third stage, one development block from each tehsil was chosen purposefully. In fourth stage, one village from each selected block was chosen randomly. Finally, 20 farm households from each village were selected randomly. Thus, a total of 2 districts, 10 tehsils, 10 development blocks, 10 villages, and 200 farm households were selected for the study.

The Binary Logistic Regression (BLR) model was adopted for identifying the key determinants of climate change adaptation in the sample farmers (Singh, 2020a; Jatav et al., 2021). BLR model was separately used for Jhansi and Jalaun districts to capture regional heterogeneity in the region. The logistic distribution function for the decision on adopting adaptation measures to climate change can be specified as:

$$\text{Logit}(P) = \log\left(\frac{P}{1-P}\right) \quad \dots (1)$$

$$\text{Let } P_i = P_r\left(\frac{Y=1}{X=x_i}\right), \text{ then the model can be written as} \quad \dots (2)$$

$$P_r\left(y = \frac{1}{x_i}\right) = \frac{\exp^{x'ib}}{1 + \exp^{x'ib}}; \log\left(\frac{P}{1-P}\right) = \text{Logit}(P_i) = \beta_0 + \beta_i \quad \dots (3)$$

Where; P_i is a probability of deciding to adopt adaptation strategies (dependent variable), X_i 's are independent variables, β_0 is the intercept and β_i is the regression coefficient of respective variables.

We can write the model in terms of odds as;

$$\frac{P_i}{(1-P_i)} = \exp(\beta_0 + \beta_1 X_i) \quad \dots (4)$$

The dependent variable (adaptation strategy) is binary, with values as 1 for farmers using at least one of the identified climate adaptation strategies and 0 for farmers using none of the strategies mentioned. This was done so that adapted farmers might be distinguished from non-adapted ones. One of the farmer's adaptation techniques, including crop pattern change, improved irrigation facilities, and the use of early matured seed varieties, have identified to climate change. The hypothesized independent variables affecting the development of adaptation strategies by farmers include the cumulative impact of different factors such as geographical, socio-economic characteristics and extended resources for farmers.

RESULTS AND DISCUSSION

Farmers' perception of climate change

Table 1 depicts that farmers are well aware of the changing climatic conditions. About 70 per cent in Jalaun and 64 per cent in Jhansi perceived that rainfall distribution had declined over the last five years. Likewise, more than 90 per cent of farmers in both districts perceived that the summer season had become relatively hotter in recent years compared with the last decade. Further, about 88 per cent of farmers in Jalaun and 98 per cent of farmers in Jhansi perceived that the frequency of heat-waves had increased, which was a major factor for mortality in the summer season. More than 90 per cent of farmers perceived that the water table in the sample villages had drastically declined due to less rainfall and higher water consumption. Therefore, farmers are digging more and deeper tube-wells to meet water demand for agriculture and domestic purposes. In total, increase in temperature and decline in rainfall have put stress on the marginalised farming community.

Table 1. Farmers' perception on Climate Change

Perception attributes	Jhansi	Jalaun
Farmers perceived that frequencies of heat-waves has been increased	98	88
Farmers perceptive that summer-days become hotter	98	90
Farmers perceived that rainfall has been declined	64	70
Farmers perceived that water table has been declined	95	90

Source: Field Survey Data, 2017. Note: values are in per cent

Adaptation strategies adopted by surveyed farmers

Table 2 shows that farmers used different climate adaptation strategies to cope with changing climate and increase farm income, i.e., cropping pattern change, use of early maturing varieties and improving irrigation system. In this connection, statistics reveal that about 82 per cent of farmers in Jhansi and about 72 per cent of farmers in Jalaun have changed their cropping patterns from wheat (water intensive crop) to chickpea (less water intensive crop). Further, by utilising natural resource management techniques and expert advice provided by local agriculture officers, about 62 per cent of farmers in Jhansi and 52 per cent of farmers in Jalaun

have improved their irrigation facilities to get regular and assured water whenever irrigation is required. As Bundelkhand is a dry region, farmers have used sprinklers to make efficient use of water. Moreover, about 72 per cent of farmers in Jhansi and 52 per cent of farmers in Jalaun have used early maturing seed varieties (EMSV) to cope with the changing climate. EMSV are extremely useful for implementing climate resilience practices. They have required less water, time and inputs compared with traditional seed varieties. Farmers in the study are growing EMSVs like UP 2382, which are ready for harvest in 109 days. Per hectare production (5545 kg/ha) is also relatively higher as they are specially designed for dry regions, like the Bundelkhand region.

Table 2. Adaptation Strategies of Farmers in surveyed Districts

Adaptation strategies	Jhansi	Jalaun
Farmers have used early maturing varieties	72	52
Farmers have improved irrigation system	62	52
Farmers have changed their cropping pattern	86	72

Source: Field survey data, 2017. Note: values are in per cent

Determinants of climate adaptation strategies

The Binary Logistic Regression (BLR) model results help in identifying the determinants of climate adaptation strategies, namely cropping pattern change, improved irrigation, and early maturing varieties (Table 3). The study has used the BLR model at the district level to capture regional dimensions of climate change adaptation. The results show that a decrease in rainfall motivated farmers in Jhansi district to change their cropping pattern while being restricted to use early maturing varieties and improve irrigation, whereas rainfall has been positively associated with climate adaptation strategies in Jalaun district (Table 3). Temperature, education, land size, participation in agricultural training programmes, access to agricultural credit, information about the climate, and crop insurance are positively associated with cropping pattern change, improved irrigation, and early maturing varieties adaptation strategies in both districts.

The calculated odds ratio shows that there is a 2.54 times higher probability that farmers will change their cropping pattern in favour of low water-intensive crops (i.e., chickpea) from high water-intensive crops (i.e., wheat), if they perceive that rainfall will decline in Jhansi district. On the other hand, there is a 3.24, 2.64 and 1.58 times higher probability of changing cropping pattern, using early maturing varieties, and improving irrigation, respectively, if farmers perceive that rainfall will decline in Jalaun district. Further, there is a 3 times higher probability to adopt recommended adaptation strategies (early maturing seed varieties) if farmers perceive that temperatures will increase in the near future in Jhansi district; on the other hand, there is a lower likelihood to adopt recommended strategies in Jalaun district compared with Jhansi district. Education is a critical indicator in the adaptation strategy for climate change. It is anticipated that educated farmers will be more likely to implement the recommended strategies. Results from Table 3 revealed that there is 2.51 and 3.64 times higher probability to change cropping pattern and use of early maturing varieties, farmers who attained higher education (above

secondary level) are more likely to adapt to climate change in Jhansi district and on the other hand, there is 1.62, 2.64 & 3.24 times higher probability to change cropping pattern, use of early maturing varieties, and improved irrigation, respectively, if farmers having education level above from secondary-level in Jalaun district. The odds ratios of land size depict that there is a 3.24, 2.64 and 4.32 times higher probability to adopt cropping pattern change, early maturing varieties, and improved irrigation adaptation strategies. Recommended adaptation strategies, if farmers have a larger land size in Jhansi district and on the other hand, the odd ratio shows that there are relatively fewer likelihoods to implement adaptation strategies in Jalaun district compared to Jhansi district.

Table 3 shows that farmers who participated in the agriculture development programme were relatively more likely to adopt cropping pattern change, early maturing varieties, and improved irrigation adaptation strategies in Jhansi compared to Jalaun. There is a 4.26, 2.34 and 3.24 times higher probability of adopting recommended strategies in Jhansi, while the corresponding figures are only 2.45 and 3.54 for Jalaun. Further, the odd ratio of access to institutional credit reveals that farmers who are availing credit from institutional sources are more likely (3.24 times higher) to have improved their irrigation system in Jhansi, while corresponding figures for Jalaun are relatively higher than those of Jhansi. Likewise, the odd ratio of information on climate shows that farmers who have information about changing climates have a 1.59 and 2.64 times higher probability of using early maturing varieties and improved irrigation in Jhansi, while on the other hand, they have a 3.64, 3.59, and 1.64 times higher probability of adopting adaptation strategies in Jalaun. Lastly, the odd ratio of crop insurance shows that there is a 4.95, 3.59, and 2.44 times higher probability of identifying adaptation strategies in Jhansi, while there is a 4.24, 3.29, and 3.82 times higher probability of adopting them in Jalaun. In totality, the likelihood analysis (odd ratio) reveals that farmers belonging to Jalaun have a higher likelihood of identifying adaptation strategies compared to those in Jhansi.

Farmers everywhere are feeling the adverse effects of the changing climate. Since most farmers already operate on the margins, their already precarious financial situations become much more precarious. Additionally, the greater susceptible system is being further compromised by the fragmentation of land size and the overuse of natural resources during the depletion stage of common property resources. This research focused on the most climate-sensitive agro-climatic area of Uttar Pradesh, India, i.e., the Bundelkhand region, to get insight into farmers' perspectives and resolve on climate change adaptation. This research shows that farmers are aware of the effects of climate change and are responding to the negative effects of climate change by making changes to their farming operations and diversifying their income streams. Farmers have adapted by shifting their cropping patterns, using new methods of irrigation, and planting early maturing cultivars in order to combat the effects of climate change. The findings of a binary logistic regression study show that well-informed farmers who are adapting to a changing environment are doing so in a sensible manner. Having access to extension services like crop insurance and institutional loans also has a favourable effect on farmers' coping behaviour.

Table 3. Determinants of Climate adaptation strategies

Independent Variables	Jhansi			Jalaun		
	Cropping pattern change	Early maturing varieties	Improved irrigation	Cropping pattern change	Early maturing varieties	Improved irrigation
Farmer perceived rainfall declined (Yes = 1, No = 0)	0.482* (2.54)	-0.265* (0.84)	-0.632* (0.64)	0.621* (3.24)	0.325* (2.64)	0.531* (1.58)
Farmer perceived temperature increased (Yes = 1, No = 0)	0.125* (3.28)	0.632* (2.54)	0.745* (3.25)	0.138* (2.88)	0.262* (1.54)	0.145* (1.25)
Education (Below secondary = 0, above = 1)	0.045* (2.51)	0.038** (3.64)	0.149** (0.91)	0.049** (1.62)	0.472** (2.64)	0.324** (3.24)
Land Size (in acre)	0.238* (3.24)	0.652* (2.64)	0.742* (4.32)	0.634* (2.83)	0.454** (1.89)	0.648* (3.92)
Training Programme (Yes = 1, No = 0)	0.421* (4.26)	0.024* (2.34)	0.064* (3.24)	0.421* (2.45)	0.025* (3.54)	0.064* (0.64)
Agricultural Credit (Yes = 1, No = 0)	0.246** (0.54)	0.045* (0.45)	0.215** (5.64)	0.846** (2.95)	0.248* (5.64)	0.616* (3.36)
Information of Climate (Yes = 1, No = 0)	0.002*** (0.95)	0.064** (1.59)	0.841* (2.64)	0.692** (3.64)	0.068** (3.59)	0.241* (1.64)
Crop Insurance (Yes = 1, No = 0)	0.652*** (4.95)	0.682** (3.59)	0.021* (2.44)	0.462** (4.24)	0.026** (3.29)	0.266* (3.82)
Constant	-1.616* (0.19)	-0.087* (0.91)	-0.294 (0.74)	-0.420* (0.65)	-0.348** (0.70)	-0.694 (0.24)
LR chi ²	28.54	26.43	33.21	15.35	3.32	13.62
Prob > chi ²	0.0019	0.0031	0.0054	0.0029	0.0062	0.000
Pseudo R ²	0.8948	0.9521	0.9528	0.9226	0.9381	0.8582
Log likelihood	-85.842	-76.635	-102.049	-166.246	-168.326	-87.698
No. observation	100	100	100	100	100	100

Source: Estimated from field survey data, 2017. Note: *, **, and *** indicate 1, 5, 10 per cent level of significance respectively. Values in parentheses are odd ratios. Because of our analysis was carried out at district level, hence, 100 observations are mentioned in the last row of table 3

CONCLUSION

The study suggests, since water table is declining continuously and creating water crisis even in the rainy season for agriculture and domestic consumption, community participation in the conservation of water-bodies is vital. The adoption of crop varieties that require less water, are drought tolerant and mature early will help increase farm productivity and reduce cultivation costs. Advance regional weather forecasting system capable of providing farmers with accurate information that will enable them to change cropping patterns and adjust farming practices are required. Community participation and regular training programs in the sample villages are surely benefiting farmers to channelize their indigenous knowledge and optimize local resources which lead to sustainable farming.

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Economic Performance of Enterprises Promoted under ARYA and Relationship with Entrepreneurial Competencies

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ABSTRACT

Attracting and retaining youth in agriculture (ARYA) is a national programme of Indian Council of Agricultural Research implemented through Krishi Vigyan Kendras (KVKs) since 2016-17. The present investigation was carried out in 2021-22 with a total of 684 rural youth, randomly identified from among the functional units under various enterprises. Among the nine major enterprises promoted under ARYA, performance of poultry units were better in terms of operational duration and total turnover per enterprise despite incurring higher expenditure. Nursery enterprises showed the highest net income per unit and also created maximum assets. On the other hand, benefit-cost ratio was higher in piggery enterprises and per day net income was highest in processing and value addition units. More employment generation was recorded in fish and goat farming enterprises. The results indicated that each of the agri business areas have strengths on different parameters. Besides the choice of enterprises that are locally viable, the entrepreneurial competency of the entrepreneurs was essential to sustain the enterprises. Successful entrepreneurship promotion has the possibilities for attracting and retaining youth in rural areas through technology-supported agribusiness development.

INTRODUCTION

Agriculture, with its allied sectors, is the largest source of livelihoods in India. About 70 percent of its rural households still depend primarily on agriculture for their livelihood (FAO, 2022). Youth involvement is strongly realized for agricultural reform so that it can keep pace with changing global economy. About half of the Indians are under the age of 25, and 65 per cent are under

the age of 35 (Census of India, 2011). India's massive youth resource has much to offer to agriculture sector but survey indicates the declining youth participation and preferences in agriculture (NSS, 2021). Channelizing the youth workforce of the country into agriculture sector require strong strategies for attracting and retaining youth in agro-based rural enterprises (Som et al., 2018). Since large number of unemployed rural youth are migrating to cities in search of work, agriculture-based entrepreneurship

development is an important approach to minimize the outward migration (Singh et al., 2014; Singh et al, 2016; Nain et al., 2019; Ray et al., 2022). Creating and sustaining livelihood opportunities in rural areas is fundamental to retain the youth in agriculture. Scientifically managed and business-oriented farms provide household wellbeing, food security and livelihoods for many millions of people (Proctor & Lucchesi, 2012). Mobilizing the youth for national development is a common phenomenon amongst the western and developing countries (Afande et al., 2015). In India too, several programmes and schemes were launched to mobilize youth to contribute to nation-building and at the same time develop themselves.

The Indian Council of Agricultural Research (ICAR) through its flagship programme of Attracting and Retaining Youth in Agriculture (ARYA) has envisioned a technology-centric and opportunities-driven entrepreneurship promotion. The programme was implemented through 25 Krishi Vigyan Kendras (KVK), spread across 25 States, in the first phase from 2016-17 onwards. The programme strategized to support the existing rural enterprises as well as the potential entrepreneurs through capacity development and technological hand-holding. KVKs considered major agro-based enterprises preferred by rural youth for skill development, extended technical back-stopping for setting up the enterprises and further facilitated with forward/backward linkages to make the enterprises functional. Preliminary pooling of the progress achieved through these programmatic efforts till 2018 (Singh et al., 2019) revealed that large number of youth were trained/oriented towards agri business opportunities and many of them established the enterprises with a reasonable degree of success. Considering the importance of these outcomes on the national goal-setting and policy making, the Division of Agricultural Extension of ICAR thought it apt to take up national level network mode research project to analyse the multi-dimensional implications of ARYA programme. Accordingly, assessment of the impact of ARYA on agri entrepreneurship and alternative livelihoods has been taken up, which also attempts to assess the performance and identify the factors contributing towards establishing and sustainably managing the agri enterprises.

METHODOLOGY

The ARYA project of ICAR was implemented in its first phase across 25 states, covering one district per state. One ARYA Nodal Scientist in each Agricultural Technology Application Research Institute planned the budget, guided KVKs and monitored the implementation. A total of 62 scientists (CCPIs in the research project) in 25 KVKs organized capacity development and extended support for establishing and managing the enterprises by the trained youth. Mushroom, poultry, processing & value addition, nursery and protected cultivation, bee keeping, piggery, goat farming, duck & fisheries, and vermicompost enterprises promoted by at least three KVKs each were considered for the impact assessment. A total of 1366 units, operational for a minimum of one year during research project formulation, were shortlisted for sampling. At the rate of 50 per cent sampling, 684 respondents were randomly identified for the study. These enterprises were initiated at different points of time during 2016-17 to 2019-20 and

hence the operational duration varied. There were 176 units functional since 2016-17 (four years), 201 units functional since 2017-18 (three years), 221 units functional since 2018-19 (two years) and 252 units functional for one year. Hence, the data on performance indicators is presented for the entire operational duration per enterprise unit, rather than the usual practice of annual performance. In order to assess the performance of enterprises, the research variables/included are; (i) gross turnover (Rs./enterprise); (ii) gross value of inputs used (Rs./enterprise); (iii) net income (Rs./enterprise); (iv) employment generated (man-days/enterprise); (v) operational duration (days/ enterprise); (vi) benefit-cost ratio; (vii) per day income (Rs./day); and (viii) value of assets created/possessed (Rs./enterprise as on 31.03.2021).

The Basic Scale of Entrepreneurial Competencies (BSEC) developed by Cardenas-Gutierrez et al., (2021) with 14 statements was pre-tested and adapted with minor modifications for assessing the entrepreneurial competencies of the entrepreneurs. Age of the entrepreneurs was taken in terms of completed years. Education level was quantified as illiterate (0), primary (1), higher primary (2), secondary (3), intermediate (4), graduate (5) and post graduate (6). Gender was quantified as men (1) and women (2). From the identified respondents, data were collected on real time basis using the google form by the CCPIs by personally visiting each enterprise. Analysis of variance (ANOVA) was used to compare mean values on each economic performance indicator among the nine enterprises, using the F-distribution. Significant result meant that the nine enterprises on a particular parameter are unequal.

RESULTS AND DISCUSSION

Total number of functional enterprise units year-wise during 2017 to 2020 and the average operational duration during each year are depicted in Figure 1. The cumulative number of functional units increased over the years from 267 during 2017-18 to 684 during 2020-21. The average operational duration of these units increased gradually from 176 days during 2017-18 to 252 days during 2020-21. The slow and steady progress indicates that the agri entrepreneurship promotion is an arduous and time-taking process. Most of these enterprises were taken up by the youth as an additional source of livelihood, besides their regular activities in farming and daily-wage activities.

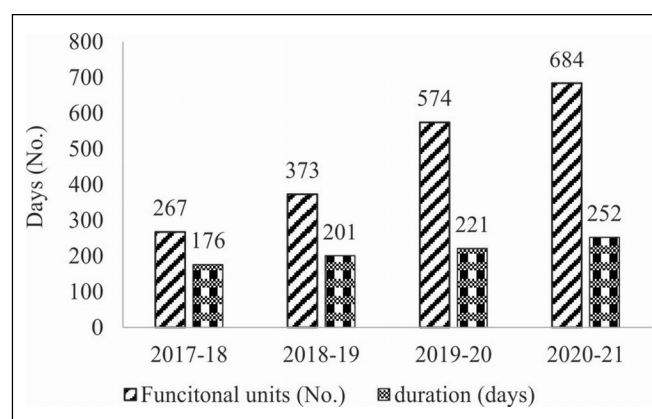


Figure 1. Functional enterprise units (No.) and the average operational duration (days)

The data pertaining to selected performance indicators of the enterprises promoted under ARYA is presented in Table 1. Operational duration varied highly significantly as indicated by F value of 23.63. The enterprise units with the longest operational duration were found in poultry enterprises, closely followed by goat farming enterprises. Nursery/protected cultivation and piggery enterprises were also operational for longer duration than the overall average (616 days). Fish and duck farming, processing and value addition, beekeeping, mushroom and vermicompost functioned for shorter period of time than the overall average operational duration.

Highest turnover per unit was recorded in poultry enterprises with a turnover of Rs. 957459/unit during the period 2017-2020. Among the livestock enterprises, poultry farming has proved to be remunerative business in rural areas. Besides quick turnover, it has the potential to generate large profit (Rath et al., 2015). Poultry enterprises that produce broiler chicken for meat purpose have the capacity to generate income every six weeks. Efficient production units produce 6-7 batches per year, thus ensuring higher turnover compared to other enterprises. Similarly the poultry layer units earn regular income after about six months of establishment period. Poultry farming has been a successful alternative livelihood for smallholder, landless and vulnerable section of people in the countryside (Vetrivel and Chandrakumaramangalam, 2013). The total turnover recorded by nursery (Rs. 911198/unit) and processing and value addition (Rs. 881053/unit) enterprises were on par with poultry. Bee keeping (Rs. 634341/unit) and piggery (Rs. 594044/unit) enterprises also recorded more than overall average (Rs. 566826/unit) turnover. Mushroom (Rs. 508586/unit), goat (Rs. 372479/unit) and fisheries (Rs. 267683/unit) enterprises had below average turnover. Vermicompost enterprises had the least turnover (Rs. 72163/unit) among all the enterprises. Mean values of gross turnover differed significantly at 1 per cent level with F value of 11.35.

The poultry enterprise units also had the highest expenditure per unit of Rs. 431740. Statistics show that the expenditure made by processing and value addition units (Rs. 395281/unit) was on par with the poultry enterprise. Poultry units not only require initial investment in the form of rearing shed and equipment but also involve expenditure for buying chicks for each batch, feed,

medicine and labour. Running the poultry enterprises demand the farmers to spend constantly and the results of the present study reiterate this fact. Small units incur high feed cost and transport cost besides regular expenditure for vaccines and veterinary care services. Nursery and protected cultivation, mushroom and bee-keeping (Rs. 234700/unit) enterprises also recorded higher than the overall average expenditure (Rs. 223800/unit). Least expenditure was incurred by vermicompost (Rs. 19578/unit) and goat farming (Rs. 78157/unit) enterprises. F value of 9.79 confirmed that the mean value of inputs differed significantly at 1 per cent.

Nursery and protected cultivation enterprises (Rs. 607824/unit) earned highest net income per unit. Nursery enterprises have the potential to generate income every day to nursery entrepreneurs. Production cycle of most of the fruits and vegetable seedlings is very short and hence provide the opportunity for regular income generation. Maintenance of mother-plants block, sourcing of quality seeds and presence of skilled manpower for multiplication/propagation are the major factors of a successful nursery of perennial planting material. The ARYA promoted nursery business units which could spend about Rs. 3 lakh earned a gross income of about Rs. 9 lakh and a net income of Rs. 6 lakh/unit. With a moderate recurring cost, nursery business in rural areas has been able to generate higher net income compared to other enterprises. The demand for quality planting material is on the rise and hence the nursery businesses have developed rapidly in recent years. Nursery business has given way for sustainable income especially to the new entrepreneurs (Singh et al., 2022). Net income recorded by poultry, piggery, processing and value addition and bee keeping enterprises were also significantly higher than the overall average net income (Rs. 343026/unit). Net income from goat farming and mushroom was moderate as the income levels were closer to the mean value. Fish and duck farming and vermicompost enterprises recorded much below the average net income. The performance of nine enterprises on net income was significantly different at 1 per cent level (F value 11.13).

Benefit cost analysis, per day income, employment generation and value of assets created are presented in Table 2. Piggery enterprises with a benefit-cost ratio of 6.37 was the most efficient ARYA enterprise in terms of gross return to gross value of inputs used. Goat farming also proved to be a very economical rural

Table 1. Gross turnover, value of inputs and net income of enterprises under ARYA

Agri Enterprises Promoted under ARYA	Functional units (No.)	Operational duration (days)	Turnover (Rs./ per unit)	Value of inputs used (Rs./ unit)	Net income (Rs./ unit)
Bee keeping	59	479	634341	234700	399641
Fish & duck farming	25	573	267683	188292	79392
Goat farming	93	810	372479	78157	294322
Mushroom	147	474	508586	260561	248025
Nursery & protected cultivation	66	717	911198	303374	607824
Piggery	47	628	594044	93239	500805
Poultry	123	835	957459	431740	525720
Processing & value addition	24	517	881053	395281	485772
Vermicompost	100	416	72163	19578	52585
Total/Average	684	616	566826	223800	343026
F-value		23.63	11.35	9.79	11.13
Sig.		.000	0.00	.00	.00

Table 2. Benefit-cost ratio, per day income, employment generation and assets-worth of the enterprises

Agri Enterprises Promoted under ARYA	BC ratio per enterprise unit	Per Day Income (Rs./day/ enterprise unit)	Employment (man-days) per enterprise unit	Assets value (Rs./ enterprise unit)
Bee Keeping	2.70	834	728	203053
Fish & Duck farming	1.42	139	3211	160296
Goat farming	4.77	363	1299	341781
Mushroom	1.95	523	532	167609
Nursery & Protected cultivation	3.00	848	1068	541001
Piggery	6.37	797	912	494189
Poultry	2.22	630	689	444434
Processing & Value Addition	2.23	940	599	160906
Vermicompost	3.69	126	355	83339
Total/Average	2.53	558	834	289774
F-value	18.17	10.26	24.06	9.77
Sign	.00	.00	.000	.00

enterprise with a benefit-cost ratio of 4.77. Both these enterprises were managed with minimum expenditure (less than Rs. 1.00 lakh/unit) and hence their profitability was very high. Benefit cost ratio for other enterprises differed significantly at 1 per cent level as indicated by F value of 18.17. Piggery units are found to be profitable as feed resource was better-utilized making it more input-use efficient. Efficiency in pig production could be achieved through scientific management practices for optimum utilization of resources (Raja et al., 2022). Piglet marketing adds to the regularity of fund flow, higher turnover and greater returns to per rupee invested. Operational efficiency could be the key factor for successful pig production (Agri. Farming, 2022). Pig rearing households are staying in close proximity (Sahu & Gupta, 2022) and hence are better managed with feed and veterinary care (Raja et al., 2022). Educated youth have started scientific and commercial pig farming business (RF Roys Farm, 2022) and is compatible and viable with small and marginal farming systems as it can be fed with by-products from crops and household (Gupta et al, 2013; Bharati et al., 2022).

The highest income per day in functional units was observed in processing and value addition (Rs. 940/day) enterprises. Food processing sector is known for its high growth potential. Food processing sector in India is one of the largest in the world with an expected output of \$535 billion by 2025-26. India is processing only a fraction of its agricultural output, thus presenting immense opportunities. Annual Survey of Industries 2019-20 estimated that food processing sector contributed 12.22% of total persons engaged in the registered manufacturing sector. Unregistered food processing sector supports employment to 5.1 Mn workers as per the NSSO 73rd Round report. Per day income was also high in nursery, beekeeping and piggery enterprises. Poultry and mushroom enterprises also recorded per day income closer to the overall average income (Rs. 558/day). Per day returns were low in goat farming, fish farming and was least in vermicompost (Rs. 126/day) enterprises and the difference was significant at 1 per cent level (F value 10.26). In some cases, goat, fish and vermicompost enterprises were found to be practiced less intensively, more as subsidiary activities along with regular farming, which was the reason for lower income per day.

Employment generation was the highest for fish and duck farming enterprises followed by goat farming, nursery and piggery enterprises. These enterprises generated greater than the overall average employment generation (834 man-days) among the enterprises promoted under ARYA. Fish farming has the potential to generate employment for self as well as hired manpower in a commercial enterprise unit. The employment generation spreads across its supply chain, value-chain and management activities. Goat farming can generate employment in open grazing as well as semi-intensive and intensive rearing systems. Goat rearing can be practiced in any weather conditions and by all category of landholders including landless farmers. It is particularly profitable in arid/semi-arid and mountainous areas where crop and dairy are not economical (Shivakumara et al., 2017). Goat farming plays an important role in providing self-employment to people (Khillare & Kaushik, 2021; Randhave et al., 2022). Trained unemployed youth could practice scientific farming of sheep and goats for livelihood security (Verma et al., 2021). Crop-based rural enterprises can also support rural livelihoods of tribal women when promoted with adequate planning and participation (Pal et al., 2017; Dagar & Upadhyay, 2022). Below average employment generation was recorded in bee keeping, poultry, processing and value addition, mushroom enterprises and least employment generation in vermicompost (355 man-days) enterprises. Highly significant difference in the employment generation was evident from F value of 24.06.

Nursery and protected cultivation enterprise resulted in creation of more assets (Rs. 541001/unit) per unit. Those enterprises which require proper infrastructure for day to day functioning ought to have higher assets creation. Nurseries can be better managed with quality shade net house, poly house, land to keep the plants at growing stage, for display and selling purpose. The capital investment on nursery was found to be economically viable in terms of net present worth, benefit-cost ratio and Internal Rate of Return (Ashoka et al., 2020). Piggery (Rs. 494189/unit) and goat farming (Rs. 341781/unit) enterprises also accumulated higher assets than the overall average value (Rs. 289774/unit). Livestock enterprises also must have good housing infrastructure to protect animals and birds from environment as well as from

Table 3. Correlation (r) between economic performance and entrepreneurial competencies and personal profile

Economic Performance Indicators	Entrepreneurial competencies			Total Entrepreneurial competencies	Personal profile		
	Operations and marketing competencies	Socio-business and legal organization competencies	Economic financial competencies		Age	Education	Gender
Operational duration	0.055	0.098	-0.023	0.062	0.036	-0.03	-0.078
Gross Turnover	0.155**	0.146**	0.105	0.169**	0.107*	-0.024	-0.087
Gross value of inputs used	0.159**	0.147**	0.151**	0.185**	0.093	0.018	-0.049
Net Income	0.120*	0.116*	0.046	0.122**	0.097	-0.055	-0.101
BC ratio	-0.065	-0.015	-0.183**	-0.091	0.017	-0.314***	0.027
Employment generation	0.096	0.048	-0.099	0.039	0.02	-0.142**	0.014
Per Day Income	0.132**	0.124**	0.052	0.133**	0.037	-0.071	-0.078
Assets Worth	0.138**	0.133**	0.045	0.137**	0.032	-0.037	-0.120**

*significant at 0.05 level, ** significant at 0.01 level, *** significant at 0.001 level

poaching and preying. Lower level of assets created among mushroom, processing and value addition and vermicomposting units indicate that these enterprises are still implemented at a lower scale of operation. Assets worth differed significantly among the enterprises as reflected by F values (9.77).

Entrepreneurial competencies are the key to the economic performance of enterprises promoted under ARYA (Table 3). Five of the eight performance indicators were positively and significantly correlated with overall entrepreneurial competencies of the entrepreneurs. Operational and marketing competencies and competencies in socio-business and legal organization were positively and significantly correlated with gross turnover, value of inputs used, net income, per day income and assets created. Economic-financial competencies were positively related to gross value of inputs used due to higher investment made on technology and automation in day-to-day functioning of the enterprises. This was the underlying reason for its negative correlation with benefit cost ratio. However this may be the case in the short run, but over the years, entrepreneurs with higher financial competencies hope to perform economically better.

Among the personal factors, age of the entrepreneurs was positively correlated with gross turnover. Education level was negatively correlated with benefit cost ratio and employment generation. More educated entrepreneurs were found to have opted for higher investment on technology, automation, and mechanization in the functioning of the enterprises. Education level of entrepreneurs and their entrepreneurial competencies exhibited similar pattern of association with economic performance indicators indicating strong relationship between the two. Women entrepreneurs had lesser assets creation as indicated by the negative and significant correlation.

CONCLUSION

The results are confirmative of the success of ARYA project in attracting rural youth towards agri entrepreneurship. Planned capacity development both on technological aspects as well on entrepreneurial competencies by KVKs were crucial in establishing and sustaining the enterprises. Nursery, poultry, piggery, processing and value addition have better economic performance potential,

and hence could be promoted in a big way. Mushroom, vermicompost and bee-keeping enterprises were established in large numbers, have many advantages, but could not provide substantial economic gains. Future entrepreneurship promotion on these areas has to be planned with lot of care. Individuals with higher entrepreneurial competencies have performed better across the enterprises which are crucial to attract and retain rural youth in agri entrepreneurship. Identifying the potential entrepreneurs on the basis of their entrepreneurial competencies holds the key for greater success of ARYA.

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Effect of COVID-19 Lockdown on the Investment and Profitability in Crop Enterprises: A Cross-sectional Evidences from Uttar Pradesh

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ABSTRACT

Study was conducted among 570 farmers spreading across 57 districts of Uttar Pradesh during the period of 25 March to 10 May 2020 by telephonic contact using the pre-structured interview schedule to assess the effect of COVID-19 lockdown on the investment and profitability of major *rabi* crops of the state namely wheat, mustard, lentil, chickpea, and field pea. The effect was ascertained by comparing the lockdown status with the same period (March-May) of last year (2019). Findings showed that though the price of production inputs increased during the lockdown, albeit the variation in price jump was not very high. On the profitability front, wheat and lentil growers remained the most affected as compared to mustard, field pea, and chickpea growers. The production cost was affected more as compared to the market price of these commodities. The increased production cost was attributed to increased inputs cost due to the limited opening of input outlets despite the state Government's instruction for relaxation in complete lockdown to agricultural inputs shops in the state of Uttar Pradesh. KVK experts also opined that the COVID lockdown restricted the movement of farm labourers and inputs availability which adversely affected the farm sector of the state.

INTRODUCTION

The novel coronavirus has spread widely in India alike other countries, and the number of reported infections remained very low when compared with other countries like USA, Britain, Italy, etc. (Mahendra, 2020). Due to lockdown, the economic shock was much more severe for India mainly because of two reasons. Firstly, pre-COVID-19, the economy was already slowing down, compounding existing problems of unemployment, low incomes, rural distress, malnutrition, and widespread inequality. Secondly, India's large informal sector is particularly vulnerable (Rawal and Kumar, 2020). There are multiple implications of COVID lockdown in the Indian agricultural sector also. Preliminary reports as highlighted by various media sources revealed that the non-availability of migrant labour interrupted the harvesting activities,

particularly in northwest India where wheat and pulses were being harvested. The continued restrictions on movements of people and vehicular traffic, concerns have been raised regarding negative implications of COVID-19 pandemic on the farm economy, too (ICRISAT, 2020). A group of authors from this institute also highlighted that as the end of March was the peak of *rabi* season in India and crops like wheat, gram, lentil, field pea, mustard, etc. were at a harvestable stage or almost reaching maturity (Carberry & Kumar, 2020). Considering the woos of the lockdown during that period, the Government of India and ICAR took various measures to surmount the problems arising out of this situation. Cash and food assistance to persons engaged in the informal sector, mostly migrant labourers, was also announced for which a separate PM-CARES (Prime Minister Citizen Assistance and Relief in Emergency Situations) fund was created (Rawal & Kumar,

2020) besides PM-KISAN scheme and enhanced wages under NREGS. The Indian Council of Agricultural Research (ICAR) has issued state-wise guidelines for farmers to be followed during the lockdown period. The advisory mentions specific practices during harvest and threshing of various *rabi* (winter-sown) crops as well as post-harvest, storage, and marketing of the farm produce.

The possible action points at the ground level for strengthening the farm sector in India during this situation were also suggested by Jhajharia et al., (2020), which include the need to schedule marketing of crops like wheat which come just after harvest. Likewise, labourers' reverse migration (influx) leading to a decline in agricultural wages in some communities and an increase in others, as well as critical losses of produces otherwise affected the rural economy (Kumar et al., 2021). The pandemic caused lowering of income while increasing expenditure for rural households (Roy & Ghosh, 2022). In the given situation, it is, therefore, imminent to get the first hand and empirical evidence on the impact of COVID-19 lockdown on economic yardsticks of the major *rabi* crops like wheat, mustard, lentil, chickpea and field pea as compared to their status in the pre-COVID period of the last year (2019). A systematic study was therefore conducted to quantify the investment and profitability of crop cultivators of the state of Uttar Pradesh during COVID 19 lockdown (2020) as compared to the same period in 2019.

METHODOLOGY

From each of 75 districts, 10 farmers were approached telephonically. However, owing to the limitations of telephonic survey in terms of non-willingness of the subject to join interview, giving inadequate information in the interview and leaving the interview in between, we could get the complete desirable data from 57 districts (76%) out of 75. Thus, the randomly sampled 570 farmers were interviewed telephonically and personally also by engaging the related Krishi Vigyan Kendras (KVKs) of the district during the period of 20 April to 25 June 2020 giving the situation of lockdown and partial unlock period. The post-stratification showed that there were 530 data points each for wheat and mustard farmers, 400 for chickpea farmers, 430 for lentil farmers and 290 for field pea farmers. The major research variables included investment and the profitability parameters affected due to COVID-19 lockdown. In order to derive the effect objectively, the same respondents were asked to furnish the information during the same period of last year (March-May, 2019) as during the lockdown period (March-May, 2020). The before-after research design (Kerlinger & Rint, 1986) was utilized for the present study. However, in this particular case of investigation, as the lockdown was spread across all the district of Uttar Pradesh state, the scope of recording data from without lockdown environment did not exist. Hence, whatever effect of lockdown (2020) could be estimated that was with reference to the same period of the previous year (2019) and hence, it was the net effect of lockdown. Thus, the robustness of the research design of the study was ensured. The indicators taken under-investment variables were the purchase price of inputs like Urea, DAP, MoP (all in Rs/q), Biofertilizer (Rs/kg), fungicide (Rs/kg), insecticide (Rs/kg) and labour charge (Rs/head/day) during lockdown period

(March-May, 2020) and their purchase price during the same period of year 2019. Likewise, for profitability variable, the indicators included were average market price (Rs/q), average gross cost of production (Rs/ha), average gross return (Rs/q) and B:C ratio for all the selected five crops. Besides, the data were also collected from 110 scientists of the selected 57 KVKs on their perception of the effect of lockdown on the different *rabi* crops growers in their district to cross-validate the results. The data collected on the above parameters were subjected for descriptive analysis namely average, percentage, rank, standard deviation (SD) and coefficient of variation (CV) and also the inferential statistics of paired t-test to see the significance of difference, if any.

RESULTS AND DISCUSSION

Effect of lockdown on the investment made in crop enterprises

During the lockdown period in the state of Uttar Pradesh, major *rabi* crops affected were wheat, mustard, lentil, chickpea, and field pea. These crops were either at the maturity stage or harvested and ready for threshing and marketing during that time. Most of these crops had already consumed the production inputs either at the initial stage or at their respective growth stages. Only the farm labour was the most critical input for those crops during the lockdown period. However, the market prices with respect to the inputs taken for analysis was captured pre- and during the lockdown period as these inputs were to be used for the forthcoming *Zaid* crops and summer vegetables. Effect on the input purchase price as shown in Table 1 reflect that except for DAP and Urea, then there was the increase in the price of other inputs like potash (Rs 138/q), bio-fertilizers (Rs 45/kg), fungicide (Rs 32 /kg), insecticide (Rs 50/kg) and also the labour charges (Rs 36/head/day) during lockdown period as compared to the same period of last year (2019). The price of urea and DAP was dropped by Rs 83/ q and Rs 12 /q respectively. For the other inputs like bio-fertilizers, fungicides and insecticides, there was the gain in their price to the extent of Rs 45/kg, Rs 32/kg and Rs 50/kg respectively. Similarly, for agricultural labourers, there was an average wage gain to the extent of Rs 36/labour/day. However, statistically, these price gains were non-significant. Only for the price drop for DAP ($P<0.10$) and Urea ($P<0.05$) and price gain for Potash ($P<0.05$), a significant to highly significant difference was observed because of lockdown as compared to the last year. The results are comprehensible on the ground that during the lockdown period when data were captured (March, April and May, 2020), most of the plant nutrients were utilized and hence, their demand was reduced. Therefore, the reduction in the market price of Urea and DAP is comprehensible. Potassic fertilizers owing to its higher demand and lesser availability may have seen the increasing price trends. Similarly, due to lockdown, the village labourers were probably not coming out of their home as a fear of COVID-19, and thus the limited availability of farm labour might have increased their wages. It was again the interesting output that though the price of many inputs increased during the lockdown, their coefficient of variation in price drop was not very high. For example, in the case of potash price the CV was lowest i.e. 0.09 (2020) as compared to 0.15 in 2019. Likewise, for crop labour charges, the

CV was low 0.18 (in 2020) and 0.19 (2019). For other production inputs like bio-fertilizers, insecticides and pesticides higher CV (0.24 to 0.51) indicated that farmers experienced fluctuating higher market prices in their area but with lesser magnitude. The inputs like DAP and Urea which witnessed the decline in price also showed considerable CV (0.09 to 0.39). Regarding the price rise of agri-inputs during the lockdown, Narain (2020) also reported similar experiences across various states of India. The majority of the non-vegetarians (80.84%) and vegetarians (55.09%) opined that the price of meat and milk products increased during the pandemic. Study by Shanabhoga et al., (2022) also established that the pandemic had an effect on consumption among non-vegetarian and vegetarian consumers but increased accessibility of products through deliveries or pick-up points at various locations might have reduced the price and also induce the consumption of these products.

Effect of lockdown on the economic indicators of various Rabi crops

Five common economic indicators were taken for selected *rabi* crops i.e., wheat, mustard, chickpea, lentil and field pea. The crop-wise estimation of these indicators is explained under the following subheads:

The average increase in the cost of production of wheat during lockdown (2020) was computed to be Rs 1365/ha which was significantly more ($P<0.05$) with considerably higher CV (0.29%) as compared to the previous year (0.27%) of 2019 (Table 2). The increase in the cost of production may be due to enhancing

labour charges which were required in a bigger way during harvesting, threshing, packaging and transportation activities. However, the higher CV also indicates the greater extent of variation in the cost of production from farmer to farmer. Other economic indicators like average market price (Rs/q) and average gross return (Rs/ha) showed increased magnitude during lockdown period, but it was not statistically significant and also their CV was to a lesser extent (0.03 to 0.20). B:C ratio was found to be significantly more ($P<0.05$) during the lockdown period as compared to the last year (2019).

Not only the average cost of production (Rs/ha) of mustard increased significantly ($P<0.05$), the market price earned during lockdown period was also significantly more ($P<0.05$) as compared to the last year (2019). As a result, the profitability indicator (B:C ratio) was significantly enhanced ($P<0.05$ and $P<0.10$) during lockdown period, indicating that magnitude of increase in the cost of production (4.60%) was less than the magnitude in the increase of market price (24.5%). Also, the extent of variation in all the indicators were higher (CV: 0.24-0.36) except market price (CV: 0.03-0.14) which gave the clue that cost parameters showed greater instability and market price of mustard was more constant.

Unlike wheat and mustard, both chickpea and field pea experienced the significant gain in the average cost of production ($P<0.05$), average market price ($P<0.05$) and average gross return ($P<0.10$) during lockdown period as compared to last year, the B:C ratio was significantly reduced ($P<0.05$) indicating that the degree of change in gross return was less as compared to the degree change in the cost of production (Table 2). The variability in all

Table 1. Relative status of investment in crop production affected during the lockdown period

Inputs	Descriptive values		Inferential statistics			
	2018-19	2019-20	Mean difference	t value	P (T<=t) one-tail	P (T<=t) two-tail
DAP (Rs/q)	2512.34 (249.54) {0.09}	2429.24 (241.54) {0.09}	-83.10	1.78	0.04	0.08**
Urea (Rs/q)	643.21 (246.14) {0.38}	631.67 (247.09) {0.39}	-11.54	2.32	0.01	0.02*
Potash (Rs/q)	1637.24 (251.64) {0.15}	1775.23 (172.84) {0.09}	+138.00	-4.20	0.00	0.00*
Biofertilizers (Rs/kg)	368.58 (173.41) {0.47}	413.49 (209.28) {0.51}	+44.91	-5.18	1.87	3.74
Fungicide (Rs/kg)	566.87 (177.48) {0.31}	599.26 (196.53) {0.32}	+32.39	-5.18	1.87	-3.74
Insecticide (Rs/kg)	661.73 (160.35) {0.24}	712.02 (174.06) {0.24}	+50.29	-8.74	5.09	1.02
Crop labor charge (Rs/head/day)	235.02 (45.09) {0.19}	270.96 (50.64) {0.18}	+35.94	-9.84	1.09	2.18

Figures in () indicate standard deviation, figures in {} indicate Coefficient of variation

2019-20: Lockdown period (March-May, 2020); 2018-19: No Lockdown period (March-May, 2019)

* $P<0.05$; ** $P<0.10$

Table 2. Comparative status of economic indicators of various *Rabi* crops affected due to lockdown

Crop	Ave. Market price (Rs/q)		t value	Ave. Gross cost of Production (Rs/ha)		t value	Ave. Gross return (Rs/ha)		t Value	B:C ratio		H.M.
	2018-19			2019-20			2018-19			2019-20		
	2018-19	2019-20		2018-19	2019-20		2018-19	2019-20		2018-19	2019-20	
Wheat (530 data points)	1775.92 (97.44)	1881.69 (73.83)	-13.91 ^a	37199.68 (10170.99)	38564.68 (11236.97)	-2.43 ^a	79668.91 (14885.06)	79689.65 (16225.58)	-0.09 ^a	2.23 (0.49)	2.16 (0.49)	2.63 ^a
	{0.05}	{0.03}	2.72 ^b	{0.27}	{0.29}	0.01 ^{b*}	{0.19}	{0.20}	0.46 ^b	{0.21}	{0.22}	0.005 ^{b*}
			5.45 ^c			0.02 ^{c*}			0.92 ^c			0.011 ^{c*}
Mustard (530 data points)	3840.19 (529.26)	4779.06 (4947.42)	1.38 ^a	22545.83 (6871.28)	23584.49 (7198.49)	-3.34 ^a	61426.47 (14927.00)	69101.91 (16610.25)	1.16 ^a	2.72 (0.99)	2.93 (1.05)	2.50 ^a
	{0.14}	{0.03}	0.08 ^{b**}	{0.30}	{0.30}	0.001 ^{b*}	{0.24}	{0.28}	0.12 ^b	{0.36}	{0.36}	0.01 ^{b*}
			0.17 ^c			0.001 ^{c*}			0.25 ^c			0.01 ^{c*}
Chickpea (400 data points)	4764.62 (897.51)	5005.37 (910.36)	-3.92 ^a	25663.55 (5918.02)	26654.63 (6544.91)	-3.45 ^a	75181.89 (19425.38)	68873.56 (24353.34)	1.61 ^a	3.01 (0.77)	2.69 (1.02)	2.30 ^a
	{0.18}	{0.18}	0.0002 ^{b*}	{0.23}	{0.24}	0.001 ^{b*}	{0.26}	{0.35}	0.06 ^{b**}	{0.25}	{0.37}	0.01 ^{b*}
			0.0003 ^{c*}			0.001 ^{c*}			0.11 ^c			0.03 ^{c*}
Lentil (430 data points)	4768.14 (892.97)	5177.907 (979.01)	-6.99 ^a	23967.07 (7168.34)	24769.84 (7528.59)	-2.42 ^a	59319.29 (16415.58)	59397.58 (18892.97)	-0.04 ^a	2.66 (0.98)	2.57 (1.04)	1.18 ^a
	{0.18}	{0.18}	8.3 ^b	{0.30}	{0.30}	0.01 ^{b*}	{0.27}	{0.32}	0.48 ^b	{0.37}	{0.40}	0.12 ^b
			1.66 ^c			0.02 ^{c*}			0.97 ^c			0.24 ^c
Field pea (290 data points)	3516.21 (995.64)	3719.83 (1081.52)	-3.48 ^a	22657.62 (5798.84)	23767.07 (6408.61)	-3.83 ^a	58503.76 (24857.25)	56998.38 (24440.04)	0.54 ^a	2.65 (1.09)	2.46 (0.99)	1.46 ^a
	{0.28}	{0.29}	0.001 ^{b*}	{0.25}	{0.27}	0.000 ^{b*}	{0.42}	{0.43}	0.29 _b	{0.41}	{0.40}	0.07 ^{b*}
			0.001 ^{c*}			0.001 ^{c*}			0.59 ^c			0.15 ^c

Figures in () indicate standard deviation, figures in {} indicate Coefficient of variation; ^aindicates t value, ^bindicates t value (one-tail) and ^cindicates t value (two-tail) 2019-20: Lockdown period (March-May, 2020); 2018-19: No Lockdown period (March-May, 2019); * P<0.05; ** P<0.10

the four indicators was also considerably high (CV: 0.18 – 0.43%). Contrary to these, lentil did not show any encouraging trends during the lockdown and therefore, not only the cost of production increased, the gross return and B:C ratio was comparable or even less even though the market price were more as compared to last year (Table 2).

The wheat and lentil growers remained the most affected group as compared to mustard, field pea and chickpea growers. The increased production cost was the bigger determinant as compared to the market price of these commodities during the lockdown as compared to the same period of last year. Greater increase in production cost may be further attributed to increased inputs cost due to limited opening of such outlet despite the state Government clear-cut instruction for relaxation of the complete lockdown of agricultural inputs shops in the state of Uttar Pradesh. Another positive impact of Government's decision to ensure the procurements of harvested produce enabled the mustard, chickpea and field pea farmers to fetch higher profitability during the lockdown period. Findings in other words also give the clue of the success of the State Government's decision to support agricultural farmers of the state by appropriate policy interventions during the lockdown period.

Perception of KVKs on the effect of lockdown

KVK experts agreed (92%) that there was fear prevailing among the farm labour to move out during lockdown (Table 3) and as a result, the farm works were getting affected with severity index of 0.24. In general, the lockdown created closure of all agri-outlets despite the notification by the state government for opening the agriculturally important input stores. This fact was also confirmed by the KVK specialists (83%) that there was limited to nil availability of agri-inputs due to shutdown of such outlets and those few who use to open created hike in the price of inputs especially the insecticides, fungicides, biofertilizers, etc as indicated in Table 1. The situation of lockdown further showed that he farms machinery especially harvesters, threshers and combine harvester and thresher were not available in adequate numbers which causes a delay in doing post-harvest operations. The severity of this issue was third-ranked with an index value of (0.21). The vegetable growers were another worst hit category of farmers who were not able to sell their vegetables and other perishable farm produce during lockdown (60%) mainly because of the disruption in supply logistics like transportation, storage and disposal (59%). In general, all the problems as highlighted by the KVK experts seem to be inter-related and holistic. The lockdown announcement by the Government stopped the movement of any kind and that worst affected the transport and finally the movement of agri-harvest from one place to another especially the vegetables and other perishable produces (Table 3) unlike wheat, mustard, chickpea, lentil and field pea which were less affected. The fear perception among the farm labour about further wooed the situations. Even the advisories issued by the Government of Uttar Pradesh and ICAR about precautions to be taken while doing the farm operations during did not seem to work initially for the vegetable growers.

Table 3. Perception of the effect of lockdown among crop and vegetable growing farmers

S.No.	Lockdown effects	Percent	Severity index
1	Fear among agricultural labourers about -19 and hence there was difficulty in getting farm work done	91.80	0.24 (I)
2	Non/limited availability of Agri-inputs due to shutdown of Agri- input shops.	82.72	0.22 (II)
3	Harvesting of mature <i>Rabi</i> crops was affected due to non-availability of the Agriculture equipment like harvester, thresher and even the combined harvester on time.	80.90	0.21 (III)
4	Sowing of <i>Zaid</i> crops was affected owing to challenges in inputs availability and labours availability	67.27	0.18 (IV)
5	Most of the farmers were not able to send their vegetables and other perishable produces to the market	60.00	0.16 (V)
6	Adverse effect on the supply chain of vegetables and fruits	58.18	0.15 (VI)

Interventions of frontline extension systems

A three-pronged strategy was executed in the state by ICAR and KVK partnership. Firstly, to make the rural farming community aware of nature and disease spread behaviour of COVID-19, two apps namely AROGYASETU and KISAN RATH were disseminated for downloading and use; secondly, these farmers were also disseminated the state-approved and ICAR approved farm advisories which may guide them to successfully perform their farm operations under this lockdown condition; and thirdly, under such stressed situation, farmers were also arranged to supply through the KVKs the quality seeds and planting materials. Further, to reinforce the decisions, three video-conferencing meetings were held with the participation of KVK Heads and Directors of Extension of various SAUS, ICAR institutes, NGOs and Educational societies. As a result of these efforts, a total of 93 thousand farmers (about 48%) of the state downloaded both the apps, out of 2.46 lakh farmers who were given this information to download them. It was also reported that in the formal education system also, it was not possible to afford lock down and therefore, online classes can effectively meet the need of the students and they are interested in having online classes (Bhati et al., 2020). The downloading is still regularly being done by the farmers. Similarly, using various channels like WhatsApp, mKISAN, print and electronic media, radio talk, KCC and other ICT platforms, as many as 18.70 lakh farmers were disseminated the various advisories related to field and horticultural crops, livestock and poultry, low-cost sanitization, etc which have immensely benefitted the rural farming community. To further consolidate the efforts, the KVKs of the state supplied 350 q of quality seeds of forthcoming summer crops and 1.23 lakh seedlings and saplings to the farmers. A study by Singh et al., (2021) reported that majority of rural girls were found to have moderate level of knowledge and were reported to have a neutral attitude towards health seeking and preventive behaviour. Nearly half of the respondents were reported to be following inappropriate practices and had few personal/familial/school related issues which needed immediate attention and help. According to Roy & Ghosh (2022), personal cosmopolite sources use, social recognition, annual family income before and during pandemic and expenditure before and during pandemic explained 63.7 per cent variation in of adaptation level. This reiterates the importance of extension advisory services to secure sustainable rural livelihoods.

CONCLUSION

As the wheat harvesting was completed with bumper production, State Govt. should develop the modality to ensure its effective procurement by opening purchase centres at the village level and it was done by the related officials. Likewise, production inputs like seeds, fertilizers, chemicals for the standing vegetable crops as well as for the forthcoming *zaid* (mungbean, groundnut, summer maize, pearl millets, etc.) and *khariif* (paddy, pigeon pea, etc) crops are to be ensured adequately and at the reasonable price during such vagaries. Vegetable growers who are the smallholders and capital-starved need special attention by ensuring their access to city *mandis* and local market so that may sell out the semi-perishable produce like a vegetable. In such time of challenge, the village, as well as city-based organizations, groups and Govt. agents, very proactively as well as voluntarily ought to come forward to help farmers so that agriculture may continue to ensure the income flow to them.

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Do Socio-economic Conditions and Personal Behaviour Influence the Adoption of Climate Change Mitigating Measures

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ABSTRACT

This study aimed to identify the factors affecting farmers' perception of climate change and the adoption of Soil and Water Conservation (SWC) measures as a mitigation strategy for climate change. From the existing literature review, the study has identified the factors that potentially influence the adoption of climate mitigation and adaptation technologies. The binary logit model was employed using survey data collected from the Agra district of Uttar Pradesh during the year 2018-19. Results show that about 60 per cent of households had a clear perception of climate change, and age, education, membership of groups, mass media exposure, and extension agency contacts were key influencing factors in farmers' perception of climate change. Similarly, education, occupation, mass media exposure, awareness of climate change consequences, climate change perception, and attitude of farmers increase the probability of adopting soil and water conservation measures by the farmers in their fields. Therefore, the study results have significant implications for policies and campaigns promoting adopting climate-smart technologies to make the agricultural system more resilient to climate change.

INTRODUCTION

As global warming and climate change predictions become increasingly certain, there is mounting pressure to understand disaster risk better. Climate change is a significant contributing factor to the recent losses and damages to the agricultural sector (Greene et al., 2011; Meena et al., 2022). In Asia, crop yield is projected to be declined by 5-30 per cent by 2050 due to rising temperatures, and in India, it has been expected that a 2.7°C to 4.3°C rise in temperature by 2050 will lead to a reduction in yield of rice and wheat by 32-40 per cent and 41-52 per cent, respectively (Gupta & Pathak, 2016). In recent years, the projected adverse impact of climate change has attracted significant attention to adopting climate-smart agricultural (CSA) technologies to cope with the risk associated with climate change (Birtal et al., 2019; Mairura et al., 2021; Naik et al., 2023). An appropriate

understanding of the determinants of farmers' perception of climate change is vital for making pro-farmer policies and adopting effective mitigation and adaptation strategies (Meena et al., 2022a). Most of the existing literature has reported the farmer's perception of climate change in terms of changes in temperatures, total rainfall, monsoon onsets and offsets, change in droughts frequency, lengths of summer and winter seasons, etc. (Banerjee, 2015; Ravikumar et al., 2015; Ghanghas et al., 2015; Guhathakurta et al., 2020; Meena et al., 2022b). The studies analysed the determinants of farmers' perception of climate change, assuming a farmer has the perception of climate change by considering any of the above-listed variables. However, this study used "clear perception" to integrate four variables, namely the perceived existence of climate change, change in temperature, rainfall, and drought, to identify the determinants of farmers' perception of climate change.

In India, climate change threatens the sustainability of the agriculture sector by altering soil quality and the availability of irrigation water (Meena, 2022b). Policymakers and development practitioners are approaching farmers to adopt CSA technologies at the grass root level that help the sustainability of agricultural productivity, and adapt and make resilient agricultural systems. Farmers' perception of climate change and decision by farmers whether to adopt mitigation measures depends on various factors such as the magnitude of financial incentives likely to receive, socio-economic conditions of farmers, institutional variables, and personal behaviour. Several studies have identified different socio-economic factors such as age, education level, total income, primary occupation pattern, and family size; institutional information such as access to information, groups membership, and extension visits; personal attributes such as attitude, awareness, fatalism, perception, etc., that are important variables to influence adoption of mitigating measures either negatively or positively (Barman & Das, 2010; Pande et al., 2011; Mondal et al., 2013). Therefore, information on determinants of the adoption of CSA technologies enables policymakers to enact practicable strategies to encourage farmers to adopt. Soil and water conservation (SWC) has been considered one of the critical components of mitigation and adaptation strategies. Therefore, the objective of the study was to identify the determinants of a clear perception of climate change and the adoption of SWC measures.

METHODOLOGY

The study was conducted at ICAR-Indian Institute of Soil and Water Conservation, Research Centre, Agra, during 2018-19. Primary data were collected from households using a semi-structured questionnaire using multiple-stage sampling. Agra district in the Semi-arid region of Uttar Pradesh state was selected purposively due to its high vulnerability to climate change. Within a district, three blocks were selected randomly, and one village from each block was randomly selected. A total of 120 households were selected randomly from the villages. Descriptive analysis was used to describe the independent variables, farmers' perceptions, and distribution of SWC adopted by farmers.

The study used the 'clear perception' and 'adoption of SWC measures' as dependent variables to identify the determinants of farmers' perception and adoption of SWC measures, respectively. A farmer is considered to have a "clear perception" if all four conditions are satisfied below: 1. The farmer believes that climate change exists; 2. The farmer perceives an increase in the average temperature over the last 20 years; 3. The farmer perceives a change in total rainfall and rainfall pattern over the last 20 years; and 4. The farmer perceived an increase in the droughts frequency over the last 20 years. Thus, it allows the separation of farmers who clearly perceive climate change from those who do not (Roco et al., 2015). The rationale for the integration of three variables (temperature, rainfall, and drought) stems from the historical evidence that average temperatures have risen, average rainfall has declined, and droughts have become more prevalent in a consistent pattern (Sharma et al., 2018; Guhathakurta et al., 2020).

A farmer was considered an adopter of SWC measures if he implemented the measure at least in one of his farm plots. SWC

measures include levelling, bunding, vegetative bund, broad bed furrow, summer ploughing, green manuring, farm pond, and recharge filters on farmers' plots. The study employed a binary logistic regression model to evaluate the determinants of farmers' perception of climate change and the adoption of SWC measures. The mathematical expression of the equation is given below:

$$\ln \left[\frac{p}{1-p} \right] = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_j x_j$$

Where p is the probability of perceiving climatic change or adopting SWC measures, and $1-p$ is the probability of not perceiving climate change or adopting an SWC measure. β_0 was the intercept, $\beta_1, \beta_2 \dots \beta_j$ were the regression coefficients of determinants, and $X_1, X_2 \dots X_j$ represented the socio-economic, institutional, and personal psychological explanatory variables.

RESULTS AND DISCUSSION

Determinants of farmers' clear perception of climate change

The response of households to questions related to the clear perception of climate change variables is presented in Table 1. According to our definition of clear perception in this study, about 60 per cent of households had a clear perception of climate change. Results showed that a third-fourth of households reported increases in drought frequency and more than a third-fourth of households reported an increase in average temperature, and more than 80% of farmers reported a reduction in rainfall and existing of climate change in the last 20 years.

Table 1. Farmers' perceptions of climatic variability

Statement	Percentage of Farmers
Existence of climate change	85
Increase in the average temperature over the last 20 years	79
Reduction in the rainfall over the last 20 years	84
Increase in the occurrence of droughts over the last 20 years	75
A clear perception of climate change	60

The econometric estimates of the logit model indicate that age negatively affects perception (Table 2), indicating that younger farmers are more likely to perceive climate change than older ones. As expected, education positively impacts the perception that the likelihood of a farmer perceiving climate change increases by 3.1 per cent for each year of schooling completed. The model's parameters related to social participation were highly significant and positive. Access to information through mass media (press, television, agriculture exhibitions/fairs, and the internet) had a marginal effect of 24.1 per cent. At the same time, contact with extension agencies (Agriculture officer, Scientists, Gram Sevak/VDO, NGOs) increased the likelihood of perceiving climate change by 35.5 per cent. The findings are similar to the results reported by Mandal et al., (2022).

Table 2. Determinants of farmers' clear perception of climate change

Variable	Coefficient	Robust standard error	Marginal effects
Age	-0.0189*	0.0201	-0.0035
Land Size	-0.0041	0.0171	-0.0007
Education	0.166*	0.085	0.0314
Income	0.0001	0.0001	0.0001
Social Participation	1.557**	0.744	0.2735
Mass Media Exposure	1.282**	0.618	0.2413
Extension contact	2.424***	0.730	0.3556
Constant	-1.251	1.157	
Log pseudo-likelihood	-48.011		
Pseudo R ²	0.457		
N	120		

Note: *, **, and *** indicate levels of significance at 10, 5, and 1 percent of probabilities, respectively

Determinants of SWC measures adoption

The details of SWC measures adopted by the farmers at their fields are presented in Table 3, and results showed that bunding, leveling, summer ploughing, and vegetative bund were the predominant SWC measures adopted by the farmers. The predominance of bunding and leveling in the study areas could be attributed to compatibility with local farming practices, availability of technical and financial support, improving yield by preventing soil runoff during heavy rainfall, reducing the loss of fertile topsoil, and capturing and retaining rainwater. Many previous studies have also reported that SWC fosters agriculture production and helps mitigate the adverse effect of climate change (Mondal et al., 2013; Meena et al., 2020 & 2021). Moreover, Meena et al., (2022a) conducted another study in the same area and reported that most farmers perceived SWC measures as the most effective strategies for mitigating the effects of climate change. Therefore, this study attempted to identify the determinants of adopting SWC measures as a mitigating strategy for climate change.

The estimate of determinants of SWC measures showed that awareness and perception are critical factors that affect the adoption of SWC measures. Farmers who are aware of the adverse impact of climate change on agriculture and perceive that SWC measures can reduce costs, increase yields, or mitigate the impacts of climate change are more likely to adopt SWC measures. Education positively influences farmers' adoption of SWC measures, i.e., the probability of adopting SWC measures increased by 1.5 per cent for each year

Table 3. Adoption of SWC measures by the farmers at their farms

SWC Conservation measures	SWC adopted by farmers on farms (%)
Bunding	54.50
Levelling	35.09
Vegetative bund	22.73
Broad bed furrow	14.29
Summer Ploughing	25.76
Green manuring	19.05
Others	4.17
Overall adoption of SWC	66.67

completed schooling (Table 4). Similarly, as expected, occupation as agriculture, social participation, extension visits, and positive attitudes towards environments and climate change mitigating and adaption technologies increase the probability of adopting SWC measures significantly. At the same time, farmers' total income and fatalism behaviour negatively influenced their adoption of SWC measures at their farms. However, marginal effect coefficients showed that occupation, attitude, awareness and perception, and extension contacts are major key determinants of SWC measures adoption. Farmers who participate in the social network have likely more access to information related to various aspects of climate change and its mitigation measures by sharing knowledge and experience. Contact with extension agents facilitates access to technical information, resources, and inputs necessary for implementing SWC practices. Attitude plays a crucial role in the adoption of SWC measures. If farmers have a positive attitude toward the benefits of sustainable practices, they are more likely to adopt these measures. Attitude can be influenced by factors such as social norms, values, and beliefs, as well as previous experiences with these practices. Farmers who have a negative attitude or fatalistic behaviour are not ready to adopt SWC measures. Thus, it is essential to promote positive attitudes toward SWC measures among farmers to encourage adoption (Meena et al., 2022b). These findings have important implications for policymakers, extension workers, and other stakeholders seeking to promote sustainable agricultural practices. The awareness programs for adopting SWC measures must demonstrate the indirect benefits of SWC measures in monetary terms (Meena et al., 2022c). Policymakers should target enhancing farmers' awareness and positive attitudes toward adopting sustainable agricultural practices through increasing extension contacts, targeted education campaigns, and mass-level awareness programs.

Table 4. Determinants of SWC adoption under climate changing scenario

Variable	Coefficient	Robust standard error	Marginal effects
Age	0.0311	0.044	0.0018
Land Size	0.0424	0.049	0.0025
Education	0.2593**	0.130	0.0153
Occupation	2.692**	1.127	0.3492
Livestock	-0.330	0.206	-0.0195
Total income	-0.00001*	0.0006	-0.00007
Social Participation	2.080*	1.165	0.0980
Mass Media Exposure	1.623	1.147	0.0962
Extension contact	2.634**	1.148	0.1399
Awareness	2.036**	0.978	0.1440
Perception	1.567*	0.932	0.1036
Fatalism	-2.780*	2.181	-0.1647
Knowledge	1.321	2.506	0.0782
Attitude	10.934**	4.320	0.6476
Constant	-9.7570***	3.298	
Log pseudo-likelihood	-23.69		
Pseudo R ²	0.659		
N	120		

Note: *, **, and *** indicate levels of significance at 10, 5, and 1 percent of probabilities, respectively

CONCLUSION

Results indicated that 60 per cent of farmers have a clear perception of climate change, and education, social participation as members of the organization, mass media exposure, and extension agency visit positively influenced the farmers' perception of climate change. SWC measures have been well acknowledged as a potent component of mitigation and adaptation strategies for climate change. The estimate of determinants of adopting SWC measures showed that education, attitude, awareness and perception of climate change, and extension visits are key factors for enhancing the adoption of SWC measures among the farmers. Based on the results, the study suggests that policymakers should focus on increasing awareness programs to change farmers' perceptions of climate change and attitudes towards climate-smart technologies through more extension visits and educational campaigns to make sustainable agricultural production and improve the agricultural system resilient to climate change.

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Impact of Climate Resilient Technological Interventions in Jodhpur District of Rajasthan

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ABSTRACT

The agriculture practices in Rajasthan are difficult due to high temperature and low rainfall. The Technology Demonstration Component of National Innovation on Climate resilient Agriculture Project was implemented through KVK, CAZRI, Jodhpur to address climate change issues and improving livelihood of farmers of the region. The study was conducted during 2021-22 and 120 respondents were selected randomly from two villages of Jodhpur district of Rajasthan, to access utility of the services, adoption status and outcome of technological interventions of NICRA. The utility of supply of seeds and critical inputs was perceived as most useful followed by animal health care, availability of farm machinery respectively. The adoption of short duration and drought tolerant varieties of *kharif* crops lead to 34.20 per cent average yield increase. The adoption of improved breeds and mmineral mixture supplements & multi-nutrient feed block accorded second and third respectively on the basis of extent of adoption. The cropping intensity was increased by 18.52 per cent and employment (man days) increased by 16.80 per cent after NICRA interventions. Per family annual income increased by 65.17 per cent and average savings increased by 80 per cent after the NICRA project.

INTRODUCTION

Climate change has become a global concern demanding attention and action due to the rising global temperatures, widespread melting of ice, changes in the intensity and frequency of occurrence of extreme events. In a densely populated country like India, particularly the effects of climate change are more detrimental in view of its highly vulnerable nature (Bal et al., 2016). Agriculture production is mainly dependent on climatic conditions. All the sectors and societies of world are vulnerable to climate change, but agriculture being primarily dependent on climate, is among the most vulnerable group. Building the capacity of extension scientists on impact of climate change especially in harnessing the increased CO level and Carbon sequestration processes and climate resilient species of plants and animal for

promotion of remunerative agriculture is always stressed upon (Ghanghas et al., 2015) and to support farm level decisions and minimize the loses in adverse climatic and weather conditions farmers' understanding about interaction of climate and agro-ecosystem need to be bridged through inclusion of farmers' communication network (Ravikumar et al., 2015). Applying right resources at the right place and, at the right time, using the right method with combination of technologies and practices can help in achieving optimum resource stewardship and resource conservation in the farmers' field (Shitu et al., 2018). Rainfall is the key variable influencing crop productivity in rainfed agriculture. Intermittent and prolonged droughts are major cause of yield reduction in most crops. The rainfall drives water availability and determines sowing time (rainfed crops), temperature drives crop

growth, duration, dry spells cause significant impact on standing crops, physiology, loss of economic products (fruit drop) and extreme events (high rainfall/floods/heat wave/cold wave/cyclone / hail/frost) cause enormous losses of standing crops. Rainfed crops are likely to be worst hit by climate change because of the limited options for coping with variability of rainfall and temperature (Anonymous, 2015). Rajasthan, largest state of India is among the leading producers of mustard, pearl millet, cumin, coriander and fenugreek, which shows the importance of the state in Indian agriculture. The agriculture practices in Rajasthan are more tough due to harsh dry climate in major area of the state. To address these issues, ICAR has launched a major network project, National imitative on Climate Resilient Agriculture (NICRA) and Technology Demonstration Component of project was implemented through Krishi Vigyan Kendra, Central Arid Zone Research Institute, Jodhpur since 2011. The important climatic vulnerabilities of the Jodhpur district were high drought proneness, heat stress, low rainfall, mid and terminal dry spells. The present study was conducted with an objective to access utility of the services provided by the KVK under NICRA project and to access the agro-economic impact of technological interventions on beneficiaries.

METHODOLOGY

The study was conducted at purposively selected two villages (Purkhawas and Lunawas Khara) of Jodhpur district of Rajasthan during 2021-22 where NICRA-TDC project is functional since 2011 through KVK, CAZRI, Jodhpur. A list of beneficiaries of project was prepared and from this list 120 respondents were randomly selected. The usefulness of the services provided by the KVK was measured by recording choice of the beneficiaries against each service provided by KVK on five-point continuum scale (Highly Useful, Useful, Undecided, Not Useful and Not Useful). The sum of scores of each service was calculated by multiplying the frequency under each category i.e. Highly Useful, Useful, Undecided, Not Useful and Not Useful at All with scores 4, 3, 2, 1 and 0, respectively.

The extent of adoption of Climate Resilient Technological Interventions (CRTI) was obtained from the responses of an individual on a three-point continuum (fully adopted, partially adopted, not adopted) scale, with scores 2, 1 and 0, respectively. The total score of each CRTI was obtained by multiplying the frequency under each category (Fully Adopted, Partially Adopted, Not Adopted) with their respective scores (i.e., $f_i \times 0 + f_j \times 1 + f_k \times 2$). The possible maximum and minimum scores were 240 and 0, respectively. The mean score for each technology was obtained by dividing the total score with total sample size (120) and the ranks were given accordingly.

The outcome of most significant interventions which have increased yield and improved livelihood of respondents were observed and data were presented. To assess the change, the beneficiaries of NICRA were compared with their pre- NICRA position. Before-after comparison was made possible with the help of baseline data and recall memory of respondents. The average score of beneficiaries before and after NICRA was worked out and percentage increase or decrease was calculated mentioned below:

$$\text{Percent increase/decrease} = \frac{\text{Average Score after} - \text{Average Score before}}{\text{Average Score after}} \times 100$$

The difference between the two scores (before and after) was statistically tested using paired t-test and comparison at particular level of significance.

RESULTS AND DISCUSSION

Utility of services perceived by Beneficiaries

The results regarding the utility of services provided by NICRA as perceived by beneficiaries are presented in Table 1. The supply of seed and critical Inputs service was perceived as most useful by awarding first rank with sum of scores equal to 387. The majority of the farmers (45.83%) has perceived as useful, whereas, 25 percent farmers perceived as highly useful and similar farmers (25%) undecided. The reason behind most importance of this service may be that farmers are using their own traditional seed and non-awareness as well as non-availability of climate resilient improved seed and other inputs.

Table 1. Utility of the services provided by KVK under NICRA-TDC

Service	Sum of Scores	Rank
Supply of Seed and Critical Inputs	387	I
Animal Health Care	346	II
Availability of Farm Machinery	344	III
Trainings	306	IV
Weather based Agro. Advisories	248	V

The animal health care services was perceived second most important service and 51.67 per cent respondents perceived as useful, 23.33 per cent respondents as highly useful, undecided (15.00%), and not useful (10.00%). The findings are supported with Yankam et al., (2019). The second most preference to this service might be due to importance of livestock in economy of arid region. The Availability of Farm Machinery got rank third on its utility. The 26.67 per cent beneficiaries perceived it to be highly useful, while as 43.33 per cent perceived it as useful followed by undecided (21.67%), not useful (6.67%) and not useful at all (01.67%). The findings are in line with Kisku et al., (2022) who reported majority (75%) of the farmers had moderate perception towards custom hiring services. Utility of trainings got fourth rank with sum of scores equal to 306. It was perceived as highly useful by 26.67 per cent respondents, useful (21.67%), undecided (35.00%), not useful (13.33%) and not useful at all (3.33%).

The Meena et al., (2022) also observed need to undertake awareness-increasing programs to change people's attitudes and improve the adaptive capacity of farmers in dealing with current and future climate change. Weather based agro advisory services usefulness got fifth rank with sum of scores equal to 248. The 11.67 per cent of the beneficiaries perceived WBAAS as highly useful, 20 per cent as useful, 35 per cent were undecided, 30 per cent perceived as not useful and 3.33 per cent perceived as not useful at all. The findings are in partial confirmation with Kumar et al., (2022) who reported that almost, 70 per cent of registered

Table 2. Adoption and Outcome of Most Significant Interventions in NICRA village

Intervention	Adoption		Outcome (% increase in yield)
	Mean Score	Rank	
Short duration and drought tolerant varieties of Kharif crops	1.80	I	34.20
Improved Breed of Cow, Buffalo and Goat	1.75	II	29.80
Mineral mixture supplements & Multi-nutrient feed block	1.72	III	22.70
Custom Hiring Centre	1.67	IV	20.00
Rain water harvest based Nutritional Garden	1.53	V	15.20
Women Friendly Drudgery Reducing Implements	1.42	VI	12.00
Compost and Vermi Composting	1.27	VII	9.80
Arid Fruit Cultivation	0.86	VIII	8.50

farmers have followed information for agriculture practices through Meghdoot application of agro-meteorology advisory services .

Adoption and outcome of most significant climate resilient technological interventions

The ranking of CRTI based on the mean scores of extent of adoption along with outcome in the form of increase in yield have been presented in Table 2. The adoption of short duration and drought tolerant varieties of Kharif crops was accorded first rank with mean score 1.80. The average yield increase of 34.20 per cent over traditional practices was recorded by adoption HHB-67 and MPMH-17 varieties of Bajra, CZM-2 of moth bean, GM-4 and IPM-02-3 varieties of mungbean. The similar results were found by with Sultana et al., (2020). The higher adoption of short duration and drought tolerant varieties was found due to low and erratic rainfall in the region.

The adoption of improved breed of cow, buffalo and goat got second rank with mean score 1.75. The 29.80 per cent (average) increased yield in comparison to previous non descriptive breed was observed by adoption of Murrah (buffalo), Tharparkar (cattle) and Sirohi (goat) breeds for breeding purpose. The Rao et al., (2017) observed doubled income (Rs. 18,000 from Rs. 9000) by adoption of innovative rearing of Konkan Kanyal goat with locally available resources. The adoption of mineral mixture supplements & multi-nutrient feed block accorded third rank with mean score 1.72. The 22.70 per cent increase of milk yield was observed in milch animals. Besides increased milk yield, the digestibility as well as picca habit of animals were improved and animals also came in heat regularly. The Harikrishna & Seema (2021) also reported that the 75 per cent of farmers adopted the usage of molasses-urea blocks and 68.33 per cent beneficiaries adopted the area specific mineral mixture.

The utilization of custom hiring centre based equipments for increasing production of crops and livestock was observed fourth

most adopted intervention with mean score 1.67. The 20 per cent increase in yield was observed by adoption of this intervention. The Seed cum fertilizer drill for timely sowing of crop and drilling fertilizers during sowing window, Water tanker for drinking of human beings as well as livestock and critical irrigation of plants, Sprayer and duster for controlling insect-pests and diseases and Weighing machine for farm and livestock products have good impact in study area as well as adjoining villages. The Rain water harvest based Nutritional Garden (Mean Score-1.53), Women Friendly Drudgery Reducing Implements (Mean Score- 1.42) Compost and Vermi Composting (Mean Score-1.27), and Arid Fruit Cultivation (Mean Score-0.86) were ranked fifth, sixth, seventh and eighth respectively by the farmers on the basis of extent of adoption. The 15.20, 12.00, 9.80 and 8.50 per cent increased yield was recorded by adoption of Rain water harvest based Nutritional Garden, Women Friendly Drudgery Reducing Implements (Improved kassi, Improved Weeder, Garbage carrier, double screening grain cleaner, Improved Badi maker etc.), Compost and Vermi Composting and Arid Fruit Cultivation respectively. The findings are similar to Kumari et al., (2022) who reported that 150 m² area of kitchen garden fulfilled more than requirement of vegetable in daily routine diet for Family (Up to 6 Members) in Rabi season (82.71%) followed by 82.71 per cent in Kharif season and 66.08 per cent in Zaid season and average net saving was Rs. 6037.98 in a year through the kitchen garden. The Jasna et. al. (2017) also reported that timely availability of inputs and right technologies and Machineries for agricultural operations through CHC and seed bank contributed positively and higher employment.

Change in Selected variables after NICRA interventions

The data presented in Table 3 reveals that the mean cropping intensity of beneficiaries before NICRA was 105.28 and after NICRA project it increased to 123.80, this clearly shows that the interventions under NICRA has successfully raised the cropping

Table 3. Change in Selected Variables after NICRA Intervention

Variable	Before NICRA intervention (average)	After NICRA intervention (average)	Percentage increase/decrease	t- value
Cropping intensity (%)	105.28	123.80	18.52	21.02**
Employment (Man Days)	204.93	239.35	16.80	10.57**
Annual Income (Per Family)	1,12,000	185000	65.17	15.60**
Savings (Rs)	6820	12280	80.00	7.45**
Expenditure on Luxurious items (Rs)	8250	15300	85.45	10.20**

** Significant at 1 per cent level of significance

intensity. The 18.52 per cent increase of cropping intensity through NICRA interventions was found statistically significant when tested with paired t-test with $t=21.02$ at one per cent level of significance. The similar results were found by Lone, T A (2021). The employment (man days) has also increased by 16.80 per cent from 204.93 man days before NICRA to 239.35 man days after NICRA and data were found to be statistically significant. The per family annual income has increased by 65.17 per cent from Rs. 1,12,000 before NICRA to Rs. 1,85,000 after NICRA and average savings of the beneficiaries was increased by 80.00 per cent after the NICRA project. The average expenditure on luxurious items by beneficiaries before NICRA was increased by 85.45 percent from Rs. 8250 to Rs. 15300.

CONCLUSION

It was concluded from the study that timely availability of drought resistant variety seeds and other critical inputs is most useful service intervention for increasing production and productivity of crops in arid region. The animal health care and availability of farm Machinery services are also important intervention to cope with climatic vulnerabilities. The higher adoption of short duration and drought tolerant varieties of Kharif crops, improved breed of cow, buffalo and goat and mineral mixture supplements & multi-nutrient feed block by farmers shows their higher interest and positive attitude towards improved methods of farming for their livelihood improvement. The significant increase in cropping intensity, and employment opportunity along with higher annual income, savings and expenditure on luxurious items by beneficiary farm families have proved good impact of the project in the study area.

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Agricultural Credit Utilization and Repayment by Farm Households in Tripura

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ABSTRACT

The study was conducted in West Tripura district of Tripura to examine the utilization and repayment of farm loans obtained by borrowers based on a survey done in 2020. The development of agriculture depends on farmers receiving adequate and timely loans. Purposive multi-stage random sampling was used to pick 120 farmers and 20 lenders for a comprehensive investigation. The majority of the sample beneficiaries availed of crop loans (82.5%) as compared to allied activities loans (17.5%) and it was observed that marginal and small farmers diverted a portion of the loan as compared to medium farmers. The extent of repayment of loans by the medium farmers was higher than the small and marginal farmers. To improve the utilization and repayment pattern of credit by farm households, the Bank Field Officers need to conduct post-credit supervision to reduce credit diversion to unproductive uses and disbursement of the majority of the loan in kind form may be used.

INTRODUCTION

In an emerging market economy, debt has a significant impact on rural households in a variety of ways. It is a crucial tool for regulating consumption in a setting where seasonal income swings are common (Narayanan et al., 2016). However, developing countries' credit markets, particularly rural households, don't always act like fully competitive markets. Their dual structure allows for the coexistence of formal and informal financial systems (Kumar et al., 2015). The majority of households borrow money from informal sources of finance because there isn't a well-developed loan market in the rural sections of the country (Kumar et al., 2017; Chakraborty & Gupta, 2017). Governments frequently interfere in the functioning of the credit market in several different ways to facilitate easier access to borrowing (Gulati et al., 2002).

The transition to commercialization in the agricultural sector increases the need for capital (Kambale et al., 2015). Agricultural credit is important for the growth of the Indian economy and agricultural modernization. However, loan non-recovery is a growing issue (Pradhan, 2013). Prompt and timely repayment is crucial for

public sector credit institutions to recycle funds for development and build confidence among clients and credit users (Adhikary et al., 2013). India's credit usage scenario is distinct from other countries. Farmers' lack of financial resources limits their ability to use credit for beneficial purposes. They use agricultural loans for non-agricultural purposes like home consumption, weddings, and other prestige events, which increase their debt load and finally leave them unable to repay the loan, leading to their designation as loan defaulters (Gulati et al., 2002). As a result, the agricultural lending industry depends not only on farmers taking out loans but also on them making regular repayments.

Tripura is a northeastern hilly state located between 22°7' and 24°2' North latitudes and 91°0' and 92°0' East longitudes, with the Tropic of Cancer passing through it. The state has a large number of small and marginal farmers, who face challenges such as limited access to credit and technology, as well as inadequate infrastructure for storage and transportation of their produce (Ray et al., 2020). Despite these challenges, the farmers of Tripura have been able to increase their productivity and income, and such continued agricultural growth requires substantial financial backing. However,

one of the biggest barriers to the ongoing development and expansion of agriculture is the lack of bank financing in the form of loans and advances in the state (Ray et al., 2020). According to data from the Census of 2015–16, just 26.50 per cent of households in the state used banking services, which is low when compared to the national average of 35.50 percent (Economic Review of Tripura, 2021). Though financial intermediation is prevalent in Tripura, but detailed research on farmers' engagement in agricultural growth through institutional financing is lacking. As a result, the current study was conceived to examine the use of agricultural credit acquired by the farming community.

METHODOLOGY

The research was conducted in the west Tripura district of Tripura using multistage random sampling method. A list of farmers receiving bank loans from various financial institutions was compiled in consultation with the district's lead bank manager. The farmers were dispersed across all the blocks in three subdivisions. For the in-depth investigation, one development block from each subdivision was chosen based on the higher concentration of farmers who had taken out bank loans. Accordingly Dukli, Old Agartala, and Mohanpur blocks were chosen. Two villages were randomly selected from each block: Maheshkhala and Bikramnagar from the Dukli block, Khayerpur and D.C. Para from the Old Agartala block, and Bijoynagar and Kalagachiya from the Mohanpur block. Within the constraints of time as well as other resources, a random sampling technique was ultimately used to select 20 farmers from each selected village. Based on the size of their operational holdings, the selected households were again stratified into marginal (0-1 ha), small (1.01-2 ha), and medium (2.01-4 ha) households. The stratification resulted in 56 (46.66%) marginal farmers, 38 (31.66%) small farmers and 26 (21.66%) medium farmers into the total sample of 120 farmers.

Primary data were obtained from the sample households using a specially created and tested schedule. Secondary data were gathered from the selected district's lead bank. Finally, tabular analysis and compounding technique was used to analyze the data.

RESULTS AND DISCUSSION

The farmers availed loans for different purposes, and utilization patterns varied from one group of farmers to another according to the activities they were engaged in. Crop loans or short-term loans were utilized for seed, fertilizers, chemicals, labour, irrigational purpose and other miscellaneous productive purposes. A part of the loan, which was utilized for payment of old debts, social and religious ceremonies etc., was considered unproductive in this analysis. On the other hand, allied agricultural loans or

medium-term loans were utilized for the purchase of animals, medicine, repairing of the animal shed and other miscellaneous productive purposes. A part of the loan, which was utilized for crop production, payment of old debts etc., was considered unproductive in this analysis.

Credit utilization by the beneficiaries

Classification of beneficiaries according to use of loan revealed that out of 120 beneficiaries, 91 beneficiaries had fully utilized the loan amount and there were only 29 beneficiaries who utilized the loan partly (Table 1). No beneficiary was found to divert the entire loan amount. Among different size groups, the percent of beneficiaries diverting loan were 28.57 per cent in case of marginal farmers, 23.68 per cent in case of small farmers and 15.38 percent in case of medium farmers. Therefore, a general trend was thus observed that the diversion of loans decreased with the increase in the size of the holding which is in line with the findings of Papias and Ganesan (2009).

The total amount of loan for all farms together was Rs. 34,69,057. The distribution of total loans among various size groups of farms revealed that Rs. 11,58,330, Rs. 10,68,021 and Rs. 12,42,706 were taken by marginal, small and medium farmers, respectively. It was observed that crop loan constituted the major portion of the total loan (90.25%) while allied activities loan shared only 9.75 per cent of the total loan. Among the size groups, the share of crop loan in the total loan was found highest in marginal farms (91.02%) and lowest in small farms (89.58%). Similarly, the share of medium farms in total allied activities loan (Rs. 338254) was found to be highest (36.37%) and lowest for marginal farmers (30.74). Thus, in both cases, the amount of loan disbursed for medium farmers was highest due to large-scale holding. According to the scale of finance, followed by NABARD, disbursement of the loan takes place according to the operational holding of the farmers (Gulati, 2002).

The magnitude of utilization and diversion of loan for crop and allied agricultural activities is presented in Table 2. From the table, it is evident that in case of crop loan, on an average each farm utilized Rs. 26466.53 out of the total loan amount of Rs. 31624.27 for productive purposes. Amongst the farm size, the per farm utilization of loans was Rs. 17497.81, Rs. 26297.65 and Rs. 46788.67 out of total loan amount of Rs. 22432.70, Rs. 30864.00 and Rs. 53318.19 respectively in marginal, small and medium sample borrower farmer. Similarly, in allied agricultural activities loan, on an average, each farm utilized Rs. 12989.29, out of a total loan amount of Rs. 16107.33 for productive purposes. It was observed that in case of crop loan, the marginal farmers had diverted a maximum proportion of the loan (21.99%) followed by

Table 1. Distribution of sample beneficiaries according to the use of loan

Size group of farmers	Total beneficiaries	No. of beneficiaries utilizing the loan		Incidence of diversification of loan (%)
		Fully	Partly	
Marginal	56	40	16	28.57
Small	38	29	9	23.68
Medium	26	22	4	15.38
All groups	120	91	29	24.17

Table 2. Magnitude of utilization and diversion of loan by the beneficiaries

Size group of farmers	No. of beneficiaries		Total loan received (Rs.)		Amount of loan utilized (Rs.)		Amount of loan diverted (Rs.)	
	Crop loan	Allied agril. loan	Crop loan	Allied agril. loan	Crop loan	Allied agril. loan	Crop loan	Allied agril. loan
Marginal	47	9	1054337 (100) [22432.70]	103993 (100) [11554.77]	822397 (78.01) [17497.81]	77649 (74.67) [8627.67]	231940 (21.99) [4934.89]	26344 (25.33) [2927.11]
Small	31	7	956784 (100) [30864.00]	111237 (100) [15891.00]	815227 (85.20) [26297.65]	91674 (82.41) [13096.29]	141557 (14.80) [4566.36]	19563 (17.59) [2794.71]
Medium	21	5	1119682 (100) [53318.19]	123024 (100) [24604.80]	982562 (87.75) [46788.67]	103452 (84.09) [20690.40]	137120 (12.25) [6529.52]	19572 (15.91) [3914.40]
All groups	99	21	3130803 (100) [31624.27]	338254 (100) [16107.33]	2620186 (83.69) [26466.53]	272775 (80.64) [12989.29]	510617 (16.31) [5157.75]	65479 (19.36) [3118.04]

Figures in parentheses indicate percent to total, Figures in [] indicate the average amount per farm

small farmers (14.80%) and medium farmers (12.25%) out of the total loan amount. The diversion was mostly due to the bank's mode of disbursement of the loan. Earlier, most of the institutional agencies used to disburse loan both in cash and in-kind but in recent years they started to disburse the loan in cash only. This made the farmers misutilize the amount of loan they used to get. A similar result was also observed for loans available for allied agricultural activities. It was observed that marginal farmers diverted a major portion of the loan (25.33%) followed by small farmers (17.59%) and medium farmers (15.91%). Thus, in both cases, maximum diversion of the loan was evidenced by the marginal farmers for some unproductive purposes. The extent of diversion was found to decrease with the increase in the size of the holding. Sharma and co-authors (2014) observed a similar credit diversion trend while studying the utilization of short-term term loan in Rajasthan.

From Table 2, it could also be seen that percent of the utilization of crop and allied agricultural loan was highest in the medium-size group and lowest in the marginal-size group. It could be seen that the percent of diversion of crop loan was highest in the marginal size group of farmers (21.99%) and lowest in the medium size group of farmers (12.25%). The same pattern can be seen in allied agricultural activities.

Table 3 explains the details of crop loan utilized by different size groups of farm. A major proportion of the loan (43.53%) was utilized for payment of labour charges in all size groups of farmer. While the marginal farmers utilized 39.22 per cent of the total loan for the purpose and the small and medium farmers' utilization for the same were 42.66 and 48.33 per cent respectively. The other productive uses were irrigational charges, purchase of seeds and manures and fertilizers which accounted for 29.11, 4.01 and 5.40 per cent respectively for all groups of farms. Maximum diversion towards unproductive use was observed in the case of payment of old debts. Diversion, in this case, was 10.13 per cent for all the farms taken together. On average 51.50 percent of the loan was utilized for the purchase of animals. Utilization of loans for this purpose in the case of marginal, small and medium farmers was

48.98, 51.21 and 53.88 percent of total loan respectively. Maximum diversion towards unproductive use was observed in case of payment of old debts (9.32%). The marginal farmers diverted the highest amount (11.34%) contrary to the medium farmers who diverted only 7.61 percent towards payment of old debts. Through diversion, it was confirmed that the farmers showed a keen interest in farming rather than opening up other enterprises. This was the main reason for many beneficiaries availing crop loans in the study area and similar findings were reported by Bhatia et al. (2011) who studied the extent of financial inclusion of rural households. Moreover, the lack of enterprising ability of the marginal, small and medium farmers was one of the major constraints, for which allied agricultural activities were not implemented fruitfully.

The analysis of the loan utilization pattern of the farmers emerged two important issues for detailed investigations. First, the farmers with smaller holdings need greater post-credit supervision so that the diversion by them towards unproductive and unauthorized purposes may be minimized. Second, a greater linkage has to be established between the amount of loan advanced and the level as well as the pattern of inputs used which was also highlighted by Kumar et al., (2015). This requires appropriate guidance by lending institutions regarding the correct choices of inputs to be used and activities to which they have to be applied to obtain an optimum result (Sonia et al., 2022).

Extent of repayment of crop and allied agricultural loan by the beneficiaries

The percentage of repayment among the beneficiaries in case of crop loan was satisfactory but low in allied agricultural activities loan and it varied considerably in all the three size group of farm (Table 4). The repayment was 88.43 per cent for crop loan and 85.13 per cent for allied agricultural loan. The repayment percentage of crop loan was highest among medium farmers (93.29%) and least among marginal farmers (83.11%). On average, the total crop loan due for repayment was Rs. 33,837.97 for all the farms taken together. Per farm total allied agricultural loan due for repayment was Rs. 17,234.85, of which the total loan repaid was Rs. 14,672.60

Table 3. Pattern of the utilization of crop and allied agricultural loan by the beneficiaries

Purpose	Pattern of the utilization of crop loan by the beneficiaries				Pattern of the utilization of allied agricultural activities loan by the beneficiaries			
	Size group of farmers				Size group of farmers			
	Marginal	Small	Medium	All groups	Marginal	Small	Medium	All Groups
Productive use (Rs.)								
Seed	40170.24 (3.81)	30330.05 (3.17)	55088.35 (4.92)	125588.6 (4.01)	50935.77 (48.98)	56964.47 (51.21)	66285.33 (53.88)	174185.6 (51.50)
Manures & fertilizers	56090.728 (5.32)	46116.99 (42.66)	66733.05 (5.96)	168940.8 (5.40)	12229.58 (11.76)	16930.27 (15.22)	9460.546 (7.69)	38620.39 (11.42)
Labour charges	413510.97 (39.22)	408164.1 (42.66)	541142.3 (48.33)	1362817 (43.53)	9224.179 (8.87)	10589.76 (9.52)	20274.36 (16.48)	40088.3 (11.85)
Irrigational charges	301224.08 (28.57)	310093.7 (32.41)	299962.8 (26.79)	911280.6 (29.11)	3556.561 (3.42)	1127.082 (1.01)	2129.434 (1.73)	6813.077 (2.01)
Other misc.	11400.98 (1.08)	20522.21 (2.14)	19635.48 (1.75)	51558.67 (1.65)	1702.912 (1.64)	6062.417 (5.45)	5302.334 (4.31)	13067.66 (3.86)
Subtotal (A)	822397 (78.00)	815227 (85.20)	982562 (87.75)	2620186 (83.69)	77649 (74.67)	91674 (82.41)	103452 (84.09)	272775 (80.64)
Unproductive use (Rs.)								
Social & religious ceremonies	12546.61 (1.19)	29755.98 (3.11)	27320.24 (2.44)	69622.83 (2.22)	9057.79 (8.71)	1601.813 (1.44)	2743.435 (2.23)	13403.04 (3.96)
Payment of old debts	169748.26 (16.10)	84675.38 (8.85)	62814.16 (5.61)	317237.8 (10.13)	11792.81 (11.34)	10367.29 (9.32)	9362.126 (7.61)	31522.22 (9.32)
Household consumption	20463.21 (1.94)	8988.3 (0.93)	14321.8 (1.27)	43773.31 (1.39)	3559.134 (3.42)	5817.695 (5.23)	1869.965 (1.52)	11246.79 (3.32)
Other unproductive use	29181.92 (2.76)	18137.33 (1.89)	32663.8 (2.91)	79983.05 (2.55)	1934.27 (1.86)	1776.204 (1.60)	5596.474 (4.55)	9306.948 (8.01)
Subtotal (B)	231940 (21.99)	141557 (14.80)	137120 (12.25)	510617 (16.31)	26344 (25.33)	19563 (17.59)	19572 (15.91)	65479 (19.36)
Total (A+B)	1054337 (100)	956784 (100)	1119682 (100)	3130803 (100)	103993 (100)	111237 (100)	123024 (100).	338254 (100)

Table 4. Extent of repayment of the loan by the beneficiaries

Size group of farmers	Total loan due for repayment (Rs.)		Total loan repaid (Rs.)		Total loan outstanding (Rs.)	
	Crop loan	Allied agril. loan	Crop loan	Allied agril. Loan	Crop loan	Allied agril. Loan
Marginal	1128140.59 (100) [24002.99]	111273 (100) [12363.6]	937555.7 (83.11) [19947.99]	91381.5 (82.12) [10153.5]	190584.89 (16.89) [4054.99]	19891 (17.88) [2210.11]
Small	1023759 (100) [33024.48]	119023.59 (100) [17003.37]	907075 (88.60) [29260.47]	101177.8 (85.01) [14453.97]	116684 (11.40) [3764.01]	17845.8 (14.99) [2549.40]
Medium	1198060 (100) [57050.46]	131635.68 (100) [26327.14]	1117701 (93.29) [53223.86]	115565.24 (87.79) [23113.05]	80358.7 (6.71) [3826.60]	16070.44 (12.21) [3214.09]
All groups	3349959 (100) [33837.97]	361931.8 (100) [17234.85]	2962331 (88.43) [29922.54]	308124.5 (85.13) [14672.6]	387627.9 (11.57) [3915.43]	53807.24 (14.87) [2562.25]

Figures in parentheses indicate percent to total, Figures in [] indicate the average amount per farm

Table 5. Distribution of beneficiaries according to repayment pattern and reasons for non-repayment

Size group of farmers	Repayment pattern (%)			Reasons for non-repayment (%)					
	Regular	Irregular	Defaulter	Low annual income	High domestic expense	Crop failure	Death of animal	Stocking for higher price	Others
Marginal (56)	62.50	17.86	21.43	40.91	31.82	13.63	9.09	4.55	-
Small (38)	68.42	13.15	18.42	16.67	33.33	16.67	8.33	16.67	8.33
Medium (26)	73.08	15.38	11.54	-	57.14	42.86	-	-	-
All group	65.83	15.00	18.33	28.83	36.59	19.51	7.32	7.32	2.44

and the total loan outstanding was Rs. 2562.25. It was observed that the percentage share of the total loan repaid to the total loan due for repayment increased with the increase in the size of the holding while that of the outstanding loan amount increased with the decrease in farm size.

The distribution of beneficiaries according to repayment pattern as shown in Table 5 indicates that out of a total of 120 beneficiaries, 79 beneficiaries were regulars (65.83%) who repaid the loan amount fully, 19 beneficiaries were irregulars (15%) who repaid only a part of the loan amount and 22 beneficiaries were defaulters (18.33%) who had not repaid their outstanding amount at all. The incidence of defaulters and regulars varied differently in different size group of farms. The constituent of defaulters was 21.43 percent in the marginal size group, 18.42 per cent the in small size group and 11.54 per cent in the medium size group. On the other hand, the percentage of regulars was 62.50, 68.42 and 73.08 per cent in the case of marginal, small and medium farmers, respectively. Thus, the analysis revealed that while the number of defaulters increased with the decrease in the farm size, the number of regulars increased with the increase in farm size. Likewise Alexpandi (2014) while appraising the repayment capacity concluded that larger the size of the holding, the greater the repaying capacity and vice versa.

To ascertain the causes of non-repayment, certain questions were asked to the respondents and the summary of this analysis is presented in Table 5. Poor repayment performance of Tripura farmers due to small size holding, more particularly marginal farmers, was found by Ghosal (2011) who pointed out that gross output from such holding was even not sufficient to meet the

consumption needs of the farmers. Thus the problem of overdue could be minimized provided the utilization of loans is supervised effectively and the farmers are approached at the right time for repayment. The bank should take responsibility for supplying the loans according to farmers' needs and at the beginning of the crop season to improve the chances of recovery (Prakash et al., 2022). Competent management is also required to organize the recovery drive more efficiently.

CONCLUSION

The practice of diversion had been observed in all sizes of farmer groups. Due to the farmers' lack of enterprising capacity, it was discovered that the number of farmers availing crop loan was larger than the number of farmers availing allied agricultural activities loan under farm sector in the research area. As a result, the loan was used for both productive and non-productive reasons by farmers of all sizes. Loan diversion was shown to be higher in the case of marginal farmers due to smaller land holdings than in the case of medium farmers. Loan recovery increased in line with the size of the holding. Therefore, post-credit supervision by the bank official is being recommended.

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Impact Assessment of CFLD Pulses on Pigeonpea Productivity and Profitability in Farmer's Field

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ABSTRACT

Front line demonstration is the most appropriate method to transfer improved technology in farmer's field. The study was conducted by ICAR-ATARI, Patna (Bihar and Jharkhand) on pigeon pea during crop season from 2019-2021. Study was conducted in 5520 number of demonstrations, altogether covering 1708.80 ha land area during the three years. Among the different varieties assessed it was observed that cv. NDA-1 and IPA-203 were outperformed in Bihar and Jharkhand respectively. The findings with respect to technology gap, extension gap and technology index of different cultivars grown were varying from 0.121 to 1.49 t/ha; 0.309 to 0.673 t/ha and 6.72 per cent to 49 per cent, respectively in Bihar and Jharkhand. The overall demonstration yield varied between 1.04 to 1.78 t/ha which is 22.55 per cent to 71.68 per cent more than the farmer's practices prevailing. Improved technology used under demonstration plot promoted higher yield than the local check with respect to highest net return from demonstration plot was Rs. 70365/ha and Rs. 47037.50/ha and the B:C ratio ranged from 1.33 to 2.82 and 1.02 to 2.43 in Bihar and Jharkhand respectively. Productivity and profitability can be enhanced by appropriate use of critical inputs and newer technological intervention.

INTRODUCTION

Pigeon pea is the second most important pulse crop in India after gram on production and consumption basis and commonly known as red gram or tur or arhar in different parts of the countries. It is mainly used as dehulled split peas; green seeds and pods used as fresh as well as green vegetables. India occupies first position in the world with respect to area and production and mainly cultivated in the state of Maharashtra, Madhya Pradesh, Karnataka, Uttar Pradesh, Gujarat, Jharkhand, Bihar, etc. which contributes more than 80 per cent of total production. Pigeonpea (*Cajanus cajan* L.) belongs to the family *Fabaceae* is an often-cross pollinated crop with diploid chromosome number of $2n=22$. Plant root helps in releasing soil-bound phosphorus for plant growth in available form. Pigeon pea is hardy, widely adopted and drought tolerant in nature which allow its cultivation in wide range

of environmental conditions and cropping systems. Pigeonpea fixes atmospheric nitrogen of about 40 kg/ha. Majority of cultivars and landraces are long duration type and grown as an intercrop with other early maturing cereals and crops. Due to low investment cost, it has become an ideal crop for sustainable agriculture in dry land and rainfed areas. By adopting improved technology and agronomic package of practices yield of pigeonpea can be obtained from 25-30 q/ha in irrigated condition and 15-20 q/ha under un-irrigated condition depending upon varieties and soil fertility climatic condition. Along with grain yield, it also gives 50-60 q/ha of dry stem which is used mainly for fuel and thatching purpose in rural areas. The main objective of this study was to enhance the productivity and profitability of pigeon pea under farmer's field by using high yielding cultivars with good quality seed, pest management and improved production technology. It is observed that the technology should be such that the farmers

could get the net returns equivalent to that they get from the other crops they mainly grow then only the farmers will go for cultivation of pulses (Kumar et al., 2010).

METHODOLOGY

Cluster frontline demonstration (CFLD) is one of the most powerful tools of extension because farmers' perception is driven by "seeing is believing". The main purpose and objectives of CFLD is to demonstrate newly released technologies (variety, INM, IPM, other practices, etc.) in bunch of packages rather than individual technology. In this study a cluster of 10 ha area has been selected which will give more accurate performance of the technology under assessment covering across the agro-climatic zone for the study. The year wise yield data from 2019 to 2021 was collected from farmers filed through KVKs as authority of ICAR-ATARI, Patna (Bihar and Jharkhand) of Cluster Front Line Demonstration on pigeonpea. Each cluster had minimum 10ha of land areas and 20-25 farmers were selected for demonstration. During three years period total 5520 demonstrations were conducted covering 1708.80 ha land with eight varieties in Bihar and seven varieties in Jharkhand. Four cultivars of pigeonpea viz; IPA-203, LRG-41, Rajendra Arhar-1 and Rajeev Lochan were demonstrated in both Bihar and Jharkhand and other cultivars in only one states based on the seed availability and suitability.

Required critical inputs for demonstration at farmer's site were provided by KVKs from the project centrally sponsored fund of CFLD provided ICAR-ATARI Zone IV. Concerned KVKs SMS implemented demonstrations and recorded needful data periodically. The basic information pertaining to pigeon pea package of practices of were collected by the KVKs before conducting demonstrations (Choudhary, 1999). Farmer itself maintained the control plot (farmer's field) by with their own acquired knowledge. Yield data were recorded immediately threshing and cleaning from both demonstration plot and farmer's field. Calculations of extension gap, technology gap and technology index of different cultivars were done as suggested by Samui et al., (2000). To assess the impact of cluster front line demonstration values were

determined on yield, per cent increase over control. Economic analysis was done on the basis of crop value and used inputs in local market. To check the economic feasibility Benefit cost ratio of demonstration and farmer's field were calculated using suitable statistical tools for different parameters as given below:

Technology gap = Potential Yield (Py) - Demonstration Yield (Dy)

Extension gap = Demonstration Yield (Dy) - Farmer's Yield (Fy)

$$\text{Percent increase in yield} = \frac{\text{Extension gap}}{\text{Farmer's yield}} \times 100$$

$$\text{Technology index} = \frac{\text{Technology gap}}{\text{Potential yield}} \times 100$$

$$\text{Benefit-cost ratio} = \frac{\text{Gross return}}{\text{Gross cost}}$$

RESULTS AND DISCUSSION

Technological adoption gaps

Full technological gap in respect of using high yielding improved variety, appropriate seed rate, method of sowing, seed treatments, etc have been observed whereas partial gap up to 50 per cent has been recorded in nutrient application, weed management, irrigation and plant protection measures. In case of land preparation and time of sowing no adoption, gap was noticed (Table 1). Farmers in general sow un-descript or old variety instead of recommended improved varieties with disease resistance of the region may be attributed due to unavailability of quality seed in time and lack of awareness were the main reasons. Farmers of the region generally applied higher seed rate than the recommended and they are not using seed treatment techniques for wilt and collar rot management and to better nodulation for biological N fixation of plants because of lack of knowledge and awareness and sometimes due to use pest infested seed. In general farmers give more weightage to land preparation and sowing time and less

Table 1. Differences between technological interventions and farmers practices under CFLD in pulses

Particulars	Technological interventions	Existing practices	Technological gap
Land preparation	Ploughing with cultivator (2) and levelling	Ploughing with cultivator (2) and levelling	No gap
Variety	High yielding	Non-descript/ too old var	Full gap Full gap (100%)
Time of sowing	2 nd fortnight of June to 1 st week of July	2 nd fortnight of June to 1 st week of July	No gap
Seed rate (kg/ha)	20	30-40	Full gap (100%)
Seed treatment	Trichoderma powder & Rhizobium culture	No seed treatment/carbendazim	Full gap (100%)
Sowing method	Line sowing	Broadcasting	Full gap (100%)
Fertilizer application and dose (kg/ha)	20N, 40P ₂ O ₅ and 20 K ₂ O	Improper use	Partial gap (50%)
Weed management	Pendimethalin 30% EC @ 3.3 lit/ha + 01 hand weeding if required	Improper weed control measures	Partial gap (50%)
Irrigation	In absence of rain	Rainfed/ untimely	Partial gap (50%)
Plant protection	IPM	Indiscriminate use	Partial gap
Intercultural operations	One Nibbling at 40-50 days crop	01 Nibbling at 35-60 days crop/ improper	Partial gap

on the critical inputs. Similar type of results has been obtained by Burman et al., (2010) & Singh et al., (2020) reported that there is a gap in adoption of technologies in major pulse crop both in irrigated and rainfed cropping system.

Positive impact of critical inputs and technological interventions were observed on the both demonstration and farmer's field with respect to grain yield and related data i.e., extension gap, technology gap, percentage increase over control and technology index were depicted (Table 2). Average demonstration yield in Bihar varied between 1.42 to 1.78 t/ha and 1.04 to 1.34 t/ha in Jharkhand whereas farmer's field yield varied from 0.85 to 1.13 t/ha and 0.710 to 0.98 t/ha respectively. Higher yield under demonstrated conditions were due to use of recent technological inputs and improved package of practices in both the states. Similarly, higher average yield of different pulses (pigeon pea, chickpea, field pea and lentil) than farmer's practices were also reported by Kumbhare et al., (2014); Tomar et al., (2021) & Kumar et al., (2022). Slightly more demonstrations plot yield and farmer's field were recorded in Bihar than the Jharkhand may be due to soil fertility and climatic condition particularly retention of moisture for longer duration.

Demonstration yield of varieties

In Bihar highest demonstration yield (1.78 t/ha) was recorded in var. IPA-203 and lowest (1.46 t/ha) in cv. Bahar (Table 2). However, in Jharkhand maximum demonstration yield to tune of (1.34 t/ha) was recorded in cv. LRG-41 and lowest (1.40 t/ha) in var. Birsa Arhar-1. Higher demonstration yield in this variety is attributed to its genetic potential and congenial environmental condition. Similar result had been obtained by Singh et al., (2022) & Raju et al., (2015) also recorded yield increment under cluster

front line demonstration of pigeon pea. Singh et al., (2020a) also reported overall higher demonstrations yield of pigeon pea (1.28 to 1.73 t/ha) than the local practices in different varieties/ location.

Technology gap and impact over farmers practices

The technology gap refers to difference between potential yield and demonstration plot yield. In Bihar, maximum technology gap 1.21 t/ha was in var Rajendra Arhar-1 and lowest 0.12 t/ha in var. Rajeev Lochan with overall cumulative technology gap of 0.58 t/ha among the different varieties (Table 2). Similarly in Jharkhand maximum technology gap (1.49 t/ha) was recorded in var Rajendra Arhar-1 and minimum (0.46 t/ha) in varieties Birsa Arhar-1. These results are in agreement with the findings of Mukherjee (2003). Percent increase in yield over control is another powerful tool for impact analysis. In Bihar state percent change in yield over control was varied from 22.55 to 71.68 per cent whereas, in Jharkhand 36.14 to 61.13 per cent. Percent increase in yield is the ratio of extension gap and farmer's yield expressed in percentage were analysed and the values ranged from 36.70 per cent to 42.55 per cent over the local practices in Bihar and Jharkhand respectively. Similarly, percentage increase in yield was also reported by Singh et al., (2020a).

Extension gap

Extension gap refers to yield difference between demonstration plot and control plot. This gap can be minimised by applying different extension activities such as cluster demonstration, farmer's awareness training programme and *kisan gosthis*, etc. (Kumar et al., 2022). In Bihar, highest extension gap (0.67 t/ha) was recorded in the cv. Malviya-13 and lowest (0.31 t/ha) in cv. Rajeev Lochan. However, in Jharkhand extension gap of 0.50 t/ha was observed

Table 2. Impact of technological interventions and varietal performance on yield of pigeon pea and gap analysis

State	Variety	Year of release	Area (ha)	Demo	Yield (t/ha)			Technology gap (t/ha)	Extension gap (t/ha)	Increase over control (%)	Technology index (%)
					Poten-tial	Demons-tration	Farmer's field				
Bihar	Rajendra Arhar-1	2015	130.00	398.00	2.80	1.59	1.08	1.21	0.52	48.00	43.07
	NDA-1	1997	330.00	944.00	2.00	1.57	1.13	0.43	0.44	38.92	21.65
	Malviya 13	2005	20.00	53.00	2.70	1.69	1.02	1.01	0.67	65.98	37.30
	Pusa 9	1993	20.00	69.00	2.20	1.58	0.94	0.63	0.64	67.55	28.41
	LRG-41	2006	200.00	675.00	2.00	1.42	1.03	0.58	0.40	38.73	28.90
	IPA-203	2014	213.16	651.00	1.94	1.78	1.13	0.17	0.66	58.31	8.62
	Bahar	1980	15.00	44.00	2.00	1.46	0.85	0.54	0.61	71.68	26.95
	Rajeev Lochan	2011	10.00	34.00	1.80	1.68	1.37	0.12	0.31	22.55	6.72
	Total		938.16	2868.00	12.77	8.55	4.69	4.25	411.72	201.62	201.62
	Average				2.18	1.60	1.07	0.58	0.53	51.47	25.20
Jharkhand	IPA- 203	2014	365.10	1214.00	1.95	1.29	0.83	0.66	0.46	54.82	34.07
	NDA-2	2008	160.00	517.00	2.50	1.28	0.88	1.23	0.39	44.39	49.00
	Rajendra Arhar-1	2015	50.00	146.00	2.80	1.31	0.81	1.49	0.50	61.13	53.21
	Birsa Arhar-1	1992	40.00	107.00	1.50	1.04	0.71	0.46	0.33	46.48	30.67
	VLArhar-1	2006	90.00	278.00	1.80	1.25	0.90	0.55	0.35	38.40	30.72
	LRG-41	2006	50.00	323.00	2.00	1.34	0.99	0.66	0.36	36.14	32.95
	Rajeev Lochan	2011	15.54	67.00	1.80	1.08	0.73	0.72	0.35	47.95	40.00
	Total		770.64	2652	14.35	8.59	5.85	5.77	2.74	329.31	270.62
	Average				2.05	1.23	0.84	0.82	0.39	47.04	38.66

Table 3. Economic analysis of demonstration and farmer's plot of pigeon pea

State	Variety	Demonstration plot				Farmer's field			
		Gross cost (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C	Gross cost (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C
Bihar	Rajendra Arhar-1	21783.33	61271.67	39488.33	2.10	19133.33	38166.67	19033.33	1.33
	NDA-1	22019.90	78987.90	56867.85	3.46	20116.90	56516.35	36720.45	2.71
	Malviya 13	25635.00	96000.00	70365.00	3.25	23657.50	57300.00	33642.50	1.93
	Pusa 9	22160.00	80203.50	58043.50	3.73	19912.50	54097.50	34185.00	2.82
	LRG-41	26596.00	80173.15	53577.15	2.91	24614.46	60471.31	35856.85	2.33
	IPA-203	21790.53	79674.00	57883.47	3.63	21620.76	59954.21	38333.45	2.08
	Bahar	22595.00	80355.00	57760.00	3.56	16564.00	44825.00	28261.00	2.71
	Rajeev Lochan	34600.00	104098.00	69498.00	2.01	30850.00	84940.00	54090.00	1.75
Jharkhand	IPA-203	25588.34	67655.66	42094.90	2.25	22559.93	44298.76	21738.79	1.57
	NDA-2	23219.50	66546.00	43326.50	2.82	20868.75	46266.38	25526.38	2.16
	Rajendra Arhar-1	17400.00	40600.00	23200.00	1.33	13500.00	27300.00	13800.00	1.02
	Birsa Arhar-1	24500.00	58678.00	34178.00	1.90	20000.00	39962.50	19962.50	1.50
	VL Arhar-1	19845.00	66039.04	46194.04	2.22	18987.50	44658.50	25825.75	1.88
	LRG-41	29847.50	76885.00	47037.50	2.09	28810.00	56488.75	27678.75	1.49
	Rajeev Lochan	21000.00	64800.00	43800.00	3.08	18000.00	43800.00	25800.00	2.43

in var. Rajendra Arhar-1 and minimum 0.33 t/ha invar. Birsa Arhar-1 (Table 2). These findings are in line with findings of Singh et al., (2020c). Similarly, the yield gap minimization in pulses was reported by Nain et al., (2014); Nain et al., (2015); Dubey et al., (2018) & Dubey et al., (2022).

Technology index

Technology index is another important tool for judging the adoption and impact of different technologies. It is derived as the ratio between technology gap and potential yield in terms of percentage. Lower value of technology index means better performance of technological intervention. In the present study, technology index varied from 6.72 to 37.30 per cent in Bihar and 30.67 per cent to 53.21 per cent in Jharkhand (Table 2). From the data it can be seen that the technology index in Bihar was lower than Jharkhand means demonstrated varieties showed better result in Bihar than Jharkhand. Likewise, variation in technology index (41.96 to 69.75%) in Bundelkhand region of UP was reported by Singh et al., (2020c). Similar results were also obtained by Kumar et al., (2010) and Jha et al., (2020). Large variation in technology index might be due to variation in existing weather condition, soil fertility status and insect-pests infestation.

Economic analysis

Data related to economic analysis of demonstration and control plot are presented as gross cost, gross return, net return and benefit cost ratio (B:C) in (Table 3). In Bihar, on the basis of performances of different varieties, the highest net return (Rs. 70365.00/ha) was recorded in Malviya-13 followed by Pusa-9 (Rs. 58043.50/ha) and the lowest net return Rs. 39488.33/ha in cv. Rajendra Arhar-1. Similarly, demonstrated varietal trend was recorded for benefit cost ratio and lowest values (1.33) observed in cv. Rajendra Arhar-1 and highest in cv. Pusa-9 (2.82) under agro-climate of Bihar. In Jharkhand, the highest net return (Rs. 47037.50/ha) from demonstration plot was recorded in cultivar LRG-41

followed by VL Arhar-1 (Rs. 46194.04/ha) and lowest net return (Rs. 23200.00/ha) from the cv. Rajendra Arhar-1. However, the highest benefit cost ratio (2.43) in cv. Rajeev Lochan and lowest (1.02) from the cv. Rajendra Arhar-1. High benefit cost ratio under demonstration plot as compared to farmer's field was due to higher yield under demonstration plot which is in agreement with the findings of Mokiduee et al., (2011). Likewise, front line demonstration on red gram, Dwivedi et al., (2011) and on other pulses Singh et al., (2020b); Singh & Singh (2020) also reported higher net returns as well as benefit cost ratio as compared to farmer's practices.

CONCLUSION

Cluster front line demonstrations conducted in 5520 demonstrations covering 1708.80 ha showed that productivity and economic return of pigeonpea can be increased by appropriate use of critical inputs or resources and new technological interventions. It is also seen that CFLD programme were much more helpful in conveying technical message and changing the attitude of other farmers toward adopting new and improved farming and management practices that also helps in doubling the farmer's income. Higher demonstration yields not only reduced the technology gap but also created interest among farmers in adopting demonstrated technology which ultimately bridges the extension gap. Lower technology index value showed better performance of technological interventions. This will also enhance the relationship and built confidence between farmers and extension worker. Thus, it can be advocated that adoption of improved package of practices particularly in pigeon pea production technology may result in higher productivity per unit area.

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Assessing Composite Livelihood Security and its Determinants Among Rural Households

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ABSTRACT

The study was conducted during 2022 in Lucknow district of Uttar Pradesh to analyze the livelihood security of rural households. Data was collected from 515 households through personal interview method using kobo collect. Landless and marginal farmers were more food insecure in the region. Forty four % of the households were food insecure. Composite livelihood security index was constructed using six domain indicators viz., habitat, health, economic, food, nutrition and social participation security. The weight for each domain indicator was derived from principal component analysis. The composite livelihood security index was 0.44 among the respondents. The livelihood security was high for medium farmers (0.46) followed by small farmers (0.45). Farming experience, social participation, livestock possession, income, calorie intake, body mass index and wealth significantly influenced the livelihood security. Lack of awareness on pest and disease control and poor price realization were the major constraints faced by the farmers. Technological, institutional and policy interventions are necessary to enhance their livelihood status.

INTRODUCTION

Post COVID-19 pandemic, the agriculture and allied industry emerged as the most resilient sector of the economy in India (Cariappa et al., 2021). More than half of the labour force is employed in this sector, and accounts for almost 20 per cent of GDP. As the nation's leading agricultural producer, Uttar Pradesh is known as the "Granary of India" for its abundance of wheat, sugarcane, mangoes, and other staple foods. Around 65 per cent of the state's population works in agriculture, and it also makes a sizable economic contribution to the state. Agriculture in the state is important to national food security, but its low productivity necessitates policies geared toward increasing crop yields (Jose et al., 2022). In addition, 30.4 per cent of its rural population is poor, surpassing the national average of 25.7 per cent (Anonymous, 2021a). This places the state among the poorest in India. Lucknow

being the capital city of UP is being acclaimed for its most famous Dashehari mango production. Mall is one of the major fruit belt accounts for mango cultivation over an area of 28,000 ha. Mango cultivation is the major source of livelihood for the farmers. However, its contribution alone to sustain the livelihood is decreasing over the years (Mishra et al., 2019). To become a developed nation, we must prioritize the well-being of its pro-poor marginal and small farmers. Understanding the farmers' socioeconomic status and the resources available and accessible to them is essential before developing strategies to raise farmers' income through diversification, collective actions, and the adoption of technology interventions. This study has been conducted as a part of baseline survey of second phase of ICAR funded Farmer First Project. This project is designed to provide farmer centric research and technical guidance in view of increasing their livelihood security and doubling farm income. In light of these considerations,

this research fills a gap in our knowledge of the economic stability of rural households in eastern Uttar Pradesh. A livelihoods approach can serve as a checklist of critical factors to be taken into account in order to develop appropriate measures (La Rovere & John, 2007). Every location is different and needs a tailored approach to reshape agricultural growth trajectory, this work differs from previous research in that it examines micro-level data to identify reasons restricting the sustainable livelihood of rural households.

METHODOLOGY

The survey was conducted in three villages of Lucknow district of Uttar Pradesh namely Dhakwa, Bhanpur and Hasnapur. These three villages were chosen purposively as these are the project implementation areas. We used a random selection technique to select 515 houses out of a total of 1604 to participate in the study during 2022. Kobo toolbox/collect was used for personal interview method. Herfindhal index was used to measure the extent of crop diversification (Rahman et al., 2009; Ogundari, 2013).

$$HI = \sum_{i=1}^N P_i^2$$

Where, P_i represents acreage proportion of the i^{th} crop in total cropped area. The value of zero indicates complete diversification.

The multifaceted aspects of livelihood security include six domain indicators: habitat, health, economic, food, nutrition and social participation security. Based on the broad literature review and discussion with experts, sub-indicators of the domain indicators were chosen.

The sub-indicators were first normalized (Bhavya et al., 2020; Sridhara et al., 2022, Sendhil et al., 2018) to the scale of zero (0) and one (1), premised on their functional relationship with the livelihood security. The indicator has a positive relationship ("more is better") then equation (a) and if the indicator had negative relationship ("less is better") then equation (b) was employed.

$$Y_{ij} = \frac{K_{ij} - \text{Min}(X_{ij})}{\text{Max}(X_{ij}) - \text{Min}(X_{ij})} \quad \dots (a)$$

$$Y_{ij} = \frac{\text{Max}(X_{ij}) - K_{ij}}{\text{Max}(X_{ij}) - \text{Min}(X_{ij})} \quad \dots (b)$$

Where, Y_{ij} is the index for the i^{th} indicator related with j^{th} individual, $\text{Max}(X_{ij})$ and $\text{Min}(X_{ij})$ are the maximum and minimum values of the indicator variable X_i . Further, index for the particular domain was constructed by averaging the standardized indicators.

In our study, Principal component analysis was used for construction of weights. Three components explained 62 per cent of the total variation. The weights from the PCA were calculated with the following equation (Balaganesh et al., 2020).

$$W_i = \sum |L_{ij}| E_j$$

Where, W_i represents weight of the i^{th} variable, L_{ij} represents the Eigen value of the j^{th} factor and E_j represents the loading value of the i^{th} variable on j^{th} factor.

Finally the Livelihood Security Index (LSIs) for each household has been calculated by weighted average method. Livelihood security index, the households were categorized as high, medium and low using mean and standard deviation as represented below (Sendhil et al., 2018; Balaganesh et al., 2020).

- High = Index > (Mean + 0.5 SD) = >0.403
- Moderate = (Mean – 0.5 SD) < Index < (Mean + 0.5 SD) = 0.403 to 0.472
- Low = Index < (Mean – 0.5 SD) = >0.472

RESULTS AND DISCUSSION

The majority of the households relied on agriculture for a living. The total net cropped area (TNCA) was 222 ha, whereas the total gross cropped area (GCA) was 347 ha (Table 1). The cropping intensity was 157 per cent. The region's primary perennial fruit crop, mango, occupies 27 per cent of the gross crop area (GCA), second only to cereals in terms of land use. During the Kharif and Rabi seasons, rice and wheat are the most common cereal crops farmed by farmers of all economic strata. In order to determine the degree of diversification practiced by various types of farm households, the Herfindhal index of crop diversification was developed. Results clearly indicated that medium farmers were more diversified compared to small and marginal farmers. Marginal farmers having very small area cannot diversify as economies of scale may not work, hence collective input procurement, branding and output marketing may be emphasized through formation of producer organization. Thus there is a need to encourage and motivate farmers for collective action.

Livelihood security of the households

These six sub-indicators contributed in different ways to each respondent's overall livelihood security. Habitat security, economic security, composite food security, nutritional security and the overall livelihood security of the households were statistically different across different categories in the study area (Table 2). However, they were indifferent with regard to health and social participation security. The overall livelihood security of the rural households was just 0.44 in the study area. Health security contributed the most (0.91) to the overall livelihood security of the respondents. The results are in line with the study of (Gautam & Jha, 2023). The mean livelihood security levels were high for the medium farmers (0.46), followed by small (0.45) and marginal farm households (0.43). This is because medium-sized farms typically have larger land holdings, giving their owners more options to diversify their farm activities. They not only depend

Table 1. Cropping pattern of the households

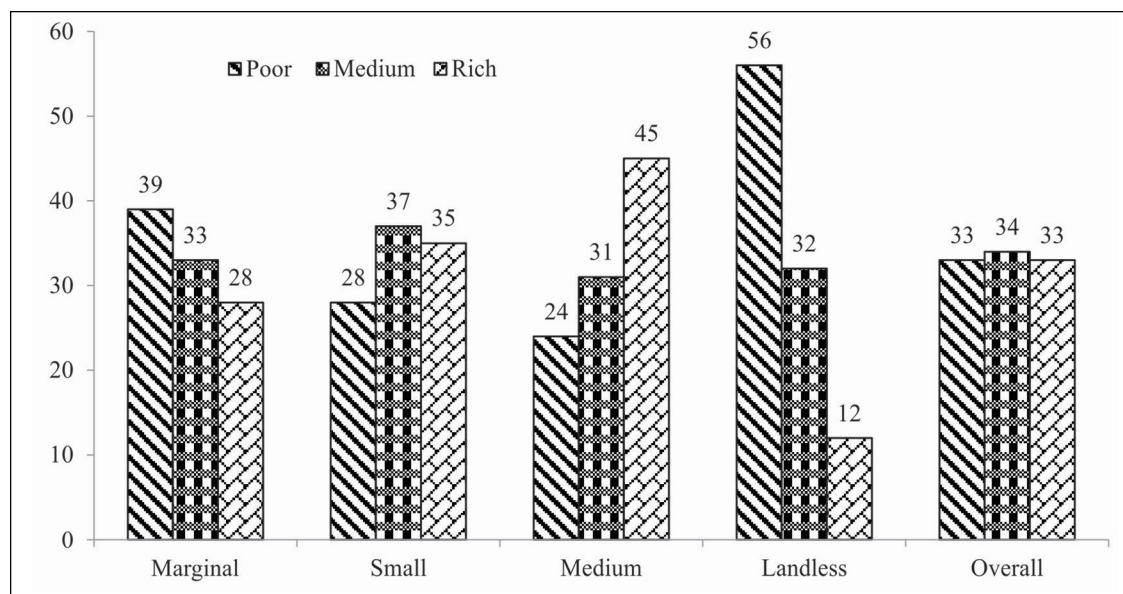
Particulars	Marginal	Small	Medium	Overall
Households (%)	40	24	28	100
Gross Cropped Area (ha)	55.22	83.98	208.09	347.26
Net Cropped Area (ha)	31.43	50.59	139.81	221.82
Cropping Intensity (%)	175.69	166.00	148.84	156.55
Crop Diversification Index	0.52	0.41	0.37	0.45

Note: Eight % of the sample respondents were landless

Table 2. Indicators of livelihood security index of the sample households

Particulars	Marginal	Small	Medium	Landless	Overall	F value
Habitat security	0.71	0.76	0.83	0.59	0.75	23.68**
Health security	0.91	0.93	0.90	0.94	0.91	0.30 ^{NS}
Economic security	0.10	0.13	0.21	0.09	0.14	62.49**
Food security	0.43	0.43	0.46	0.37	0.44	7.08**
Nutrition security	0.56	0.61	0.56	0.49	0.56	2.62*
Social participation security	0.07	0.04	0.05	0.07	0.06	0.92 ^{NS}
Livelihood security	0.43	0.45	0.46	0.39	0.44	11.04**

Note: ** and * - significance at one and five per cent, respectively and NS - Non significant

**Figure 1.** Categorization of households according to livelihood security (%)

upon farming but also invested their income into various other ventures which helped them to achieve higher livelihood in comparison. Marginal and small farmers had very less farm area and because of the operation of diseconomies of scale, diversification was also less and their livelihood was also dependent upon daily wages. Landless households had very low livelihood security level (0.39) owing to the fact that their livelihood was mainly dependent upon daily wages and the availability of work was highly fluctuating.

The households had very high level of health security (0.91) and habitat security (0.75) in the region. This is due to the availability of good health facilities at free of cost from the Government and majority of the households possessed Ayushman card (Pradhan Mantri Jan Arogya Yojana). The households were also the beneficiaries of various Government schemes/programmes such as Pradhan Mantri Avas Yojana (PMAY), Swachh Bharat Mission, Ujjawala yojana which helped them to achieve higher level of habitat security. However, the habitat security of landless households needs to be increased. The households had very low social participation and economic security. The income of the households was lower than the national average which needs to be enhanced through various technological interventions. It is also necessary to create avenues in the rural areas to check migration.

Majority of the farmers are ready to quit agriculture if an alternative option is available. Social participation of the area needs to be enhanced by the creation of producers' organization and Self help groups in the study area. Economies of scale can be assured through collective input procurement and marketing. The female households need to be educated on the calorie intake requirements for healthy life and they should be given with a balanced consumption plan by the concerned department according to the local food habits.

In addition, we divided the households into groups based on their level of livelihood (Figure 1). Majority of the landless (56%) and marginal farm households (39%) had poor livelihood security. About 30 per cent of households across all the category of households had medium level of livelihood security. Most of the respondents (45%) from medium farmers had high overall livelihood security and 24 per cent of them had low livelihood security. Based on the analysis, it appears that the majority of respondents are in a precarious livelihood situation. Thus there is a need to enhance the livelihood of the farmers of the region through various technological interventions. Government agencies and policy makers need to focus on improving various parameters of socio-economic development in the study area not only to improve the livelihood security but all facets affecting it.

Factors influencing the livelihood security of the households

The factors affecting livelihood stability were evaluated using a multiple linear regression model. According to the coefficient of multiple determinations, the factors in the model explain 60 per cent of the variance in livelihood security. The model was significant at one per cent level of significance with an F stat of 62.95 (Table 3). Age was negatively and significantly influencing the livelihood security. Young age households are very energetic, eager and their desire to learn, seek jobs and risk taking ability is higher while these factors gets reduced as age proceeds. Majority of household head are young and it would be simple to persuade young people to use better technology. Workineh et al., (2020) found that the likelihood of technological adoption decreased significantly as the age of the household head increased. Studies by Mishra et al., (2020) & Pradhan et al., (2021) have also reported the negative relationship between age and livelihood security. Farming experience had a positive effect on livelihood status. Since most of them have moderate experience in farming (24 years), adopting new technologies may not have significant challenges. As experience increases, their capacity to cope with adverse situation increases thus making them to adopt suitable corrective measures to maintain their livelihood. The results are in line with Gautam & Jhan (2023) but contradict with the study of Pradhan et al., (2021).

The farmers who had involved in social participation had higher livelihood status. Collective action among the households increases the bargaining capacity which helps them to achieve the common goal collectively and plays a significant role in technology adoption (Kumar et al., 2017). Having access to formal credit and increased bargaining power are just two of the many benefits that farmer organizations like cooperatives and Farmer Producer Companies offer their members (Partiban et al., 2015; Marbaniang et al., 2019; Vijayakumar, 2021; Kumari et al., 2022). Other benefits include increased incomes, lower input and transaction costs, and new avenues for value-added activities like processing, distribution, and marketing (Bikina et al., 2018). The results are in line with the work of Ramya et al., (2017); Pradhan et al., (2021); Gautam & Jhan (2023). Livestock ownership was

associated with increased financial stability. In addition to providing essential sustenance, they are a vital asset and safety net for the disadvantaged, especially women (Hegde, 2006; Saxena, 2020).

Livestock possession has a considerable positive impact on equity in terms of income and employment and poverty reduction in rural areas, according to a number of empirical researches (Ali, 2007; Randolph et al., 2007; Deshingkar et al., 2008; Saxena et al., 2017). Income also positively influenced the livelihood. When one's financial situation is stable, they are in a better position to take advantage of novel approaches that strengthen their ability to make a living. The present finding is in line with Sunanda et al., (2014); Pradhan et al., (2021), Dagar & Upadhyay, (2022); Gautam & Jhan (2023). Calorie intake had a positive relationship with livelihood as energy is the important component to do work and carry out all activities needed to uplift their livelihood conditions. Wealth index and body mass index (BMI) positively influenced the livelihood.

Constraints faced by the farmers

The constraints faced by the farmers are presented in Table 4. Lack of awareness on pest and disease control, poor price realization, low productivity of mango, labour scarcity and lack of alternative livelihood avenues in rural areas were the major constraints faced by the farmers in the region.

Table 4. Major constraints faced by the farmers

Constraints	Rank
Lack of awareness on pest and disease control	I
Poor price realization	II
Low productivity of mango	III
Labour scarcity during peak season	IV
Lack of alternative livelihood avenues in rural areas	V
Huge post harvest loss and lack of processing facilities	VI
Lack of space utilization in orchards	VII
Lack of awareness on Government schemes	VIII
Lack of green fodder availability	IX

Table 3. Factors affecting the livelihood security of rural households

Variables	β coefficient	t value
Gender of household head	0.0053 ^{NS}	0.81
Age	-0.0017 ^{**}	-5.96
Education (years)	0.0002 ^{NS}	0.45
Family size (No.)	0.0003 ^{NS}	0.31
Farming experience (years)	0.0007 ^{**}	2.46
Social Participation	0.0823 ^{**}	11.81
Livestock Possession	0.0106 ^{**}	2.11
Per-capita income (Rs./annum)	1.48E-07 ^{**}	2.43
Calorie intake (Kcal/CU/day)	4.41E-05 ^{**}	4.7
Wealth of the households	0.0099 ^{**}	4.26
Nutritional security (BMI)	0.0052 ^{**}	8.82
Farm land holdings (acre)	0.0049 ^{NS}	1.76
Intercept	0.2217 ^{**}	7.69
Coefficient of multiple determination (R ²)	0.60 ^{**}	F = 62.95

Note: ** - significant at one % and NS- Non Significant

CONCLUSION

Crop diversification was low for marginal farmers enlightening the need of collective actions to reap the benefits of economies of scale. Though majority of the rural households were the beneficiaries of Public Distribution System (PDS), food insecurity was prevailing among them. There is a need to increase awareness regarding diversified consumption basket and energy obtained from consumption of such food. It was also observed that 67 per cent of the households belonged to poor and medium livelihood security level. Age, farming experience, social participation, livestock possession, income, calorie intake, BMI and wealth were the significant factors affecting the livelihood security. Based on the constraint analysis technological interventions such as diversification of farm activities, adoption of GAP in mango, creation of producer's organization, empowering rural women and youth for on farm processing of fruits and vegetables, weather based crop and pest management advisories are necessary to enhance their livelihood status.

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Adoption Behaviour of Climate-resilient Agricultural Practices in Punjab under NICRA Project

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ABSTRACT

An integrated package of climate-resilient technologies was demonstrated in one village per 4 selected districts namely Bathinda, Faridkot, Roopnagar and Fatehgarh Sahib of Punjab. The major objective was to augment the resilience of agricultural systems, both crop production and livestock farming to climate vulnerability. From 2011-2020, major interventions made in crop production system were; crop residue management, zero tillage, quality seed, green manuring, biofertilizers and promotion of water saving technologies such as laser land levelling, direct seeded rice, short to medium duration rice varieties, etc. Major interventions made in livestock production system included green fodder production round the year, silage making, mineral mixture, uromin lick availability and regular vaccinations. To improve livelihood, subsidiary occupations like dairy farm, backyard poultry, piggery, jaggery production and protected cultivation units were established in the NICRA villages. Farmers were highly convinced to adopt the recommended practices but adoption level of demonstrated natural resource management technologies was variable and specific to a district. The satisfying results were witnessed under the NICRA project and there was an increase in the adaptive capacities, and enhanced incomes. NICRA villages functioned as model villages and became knowledge hubs/centres for out-scaling technologies in large areas.

INTRODUCTION

The climate change refers to long-term changes in either the overall climate of the earth or in regional climate over time. Since the evolution of the world, climate has been gradually changing at its natural pace, but recently, it has accelerated due to unanticipated disturbances from human activity. Change in climate is a natural phenomenon that can be brought on by changes in the earth's atmosphere (such as glaciations, ocean variability, etc.) or by natural occurrences (such as volcanism, plate tectonics, solar variation, orbital variations, etc.). Experts have concluded that

global climate change can have an impact on the crop production yields and climate change must be dealt with caution and system approach for attaining food security (Howden et al., 2007; Tripathi et al., 2016).

Climate variability has variable impact on agriculture at regional or global scale. It is very imperative to evaluate linkages between agro-ecosystems, unpredictable climate change, impact on crop growth and food security in the long run (Parry & Carter, 1989). A change in climatic variable may have a positive or negative effect on agricultural productivity at a particular situation (Greg et al., 2011). The impact of climatic variability on agricultural productivity,

particularly in developing countries has been well-documented (Gunathilaka et al., 2018). It is crucial to take action to encourage farmers to adopt climate-resilient agricultural technologies so that they can cope with the adverse impacts of climate change and variability (Pabba et al., 2022). Factor for success of any agricultural technology/practice modelling is the high demand for institutional support for smallholder farming households (Shitu et al., 2018). The need for climate-resilient agriculture and efficient use of natural resources such as water and soil are brought into greater perspective by heat/cold stress and unpredictable rainfall in Punjab, which is an important food grain growing state in India. As a response to these challenges, both research and farming community developed a wide range of agro-techniques that could enhance the resilience of agricultural system to change in climate (Wezel et al., 2014).

The Indian Council of Agricultural Research (ICAR) launched a network initiative of 'National Innovations in Climate Resilient Agriculture' (NICRA) in February 2011. The project consisted of four components: strategic research, capacity building, technology demonstration and sponsored or competitive grants (Singh & Venkateswarlu, 2011; Hadiya et al., 2020). The programme also incorporated the current best practices for climate resilience as well as put an emphasis on the need for infrastructure development for monitoring climate change scenarios across field conditions at important research institutes (Suresh & Vishvanthan, 2022). The NICRA project has been implemented in four districts of Punjab with the purpose of enhancing the resilience of agriculture at farmer's field with the demonstration of improved technologies through extension units. The impact of various climatic-resilient technologies in the field of crop and livestock production systems in Punjab was studied after the 10 years of adoption of NICRA project in a particular village.

METHODOLOGY

Drought and heat waves were primary considerations in the selection of districts, Bathinda and Faridkot. Frost and cold waves were primary climatic variability in Fatehgarh Sahib and Roopnagar. Under NICRA project, KVKs selected villages, held stakeholder meetings and carried out baseline surveys. KVK Bathinda selected village Kili Nihal Singh with total cultivated area of 810 hectares. KVK Faridkot selected village Pindi Balochan with a total cultivated area of 1060 hectares. KVK Fatehgarh Sahib selected the village of Badaucchi Kalan where total cultivated area was 952 hectares. KVK Roopnagar selected five villages- Rashidpur, Fatehgarh Viran, Rampur Fasse, Mohan Majra and Behrampur bet with total cultivated area of 853 hectares.

During this project, State extension agencies and ICAR-ATARI (Agricultural Technology Application Research Institute) played a pivotal role in village development plans. To ensure farmers' participation in the project, VCRMC (Village climate risk management committees) were formulated in the villages. The members of ZMC (Zonal Monitoring Committee) and VCRMC collectively gave suggestions to scale up the climate resilient technologies for the benefit of farming community. KVKs conducted demonstrations, awareness camps, trainings, TV-radio talks, field visits, and farmer-scientist interactions.

From 2011-2020, major interventions made in crop production system were crop residue management with different machinery

such as happy seeder, baler cum knotter etc., zero tillage, quality seed, green manuring, promotion of water saving technologies such as laser land levelling, direct seeded rice and kitchen gardening. Regular animal vaccination and use of mineral mixture/ uromin licks in animal feed were the major interventions made in livestock production system. After a period of 10 years (during 2021), survey was done among the adopting farmers to evaluate the impact and outcomes of these activities. Adoption rate, a key performance indicator of a particular technology was quantified to estimate the popularity and acceptance of that technology by farmers in a particular village/district.

With a participatory approach, constraints in agricultural productivity were recognised. For this purpose, the possible reasons for poor adoption were listed by the farmers. The social and economic reasons was prepared and distributed among twenty farmers from each selected villages for ranking of the reasons. The econometric analysis of this data was done by calculating Rank Based Quotient (RBQ) using the following formula:

$$RBQ = \frac{\sum_{i=1}^n (n+1-i^{th})}{N \times n} \times 100$$

Where, f_i = number of farmers reporting a particular reason under i^{th} rank; N = number of farmers; n = number of reasons identified

RESULTS AND DISCUSSION

Adoption of climate-resilient technologies

Before the KVK's interventions through the NICRA project, farmers were reluctant to use the new technologies or practices. With the positive results of technologies and the awareness programmes run by KVKs, farmers were encouraged to adopt new techniques which contributed to climate-resilient agriculture. The adoption of these climate-smart agricultural practices was site-specific. Not every agro-technology was successful at every location and there was no practice of 'one size fits all'.

Each and every farmer in Bathinda and Faridkot villages (98-100%) adopted laser land leveller technology as it helped them in saving water more efficiently (approximately 25-30%) and increased crop yield by 5-8 per cent as compared to conventional sowing. In case of Roopnagar (58%) and Fatehgarh Sahib (41%) districts, farmers adopted laser land levelling technology (Table 1). The perceptions of the farmers for the possible benefits of laser land levelling varied which caused the varied rate of its adoption by farmers (Larson et al., 2016). Kumar et al., (2022) also found that a large number of farmers assumed that it helped in reduction of irrigation cost and better fertilizer use efficiency in Sirsa and Karnal districts of Haryana.

Almost 75 per cent of Bathinda farmers adopted DSR technology (Table 1). This technology allowed Bathinda farmers to save 18-25 per cent of irrigation water as well as overcoming the problem of farm labour shortage. Similar results were reported by Singh et al., (2021) that DSR technology has the benefit of facilitating better weed control and timely rice establishment. DSR technology proved its potential to provide higher net returns in comparison to conventional puddled transplanted rice. DSR also prevents puddling, transplanting, and retaining standing water during

Table 1. Adoption of different interventions/technologies in the adopted districts

Interventions	Percent adoption of technology in various districts			
	Bathinda	Faridkot	Fatehgarh sahib	Roopnagar
Laser land levelling	99	98	41	58
Direct seeded rice	75	6.6	13	2
Alternate wetting & drying in transplanted rice	-	-	-	-
Zero tillage	65	49	2	7
Happy seeder	70	3.4	35	31
Baler cum knotter	75	58	-	3
Quality seed	70	70	-	-
Mineral mixture/uromin licks	55	55	5	66
Kitchen garden	85	85	100	72
Crop diversification	-	-	-	-
Animal vaccination	45	64	100	70
Green manuring	14	23	7	10

- indicates no success in adoption of technology after demonstrations

the first two weeks after seedling transplantation. While, only 13 per cent of the farmers in Fatehgarh Sahib district adopted DSR and farmers reported poor crop establishment due to heavy soil texture. In Roopnagar district, only 2 per cent of the farmers used this technology because of sandy soil which was not suitable for DSR. Weed management was the biggest problem in lower adoption of DSR as expressed by the farmers of Faridkot district. Although alternate wetting and drying in rice is the most promising climate-smart water management practice for reducing water use and decreasing methane emissions, farmers of every district did not adopt this technology. Farmers quoted availability of free electricity for tubewell connection as the main reason for negligible success in adoption of this technology.

About 65 per cent and 49 per cent of the farmers had adopted the zero till drill in Bathinda and Faridkot districts (Table 1). This was mainly ascribed to the low cost of cultivation. While, only 7 per cent of farmers in Roopnagar and 2 per cent of farmers in Fatehgarh Sahib adopted the zero till drill. This lower rate of adoption was due to the perception of farmers that zero till wheat will result in lower grain yield. Majority of farmers in Bathinda district have adopted happy seeder technology due to positive points, such as saving of irrigation water up to 15-20 per cent, increased yield due to micro atmosphere, reduction in environmental pollution and improvement in carbon in the soil. It was also observed that 35 per cent of farmers adopted Happy Seeder in Fatehgarh Sahib. Farmers were of the opinion that happy seeder technology has higher potential for adaptation in coping with heat stress. While, 31 per cent of Roopnagar farmers were convinced to use happy seeder technology as crop residue management due to the higher cost of machinery and the low window of operation (approximately 25 days). The major reason for less adoption of this technology in Faridkot area is the poor establishment, expertise to run machinery, problem in drill calibration and fear of risk of crop failure. Majority of the farmers in Bathinda (75%) and Faridkot (58%) had adopted baler-cum-knotter for the management of paddy straw. New factories were introduced in the district for lifting the bails. While in Roopnagar, very few farmers have used baler-cum-knotter technology due to high cost involved and lack of linkages with factories during these 10 years of NICRA project.

In the selected villages, farmers were reluctant to go for crop diversification. In Punjab, rice-wheat is the predominant cropping system and its diversification is restricted due to want of political will, ecology, lack of infrastructure (such as processing plants, dryers, cold storage) market forces and social preferences of the farmers. The farmers with high land holding and annual income level were having higher adoption levels of crop-resilient agricultural technologies compared to the other farmers due to frequent contacts with extension personals, the ability to invest more capital in agricultural practices, and were eager to explore new technology (Naik et al., 2023). While, majority of farmers in the smart villages adopted kitchen gardening in Fatehgarh sahib, Bathinda, Roopnagar and Faridkot districts (Table 1). KVKs provided vegetable kits and guided them about the importance of organic vegetables. The major reasons for high adoption of kitchen gardening were low cost and easy availability of vegetable seeds for establishment of nutrition garden at household level, a savings of approximately Rs 18000 per year for a family of four, and nutritional security. Similar findings were confirmed by Ojha & Singh (2019). After the training and demonstration, the dietary pattern and food habits of the villagers improved positively. As a result of KVK interventions, adoption of recommended variety has increased to the tune of 85 per cent during *kharif* and 98 per cent during *rabi* season.

Free vaccination programme initiated by KVKs resulted in a high vaccination adoption rate with 100 per cent in Fatehgarh Sahib and 70 per cent in Roopnagar avoiding any outbreaks whereas, 64 per cent got vaccinated their farm animals under the guidance of KVK in Faridkot (Table 1). Only 45 per cent farmers of Bathinda district had vaccinated their animals because of their fear, milk production may decline due to vaccination. Only 23, 14, 10 and 7 per cent of the growers in Faridkot, Bathinda, Roopnagar and Fatehgarh Sahib districts, respectively adopted green manuring due to the limited availability of seed, non-availability of electricity at the time of sowing and attack of tobacco caterpillar at initial stage.

More than 60 per cent of farmers in Roopnagar regularly feed mineral mixtures and uromin licks for higher production. In Bathinda and Faridkot, 55 per cent of the farmers adopted mineral mixture, while these supplements were used by only 5 per cent in Fatehgarh

Sahib. Through usage of supplements, problem of repeat breeding has been overcome to a large extent. This resulted in increase in milk production and reproductive potential in dairy animals. In Faridkot and Bathinda districts, farmers were cultivating a few crops for fodder purposes, such as jowar, bajra, rye grass etc. before the initiation of the project. KVKs in both districts provided quality seeds for fodder crops like maize and berseem and area under fodder crops were increased to 6.6 per cent during 2021. KVKs provided quality seeds of maize, jowar, bajra and oats that yield higher and produce rich silage. Farmers were convinced about the purpose of quality seeds and there was change in behaviour towards quality seed. In the beginning, the number of biogas plants was low because villagers were unaware of their benefits. However, following the NICRA project and subsequent motivation to the growers, farmers were convinced for establishment of biogas plants with the help of government departments.

Impact of NICRA project

Impact analysis revealed that NICRA interventions increased resilience at the farm, household and village levels. These agro-technologies helped farmers to cope with extreme weather conditions like drought, frost, cold and heat waves. During the period of NICRA project, farmers were made aware of various improved agro-technologies. Adoption level of natural resource management technologies such as zero-tillage, happy seeder, direct seeded rice and straw balers has increased in these four districts. Since 2012, area under zero tillage and happy seeder has been increasing day by day.

Demonstrations on various technologies were conducted at KVK farm to serve the purpose of showcasing the technology to farmers who frequently visited KVK for various reasons and sensitizing them for its adoption. The milk production in NICRA village has also increased by 20-25 per cent due to adoption of these interventions. Pindi Blochan, a village in the district of Faridkot was declared a burning free village in 2016. The information from the pollution control board and remote sensing supported the low level of residue burning. This might be due to implementation of climate resilient improved varieties together with better water and healthy soil management techniques.

Plausible reasons for poor adoption of particular climate-resilient technology

The constraints in the adoption of any novel agricultural technology included nature of the technology, the way in which it is conveyed to the farmers and the attitude and perception of the farmer about the technology. It was observed that among the various socio-economic reasons, higher cost of inputs with RBQ of 79.50, followed by psychological mindset with RBQ of 75.83 were the main reasons for poor adoption of particular crop residue management technology as mentioned in Table 2. Growers have varying perceptions that there will be poor and uneven germination of wheat crop and ultimately it will reduce yield of crop. They preferred to follow the conventional practices of clean cultivation.

Small and marginal farmers have less active participation in extension activities (technology demonstrations) as compared to big farmers. After discussion with the peers (big farmers), they

Table 2. Ranking of social and economic constraints for poor adoption of particular climate-resilient technology

S. No.	Social and economic constraints	RBQ	Rank
1	High cost of inputs/ machinery	79.50	I
2	Lack of linkages with extension functionaries	64.40	IV
3	Lack of empathy for environment	40.60	IX
4	Psychological mindset	75.83	II
5	Topography/climatic variability	52.00	VI
6	Peer pressure	54.10	V
7	Lack of technical guidance/expertise	40.33	X
8	Social bindings	70.20	III
9	Marketing uncertainty & fluctuations	50.00	VII
10	Stereotype nature	48.17	VIII

expressed satisfaction for a particular technology. Small farmers learnt about the technology from the experiences in their surroundings (seeing is believing). Due to lack of experience, these farmers were not so optimistic about new advancements in agriculture sector. Generally, farmers tend to rely on the opinion of the fellow farmers prior to adopting or using any new practices/technologies. Farmers were sceptical about technology unless other farmers used these technologies successfully on their farm. Topography/climatic variability were the other constraint due to varying climatic conditions in different regions.

CONCLUSION

Majority of NICRA interventions appeared to be promising in terms of imparting resilience. PAU-KVKs demonstrated technologies related to natural resource management, crop production, soil health and livestock to improve livelihood of farmers. Survey findings showed that adoption of agricultural practices depended on location, infrastructure, market forces and social preferences. A favourable influence of the exhibited technologies on social and economic aspects of farmer's life was witnessed in NICRA village. Psychological mindset of farmers played a greater role in the adoption of any intervention. It has been seen that there was increased cooperation and cohesiveness among the farmers of the NICRA villages after the introduction and implementation of the project. More efforts are required to demonstrate the region-specific climate-resilient technologies and extend their benefits to a larger number of farmers.

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Economic Analysis and Resource Use Efficiency of Cotton Production in Haryana

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ABSTRACT

The study was conducted on the economic analysis of cotton crop and its returns in two districts viz. Sirsa and Hisar of Haryana selected purposely having the highest area. The collected data was used to calculate the cost and returns and resource use efficiency of cotton crop in Haryana. The cost benefit ratio for the study area came out as 1:1.22, 1:1.04 and 1:1.13 Sirsa, Hisar and overall, respectively. The findings concluded that resource use efficiency of the cotton farms is showing decreasing returns to scale in both Sirsa (0.419) and Hisar (0.413) districts, which means that there is no scope for improvement in the yield of cotton and there is over-utilization of the resources for the cotton cultivation in Haryana.

INTRODUCTION

Cotton is botanically identified as *Gossypium* spp. and is a member of the mallow family (Malvaceae). Cotton can be cultivated in a variety of soil types, but medium to deep black clayey soil is the most ideal. Farmers can also grow cotton on sandy and sandy loam soil by adding additional irrigation (Ahmad et al., 2016). Both irrigated and rain-fed systems are used to cultivate cotton. In Haryana, the total area planted with cotton was 6.95 lakh hectares, yielding 20.5 lakh bales at a rate of 500 kg/ha in the year 2021–2022 (Singh et al., 2022). As a result, even if the area planted in cotton has reduced from the previous year, production and yield per hectare have increased, indicating that farmers have adopted improved farming practices (Kumari et al., 2022). Understanding and awareness of stakeholder views and opinions may assist in planning and management of the Bt cotton production. (Yadav et al., 2017). By generating direct and indirect jobs in the industrial and agricultural sectors, cotton has a prominent position among several cash crops that influence the nation's economic growth at various stages (Gamanagatti et al., 2012).

Resource use efficiency has a substantial impact on agricultural revenue and production. (Singh et al., 2021). The economic analysis

tools may be used to assess the feasibility of cultivation practices (Kumar et al., 2021). The most crucial inputs in agriculture are labour, seeds, bullock labour, hired labour, working capital, farm equipment and machinery, irrigation systems, manure and fertilisers, and crop protection methods (Shelke et al., 2016). The efficiency with which farmers can utilise these resources influences the income from their farms. The income and savings of farmers can be enhanced by using available resources more effectively (Shankar & Naidu, 2017).

METHODOLOGY

The present study was carried out in Haryana state. Two districts were selected purposively from the State namely, Sirsa and Hisar as these districts have the highest area under cotton. Blocks were selected at random from each selected district namely, Dabwali and Sirsa, from the Sirsa district, Adampur and Uklana from the Hisar district. Two villages were selected randomly from each selected block. In this way, a total number of eight villages, viz; Ashakhara and Ganga from Dabwali block; Kelnia and Khairkan from Sirsa block of Sirsa district. Sadalpur and Siswal from Adampur block; Prabhuwala and Surewala from Uklana block from Hisar district

were selected. For computing, the cost and returns of the cotton crop; cost of farm inputs, variable as well as fixed cost, gross returns, returns over variable cost and net returns of cotton growers were calculated separately for both the districts i.e. Sirsa and Hisar. Data on a variety of costs, including preparatory tillage, seed, fertiliser, plant protection chemicals, human labour, machine labour, irrigation, harvesting, etc., were calculated for various types of farms. These expenses made up the operating capital. Also, a 10 per cent annual interest rate was calculated on the working capital. The variable cost was made up of interest and working capital combined. The rental value of the land, transportation cost, management fees, and risk considerations were all included in the calculation of the fixed cost of cultivation per acre. By adding the variable cost to the fixed cost, the overall cost was approximated. The per-acre cotton yield was multiplied by the actual price paid to the farmers to determine gross returns. The net return and returns over variable costs were computed by subtracting the corresponding costs from the gross returns. Also, production function analysis was applied to calculate the cotton production's resource use efficiency.

RESULTS AND DISCUSSION

The costs incurred and returns realized from the cotton cultivation by the respondents are presented in Table 1. It could be seen from the table that in Sirsa district, the total cost occurred in cultivation of cotton was Rs. 118310 per ha, out of that 61.98 per cent was variable cost and 38.02 per cent was fixed cost. In the variable cost, the share of human labour for harvesting/picking was major factor amounting to Rs. 21104 (17.84%). Other major variable costs such as plant protection chemicals, fertilizers and seed contributed 16.07, 7.40 and 3.57 per cent of the total cost occurred in cultivation, respectively. Among the fixed cost, rental value of land accounted the highest cost i.e., Rs. 26163 (22.11%). Management charges, risk factor and transportation accounted for 6.20, 6.20 and 3.51 per cent of the total cost respectively.

Similarly, for Hisar district, the total cost occurred in cultivation of cotton was Rs. 110170 per hectare, out of that 61.33 per cent of the total cost was variable cost and 38.67 per cent was fixed cost. In variable cost, the share of plant protection was major

Table 1. Cost of cultivation and returns of Cotton production in Sirsa, Hisar and Overall (Rs./ha)

S.No.	Particulars	Sirsa			Hisar			Overall		
		Qty.	Value	%*	Qty.	Value	%*	Qty.	Value	%*
1	Preparatory tillage	2.2	3326	(2.81)	2.4	3410	(3.10)	2.3	3368	(2.95)
2	Pre-sowing Irrigation		1361	(1.15)		1435	(1.30)		1398	(1.22)
3	Sowing		1360	(1.15)		1243	(1.13)		1301	(1.14)
4	Ridging		396	(0.33)		381	(0.35)		388	(0.34)
5	Seed (qtl.)	5.4	4227	(3.57)	6.0	4454	(4.04)	5.7	4341	(3.80)
	(a) Nitrogen	294.7	1769	(1.49)	285.8	1715	(1.56)	290.2	1742	(1.52)
	(b) Phosphatic	87.3	2074	(1.75)	108.7	2622	(2.38)	98.0	2348	(2.06)
	(c) Potassic	76.7	1423	(1.20)	90.9	1561	(1.42)	83.8	1492	(1.31)
	(d) Zinc Sulphate	15.3	495	(0.42)	18.1	598	(0.54)	16.7	547	(0.48)
	(e) Magnesium		2140	(1.81)		1310	(1.19)		1725	(1.51)
	(f) Sulphur		849	(0.72)		623	(0.57)		736	(0.64)
6	Total Fertilizer Investment		8750	(7.40)		8428	(7.65)		8589	(7.52)
7	Fertilizer Application		899	(0.76)		901	(0.82)		900	(0.79)
8	Irrigation	5.2	3085	(2.61)	4.7	3063	(2.78)	4.9	3074	(2.69)
9	Hoeing/Weeding									
	(a) Chemical									
10	(b) manual		4403	(3.72)		4254	(3.86)		4328	(3.79)
11	Plant Protection	4.1	19016	(16.07)	4.0	22415	(20.35)	4.0	20716	(18.13)
12	Harvesting/Picking		21104	(17.84)		12430	(11.28)		16767	(14.68)
13	Miscellaneous		2242	(1.90)		2244	(2.04)		2243	(1.96)
	Total (1to 13)		70170	(59.31)		64657	(58.69)		67413	(59.01)
14	Interest on working Capital		3158	(2.67)		2910	(2.64)		3034	(2.66)
	(A) Variable cost (1 to 14)		73327	(61.98)		67566	(61.33)		70447	(61.67)
15	Management charges		7333	(6.20)		6757	(6.13)		7045	(6.17)
16	Risk factor		7333	(6.20)		6757	(6.13)		7045	(6.17)
17	Transportation		4155	(3.51)		4155	(3.77)		4155	(3.64)
18	Rental value of land		26163	(22.11)		24935	(22.63)		25549	(22.36)
	(A) Fixed Cost (15 to 18)		44983	38.02		42603	38.67		43793	38.33
	Total Cost (A + B)		118310	(100)		110170	(100)		114240	(100)
	Production (qtl./ha)	16.0	144384		12.8	114605		14.4	129494	
	Gross return		144384			114605			129494	
	Return over variable cost		71056			47039			59048	
	Net return		26074			4435			15255	
	Cost of Production/(qtl.)		7383			8600			7924	
	B:C Ratio		1:1.22			1:1.04			1:1.13	

component amounting to Rs. 22415 (20.35%) followed by picking (11.28%), fertilizers (7.65%), seed (4.04%) and irrigation (2.78%). The findings were similar to Dhakal et al., (2018) & Ahmad et al., (2019) who revealed that variable costs such as expenses on plant protection, fertilizers and labour charges form the major portion of total cultivation costs.

The average yield of cotton was 16 qtl/ha in Sirsa and 12.8 qtl/ha in Hisar. The gross returns were found to be Rs. 71056 and Rs. 47039 in Sirsa and Hisar districts, respectively, whereas net returns from both the districts were found to be Rs. 26074 and Rs. 4435, respectively. The cost of production was found Rs. 7383 per qtl in Sirsa and in case of Hisar it came out to be Rs. 8600 per qtl. The BC ratio was found to be 1.22 and 1.04 for Sirsa and Hisar, respectively. Overall total cost of cultivation was found to be Rs. 114240 while the gross and net returns were Rs. 129494 and Rs. 15255, respectively. The BC ratio on total cost was estimated to be 1.13. The findings were similar to Abid et al., (2011) who revealed that cotton is a profitable crop enterprise in areas where there is water scarcity.

Resource use efficiency

For cotton cultivation, Cobb-Douglas production function has been estimated. Marginal value productivities (MVPs) of various inputs that were employed and whose regression coefficients were determined to be significant were derived from the empirical production function. The coefficient of regression, standard error, and multiple determination coefficient of the production function suitable for the cultivation of cotton on sample farmers in the research areas are shown in Table 2. The estimated multiple determination coefficient (R^2) disclosed that selected inputs human labour, machine labour, seed, fertilizers, plant protection and irrigation were capable of explaining 61.42 and 78.98 per cent variation in cotton production in Sirsa and Hisar district, respectively. In Sirsa district, the magnitude of coefficient of

regression of machine labour and fertilizer were found positive and statistically significant at 1 and 5 per cent level of significance, respectively. This indicates that cotton production increased with an increase in machine labour and fertilizer. For example, the production function indicates that by increasing one per cent quantity of fertilizer cotton production could increase by 0.12 per cent keeping the level of other inputs constant. The magnitude of coefficients of human labour, plant protection and irrigation were found negative but statistically non-significant.

In the case of the Hisar district, the estimated multiple determination coefficient (R^2) helped in finding that the selected inputs were capable of explaining about 79.00 per cent variation in cotton production. The magnitude of human labour and seed were positive and statistically significant, whereas, fertilizer coefficient, plant protection and irrigation were negative however statistically non-significant. It indicates that these inputs did not contribute significantly to cotton production. The positive and significant coefficients of regression indicated that cotton production increased with an increase in the respective inputs. The summation of regression coefficients indicated decreasing return to scale in both the districts i.e. 0.419 in the Sirsa district and 0.413 in Hisar district. It indicates one per cent increase in all the inputs used in production simultaneously would increase cotton output by less than one per cent. The marginal value productivity (MVP) of inputs whose coefficients of regression were found statistically significant in the production function was compared with their respective unit pricing in order to analyse the resource usage efficiency in the cotton production. The t-statistics, MVP deviation from unit pricing, and significance test were applied. The monetary return that results from using one more unit of input is represented by the MVP of a specific input. While a significantly lower MVP of an input from its unit price helped in revealing that the input is being used excessively and its usage needed to be reduced, a significantly higher value of MVP of an input against its unit price suggests that usage of that input can be increased in order to increase the cotton output. The results are backed by More & Shinde (2021), who revealed that increasing input usage increases the marginal output of cotton crop up to the point of equilibrium. Manjunath et al., (2013) also found that Bt cotton varieties respond positively to increased input and gives higher returns with balanced use of fertilizers. Yadav et al., (2018) reported unfavourable weather conditions and high cost of seed as the reasons for crop failure of crop, as such seed need to be looked into seriously.

In the Sirsa district, the difference between value of MVP of machine labour and fertiliser and their unit prices was found positive and statistically significant (Table 3) which indicates greater scope for using additional units of these inputs to increase the cotton production. The difference in MVP and unit prices of other inputs was found negative indicating that these inputs were over utilized. In the Hisar district, the difference between MVP and unit prices of human labour and seed was found positive and statistically significant indicating that selected inputs are underutilised and there is a scope for using additional units of these inputs. The difference between MVP and unit price of rest of the variables was found negative and non-significant. The findings were similar to Shafiq & Rehman (2000), who revealed that there

Table 2. Regression coefficient and standard error of cotton production in Sirsa and Hisar

Variables	Coefficient	
	Sirsa	Hisar
Constant	7.679	6.927
Human labour	-0.124 ^{NS} (0.131)	0.974* (0.058)
Machine Labour	0.433** (0.259)	0.028 ^{NS} (0.221)
Seed	0.044 ^{NS} (0.111)	0.081* (0.062)
Fertilizers	0.128** (0.063)	-0.013 ^{NS} (0.057)
Plant protection	-0.005 ^{NS} (0.048)	-0.303 ^{NS} (0.173)
Irrigation	-0.057 ^{NS} (0.196)	-0.354 ^{NS} (0.184)
Return to scale	0.419	0.413
R^2 (%)	Decreasing 61.42	Decreasing 78.98

Figures in parentheses indicate the standard error of estimated parameters, *Significance at 1% level, **Significance at 5% level

Table 3. Marginal value productivities of cotton production in Sirsa and Hisar

Input	Human Labour	Machine Labour	Seed	Fertilizers	Plant protection	Irrigation
MVP	-0.616	6.524	1.501	2.731	-0.040	-1.835
Price	1.000	1.000	1.000	1.000	1.000	1.000
Difference	-1.616	5.524**	0.501	1.731**	-1.040	-2.835
S.E. of MVP	0.131	0.259	0.111	0.063	0.048	0.196
t-value	-0.952	1.670	0.393	2.024	-0.109	-0.290
Hisar						
MVP	7.428	0.334	2.068	-0.223	-1.506	-8.737
Price	1.000	1.000	1.000	1.000	1.000	1.000
Difference	6.428*	-0.666	1.068*	-1.223	-2.506	-9.737
SE of MVP	0.058	0.221	0.062	0.057	0.173	0.184
t-value	16.926	0.127	1.304	-0.230	-1.751	-1.929

*Significance at 1% level, **Significance at 5% level

is high number of underutilized inputs in cotton cultivation.

CONCLUSION

Cost benefit ratio was found 1:1.22, 1:1.04 and 1:1.13 Sirsa, Hisar and overall. The calculated coefficient of multiple determinations (R^2) reveals that selected inputs were capable of explaining 61.42 and 78.98 per cent variation in cotton production in Sirsa and Hisar districts, respectively. The difference among MVP of machine labour and fertilizers and their unit price was found to positive and significant in Sirsa district. The findings concluded that the cotton farms are showing decreasing returns to scale in both Sirsa (0.419) and Hisar (0.413) districts. To increase cotton productivity the government should give the incentive like; quality of seeds, pesticide subsidy, training of farmers, machinery operations, raw materials and improve quality at par with the international standards with effective implementation of the Technology Mission on cotton.

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Yield Gaps and Scaling up of Sesame Variety (RT-351) in Potential Areas of Rajasthan

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ABSTRACT

The study evaluates the cluster front line demonstrations (CFLDs) conducted under the national food security mission on sesame (RT-351) by 26 KVKs of Rajasthan state. Four thousand one (4001) partner farmers responded to the study during 2016-2020. The CFLDs were undertaken in a 172.00 ha area in 26 districts during these five years. Yield gaps and technology index were calculated under the study. The result shows an extension gap of 1.35 q ha⁻¹ and a technology gap of 2.78 q ha⁻¹. The technology index was found to be 35.11 per cent, while a yield advantage of 36.17 per cent was found in CFLDs. KVKs of Rajasthan state could add Rs. 1.45 crores to the income of partner farmers. The improved variety & better extension services significantly enhanced production and productivity. Participatory approaches in the sesame seed supply chain and institutional linkage were critical for scaling up sustainable technology and improving farmers' access to quality and sufficiently improved seeds. More capsules per plant and resistance to stem & root rot attracted the farmers. Technical backstopping, supplying of seed, and seed exchange through farmer-to-farmer extension were crucial on a sustainable basis. Regular monitoring by experts and farmers' feedback is vital for sustained production and productivity improvement of the sesame crop.

INTRODUCTION

After cereals, oilseeds are the world's second-most important crop in India, accounting for 15.7 per cent of the gross cultivated area and 11 per cent of the total agricultural output value (Sri et al., 2022; Anonymous, 2020a; Singh et al., 2020). Globally, India, Myanmar, and China are the highest producers of sesame. In 2018 (6,016,000 MT) sesame was grown on 11,743,000 ha, yielding an average of 512 kg/ha. India is the second country where the cultivated area is 1.73 million hectares, producing 0.74 million tonnes (third rank) and contributing 12.4 per cent of global sesame production with an average yield of 431 kg ha⁻¹ (FAOSTAT, 2020). Globally, sesame seed consumption was USD 6559.0 million in 2018, expected to touch USD 7244.9 million by 2024, with a compound annual growth rate (CAGR) of 1.7 per cent (Myint et

al., 2020). Among the sesame-growing states in India, Gujarat is the leading state contributing 22.3 per cent, followed by West Bengal (19.2%), Karnataka (13.5%), Rajasthan (9.8%), and Madhya Pradesh (MP) (9.06%). Ranganatha et al., (2013) estimated the yield gap-I (between improved technology and farmers' practices) ranged from 23.5 per cent in Rajasthan to 72.1 per cent in Uttar Pradesh (UP). If the yield gap was bridged, the national sesame production could be increased to 1145.4 thousand tonnes from 785.6 thousand tonnes. Similarly, the yield gap-II (between improved technology and average state productivity) ranged from 5.9 per cent in Karnataka to 775.1 per cent in UP. The national sesame production could be increased to 2097.6 thousand tonnes from 1145.4 thousand tonnes by bridging the yield gap II. Alike oilseeds, in pulses technology gap is observed more than extension gap at farmers field (Kumbhare et al., 2014; Nain et al., 2014; Nain

et al., 2015). Kushahwah et al., (2018) reported that the average yield gap in sesame production technology was from 0.5 to 2.0 q ha⁻¹ in MP. Under CFLDs, the additional net return of Rs. 7669 was observed.

The CFLDs were found very useful in increasing farmers' knowledge and adoption levels. These CFLDs created greater awareness and motivated the farmers to adopt appropriate oilseed production technologies (Patil et al., 2018 & 2019). However, the improved variety could not reach many farmers due to casual field extension approaches and farmers do not consider sesame a major crop and lack of access to improved seeds. As a result, the production and productivity of sesame in Rajasthan are very low and the farmers do not get the potential benefit. Therefore, this research initiated a demand-driven approach and linkage among the concerned stakeholders in order to enhance the adoption and dissemination of the RT-351 variety. To enhance sesame production, the Government of India has devised a scheme to encourage sesame production by conducting CFLDs on oilseeds under the national food security mission (NFSM). The present study conducts and evaluates the performance of CFLDs on sesame laid out in 26 districts of Rajasthan state from 2016 to 2020.

METHODOLOGY

The present study evaluates the performance of CFLDs on sesame which were conducted under the supervision of the agricultural scientists of ICAR-ATARI, Zone-II, Jodhpur, and officials of the Ministry of Agriculture and Farmers Welfare, New Delhi. The CFLDs were laid out in 26 districts of Rajasthan state from the year 2016 to 2020. Data were solicited from 4001 partner farmers in the participatory mode. The variety used in this participatory research was RT-351, which was recommended for the state. The agronomic practices for implementing the research

were 30 cm and 15 cm between row and plant, respectively. A 2.0 to 2.5 kg seed rate and fertilizers at 40 kg Nitrogen, 25 kg Phosphorus, and 20 kg Sulphur per hectare were applied. Critical inputs like seed, bio-fertilizers, etc., costing up to Rs. 5000 per ha, were provided by KVKs. Institutional linkage among the diverse actors and strong information exchange between all stakeholders leads to effective technology scaling up. The scaling-up activity was adopted from Linn et al., (2010). The KVK scientists were engaged in selecting partner farmers, site selection, clustering for demonstrations, sowing, organizing field days, interaction for feedback, and other critical stages. The training on a package of practices of RT-351 for partner farmers was given by KVKs. Field days at farmers' fields were arranged to create informal contact for two-way communication, learning and feedback on the technology demonstrated.

RESULTS AND DISCUSSION

The scaling-up activity was adopted from Linn et al., (2010). The conceptual framework of scaling up activity is presented in Figure 1. It involves three phases. In innovation phase, testing, verification, and validation of sesame technologies were done and covered the previously implemented research experiments and participatory evaluation of improved sesame varieties i.e., RT-351 which had a yield advantage of up to 801 kg ha⁻¹ compared to the local cultivars. The RT-351 variety is recommended based on its high yield performance and resistance to macrophomina stem and root rot, leaf curl, and phyllody. The demonstrations are a critical tool for extension promotion allowing the farmers to evaluate, test, and learn about the new technologies (Mbure & Clare, 2017). Farmers are more likely to test the new technology with higher expected benefits and relatively lower risks (Pannell et al., 2006). During the learning phase, farmers learned by observing the

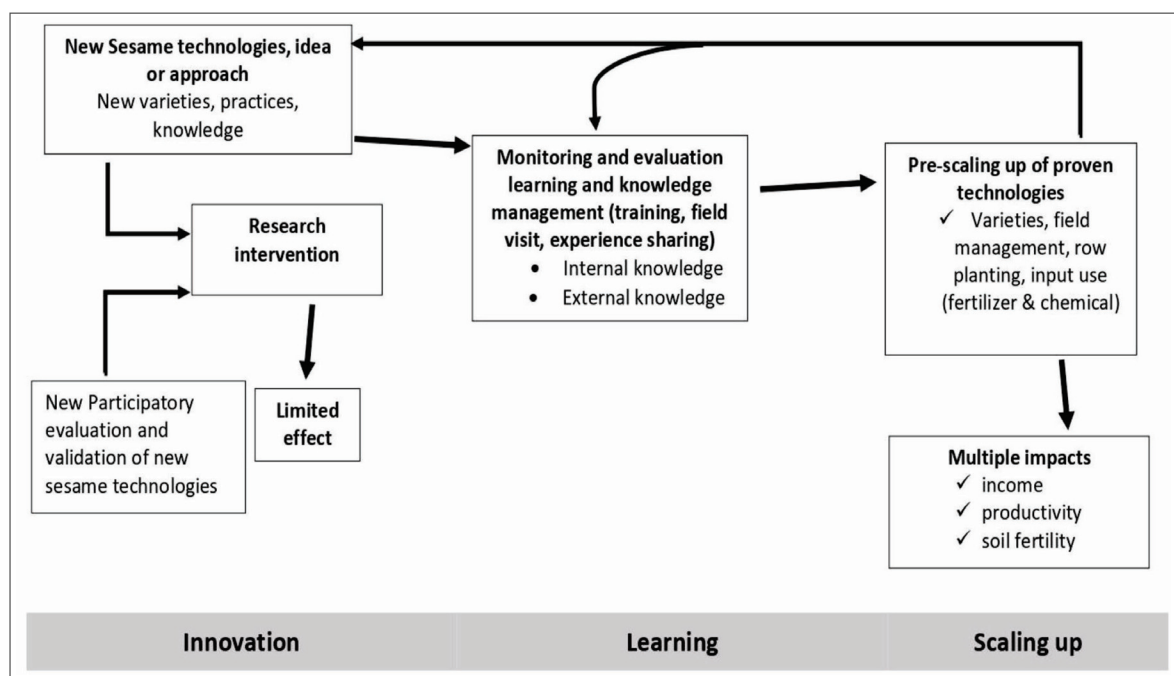


Figure 1. Conceptual framework of the scaling-up activity
Source: Adopted from Linn et al., (2010)

demonstration plots, and group dynamics taught each other. The farmers and other actors were capacitated through training and field visits and contributed by forwarding their feedback. The innovations or technologies demonstrated and tested during the innovation and learning phases were brought to a large scale-up in the scaling-up phase. The results of the study have been presented in the sub-headings as given below.

Capacity building and demonstration of improved variety of sesame

Capacity building of various stakeholders is vital in transferring innovations among the farming community through the extension systems. New technologies' adoption and diffusion rate increased when farmers' and extension personnel' knowledge, skill, and attitudes changed. For capacity building of KVK scientific staff, training/workshops on oilseed production technology were organized each year (2016-2020) by ICAR-ATARI, Jodhpur. Before implementing the activity, training was organized in each district for farmers on the full production package of the improved sesame variety. A total of 4001 farmers were trained in sesame agronomical production and seed production during the implementation period.

Farmer's attitudes and opinions towards the introduced improved variety of sesame, seed production, and marketing were remarkably changed due to continuous training; field monitoring, partnership strength, market linkage and access to improved seed, and experiences of production and marketing activities. An improved variety of the sesame (RT-351) variety was used for the pre-scaling up based on farmers' preferences. A total of 4.3 tons of improved seeds were demonstrated during implementation, and more than 1721 ha of land were covered. Most importantly, the technology was spread over sesame production potential areas through a farmer-to-farmer seed exchange. As a result, many farmers benefited from easy access to improved seeds through direct seed marketing, farmer-to-farmer seed exchange systems, and revolving seed. As traced back from each district's agriculture office, more than 83.00 ha of the area was covered with improved variety of sesame (RT-351) seed during the implementation period through farmer-to-farmer seed exchange systems.

Yield advantage of growing improved variety of sesame

Table 1 depicts the yields of sesame in the various districts of Rajasthan. The average productivity of sesame in the

Table 1. Yield increased & gap minimized in sesame in Rajasthan, India (n=4001)

S.N.	KVKs	Number of CFLDs	Yield gap minimized (q/ha)							
			Farmers' practices (q ha ⁻¹)	CFLDs (q ha ⁻¹)	Potential (q ha ⁻¹)	Yield increase (CFLDs-FP) (q ha ⁻¹)	Yield increase (%)	Extension gap (q ha ⁻¹) {CFLD- FP q ha ⁻¹ }	Technology gap (q ha ⁻¹) {potential- CFLD q ha ⁻¹ }	Technology index (%)
1.	Ajmer	220	4.53	6.96	8.00	2.43	53.47	2.43	1.04	13.00
2.	Alwar-I	70	3.42	4.77	8.00	1.35	39.47	1.35	3.23	40.37
3.	Alwar-II	58	2.42	2.92	8.00	0.50	20.66	0.50	5.08	63.50
4.	Barmer-II	40	2.10	2.87	7.00	0.77	36.67	0.77	4.13	59.00
5.	Baran	115	4.25	4.85	8.00	0.60	14.05	0.60	3.15	39.37
6.	Bharatpur	219	4.29	4.94	8.00	0.65	15.01	0.65	3.06	38.25
7.	Bhilwara-I	125	4.24	5.75	8.00	1.51	35.57	1.51	2.25	28.12
8.	Bhilwara II	75	4.85	6.35	8.00	1.50	30.93	1.50	1.65	20.62
9.	Churu-I	150	3.18	4.56	8.00	1.38	43.25	1.38	3.44	43.00
10.	Dholpur	411	6.27	8.01	8.00	1.74	27.66	1.74	-0.01	-0.12
11.	Jaipur-I	297	4.40	6.04	8.00	1.64	37.22	1.64	1.96	24.50
12.	Jaisalmer-I	63	2.69	3.62	8.00	0.94	34.85	0.94	4.38	54.75
13.	Jaisalmer-II	25	2.87	3.92	8.00	1.05	36.59	1.05	4.08	51.00
14.	Jalore	140	4.80	6.53	8.00	1.73	36.04	1.73	1.47	18.37
15.	Jodhpur-I	225	3.37	4.84	8.06	1.47	43.59	1.47	3.22	39.96
16.	Jodhpur-II	50	3.48	3.95	8.00	0.47	13.51	0.47	4.05	50.62
17.	Karauli	325	5.13	6.12	8.00	0.99	19.17	0.99	1.88	23.50
18.	Nagaur-I	110	3.30	4.39	8.00	1.09	33.00	1.09	3.61	45.12
19.	Nagaur-II	150	3.34	4.27	8.00	0.94	28.14	0.94	3.73	46.62
20.	Pali	285	3.57	4.86	8.00	1.29	36.05	1.29	3.14	39.25
21.	Rajsamand	166	3.77	5.13	8.00	1.37	36.18	1.37	2.87	35.87
22.	Sawaimadhopur	200	4.36	6.20	8.00	1.85	42.32	1.85	1.80	22.50
23.	Sirohi	275	4.29	5.70	8.00	1.41	32.74	1.41	2.30	28.75
24.	Sriganganagar	25	3.61	6.90	8.00	3.29	91.14	3.29	1.10	13.75
25.	Tonk	107	4.60	7.05	8.00	2.45	53.26	2.45	0.95	11.87
26.	Ajmer	75	2.51	3.09	8.00	0.58	23.16	0.58	4.91	61.37
Total		4001	-	-	-	-	-	-	-	-
Average		-	3.83	5.18	7.96	1.35	36.17	1.35	2.78	35.11

Source: Primary data collected from 2016 to 2020

Table 2. Economics of CFLDs on sesame (RT-351) in Rajasthan, India (n=4001)

S.S.N.	KVks	Area (ha)	CFLDs	Economics of FP (Rs/ha)			Economics of CFLDs (Rs/ha)			Total income enhancement (Rs.)		
				Gross cost	Gross return	Net return	B:C ratio	Gross cost	Gross return		Net return	B:C ratio
1.	Ajmer	110.00	220	17442.50	44688.92	27246.42	2.60	20367.00	62603.49	42236.49	3.09	1,855,942.00
2.	Alwar-I	30.00	70	12350.00	37620.00	25270.00	3.05	12800.00	52470.00	39670.00	4.10	432,000.00
3.	Alwar-II	30.00	58	19208.00	20570.00	1362.00	1.07	20625.00	24787.76	4162.76	1.20	84,022.80
4.	Barmer-II	30.00	40	13980.00	18900.00	4920.00	1.35	16225.00	25830.00	9605.00	1.59	140,550.00
5.	Baran	60.00	115	18593.00	28035.00	9442.00	1.42	19658.00	32303.00	12657.25	1.58	192,915.00
6.	Bharatpur	87.60	219	17666.67	24737.83	7071.17	1.41	19500.00	30696.58	11196.58	1.58	338,984.10
7.	Bhilwara-I	50.00	125	9500.00	32454.16	22954.00	3.42	11450.00	43969.50	17519.50	3.84	499,940.00
8.	Bhilwara II	30.00	75	10050.00	30313.00	19813.00	3.02	11650.00	41290.25	29641.00	3.54	294,840.00
9.	Churu-I	60.00	150	13876.00	33429.25	19553.25	2.33	15021.75	49009.25	33987.50	3.26	895,030.00
10.	Dholpur	170.00	411	14367.50	36165.75	21798.25	2.51	15604.00	46214.48	30610.48	3.00	1,412,945.54
11.	Jaipur-I	118.80	297	14919.00	28409.78	13490.78	1.90	17283.00	39193.04	21910.04	2.24	1,053,635.20
12.	Jaisalmer-I	30.00	63	11225.00	17665.00	6440.00	1.57	13480.00	23843.75	10363.75	1.77	110,155.00
13.	Jaisalmer-II	10.00	25	13450.00	19674.00	6224.00	1.46	15560.00	26872.00	11312.00	1.73	50,880.00
14.	Jalore	80.00	140	14633.33	31429.17	16302.67	2.15	15866.67	42752.00	26885.17	2.69	915,325.00
15.	Jodhpur-I	90.00	225	8827.50	23214.75	14387.25	2.66	9802.50	32007.50	22205.00	3.36	813,540.00
16.	Jodhpur-II	20.00	50	13320.00	27403.50	14083.50	2.10	15234.50	36681.00	21446.50	2.40	147,260.00
17.	Karauli	130.00	325	16887.25	44993.75	28106.50	2.83	17782.25	53051.25	35269.00	3.15	933,900.00
18.	Nagaur-I	50.00	110	11458.33	21761.38	10303.04	1.87	12936.67	28938.26	16001.59	2.20	254,688.30
19.	Nagaur-II	60.00	150	15977.78	21426.87	7401.25	1.34	17299.56	27839.48	10539.92	1.61	336,153.40
20.	Pali	130.00	285	12200.00	26613.47	14413.47	2.35	12739.52	33182.68	20443.17	2.77	782,255.00
21.	Rajsamand	70.00	166	9125.00	31298.75	22173.75	3.47	10625.00	42444.75	31819.75	4.13	713,360.00
22.	SawaiMadhopur	80.00	200	11542.50	28934.00	17401.00	2.00	12338.00	39258.50	26920.50	2.72	823,050.00
23.	Sirohi	110.00	275	15115.58	27201.02	12085.19	1.61	16676.33	35287.21	18610.96	1.89	734,093.00
24.	Sriganganagar	10.00	25	24240.00	40375.95	16135.95	1.67	25260.40	47847.90	22587.50	1.89	64,515.50
25.	Tonk	44.80	107	12450.00	39575.00	27125.00	3.17	14650.00	51175.00	36525.00	3.49	419,680.00
26.	Ajmer	30.00	75	5650.00	9625.00	3975.00	1.66	7250.00	19300.00	12050.00	2.66	245,500.00
	Total	1721.20	4001.00	-	-	-	-	-	-	-	-	14,545,159.84
	Average	-	-	13771.34	28712.13	14979.94	2.15	15,295.58	8,032.64	22,160.63	2.60	-

Source: Primary data collected from 2016 to 2020

demonstration fields was higher than the farmers' methods. Rai et al., (2012) found an average yield of CFLDs as 4.70 q ha^{-1} , which was 1.01 q ha^{-1} higher than the check (3.69 q ha^{-1}). Tripathi & Singh (2012) also reported a 17 per cent more yield of sesame i.e., 4.10 q ha^{-1} , which was 0.88 q ha^{-1} higher than farmer's practices (3.22 q ha^{-1}). Singh et al., (2019) observed an average yield of CFLDs on sesame as 5.65 q ha^{-1} , which was 1.75 q ha^{-1} higher than the check (3.90 q ha^{-1}). He also found an extension gap of 1.75 q ha^{-1} . Meena et al., (2017) recorded an average yield under CFLDs as 6.63 q ha^{-1} , which was 1.95 q ha^{-1} higher than farmer's practice (4.68 q ha^{-1}). During 2017 to 2018, an enrichment of 2.0 q ha^{-1} was observed where the average yield was 6.98 q ha^{-1} (Meena et al., 2018). The highest yield (8.01 q ha^{-1}) was found in Dholpur under the CFLD. The rationale behind the high productivity may be attributed to the good soil and water availability, especially during capsule formation; therefore, it exceeded the potential yield of 8 q ha^{-1} . The lowest yield was (2.87 q ha^{-1}) recorded in Barmer-II; only the Barmer district demonstrated the RT-346 variety in the Kharif 2020 season due to adverse conditions. Under the farmers' practices yields ranged from 2.10 q ha^{-1} (Barmer-II) to 6.28 q ha^{-1} (Dholpur). Overall, an average increase in grain yield of sesame under the CFLD was noticed as 1.34 q ha^{-1} . During the five years, the yield was 36.17 per cent higher than the farmers' yield. Rai et al., (2012) reported a higher yield of 1.01 q ha^{-1} through FLDs, while mass-scale adoption of sesame production technology increased the farmers' satisfaction and knowledge level.

Improving economic performances of sesame through CFLDs

Table 2 depicts the economic performance of sesame crop under CFLDs. The economic analysis indicated that sesame had a better net return from recommended practice over five years. Recommended techniques yielded a higher net return (Rs. 22160.63/ha) and average benefit-cost ratio for sesame (1:2.60), respectively as compared to the farmers' practices (Rs. 14979.94/ha and 1:2.15, respectively). The higher net returns and B:C ratio in the sesame demonstration might be due to the higher grain yield and better market pricing. During these five years, a total of 4001 CFLDs were conducted by KVKs in a 1721.20 ha area in the state. These CFLDs were added to Rs.1.45 crores as an additional income in the state economy (Figure 2).

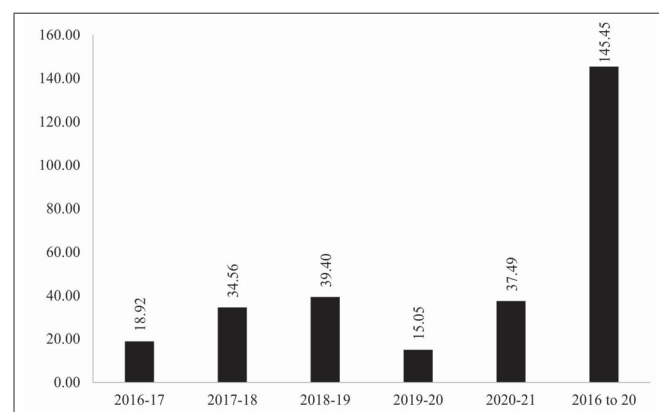


Figure 2. Income enrichment through CFLDs in Sesame, Rajasthan, India (lakhs)

Extension advisories, facilitating policies and constraints

Field day is one of the pre-scaling-up activities for the technology and it is vital in creating demand and promoting technologies to farmers and other stakeholders for getting feedback. The KVK's scientists organized the field days, subject matter specialists, and farmers at the demonstration sites; which include field visits, experience sharing, and detailed discussions on the demonstrated technologies. During the field visits, farmers explained that they were growing sesame because it holds the key as a potential rotational crop, edible oil, and high market value. Most farmers were interested and happy with the variety of sesame (RT-351) for its higher yield than their local variety. This variety has white and bold seeded and multi capsules per plant. Experts confirmed that the variety is suitable for Rajasthan and has good performance. The future of the sesame seed market is unpredictable because of the heavy rainfalls and frequent droughts in Rajasthan. The government of India is also encouraging farmers to grow sesame by increasing the MSP rate every year. During 2016-17, the MSP of the sesame crop was Rs. 5000/q and in 2020-2021, the MSP was Rs. 6855/q. Moreover, it is evident from the Figure 3. It is proven that sesame grain has high nutritive values; hence farmers use it to grow sesame. The sesame seed can be made available to other farmers under the informal seed system. Out of the total production, 3.61 per cent of produce is kept for home consumption and nearly 11.16 per cent of farmers have stored it as seeds for the next season and also promoted the farmer-to-farmer exchange for this variety of sesame (computed by authors based on KVK's feedback) and remaining product (85.23%) was sold out immediately after harvesting. Most farmers must sell their produce above MSP at the local market. The main reasons for the low productivity of sesame are its rainfed cultivation in marginal and sub-marginal lands under poor management and input-starved conditions. However, improved varieties and agro-production technologies capable of increasing the productivity levels of sesame are now developed for different agro-ecological situations in the country. A well-managed crop of sesame can yield $1200\text{-}1500 \text{ kg ha}^{-1}$ under irrigated and $800\text{-}1000 \text{ kg ha}^{-1}$ under rainfed conditions. Erratic rainfall (drought and higher rainfall) in the state affected the yield from 2016 to 2020. Farmers responded that disease & insect infestation (specifically phyllody and leafhopper) and lack of access to quality chemicals at a reasonable cost are severe constraints for sesame production in Rajasthan. A few farmers also reported that they faced post-harvesting losses due to a lack of storage facilities.

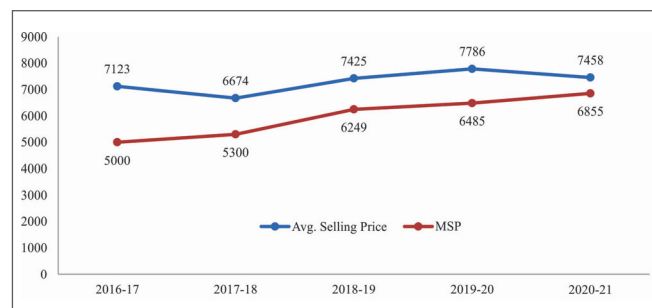


Figure 3. Selling price and minimum support price of sesame from 2016 to 2021

CONCLUSION

Sesame is a protein-rich edible oil crop that can be grown in almost all areas at 25-35°C temperature. In the intervention areas, sesame production and productivity enhanced due to improved varieties and better extension services. Improved variety of sesame (RT-351) had a yield advantage of 36.17 per cent and generated an additional income of 1.45 crore. Large-scale demonstrations of this variety, exhibited more capsules per plant and resistance to stem and root rot, which attracted farmers and resource persons' attention to grow this variety in the coming year. The results suggested that technical backstopping and supplying of early generation seed, and introducing seed exchange through farmer-to-farmer extension are crucial to crop production and productivity improvement on a sustainable basis.

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Descriptive Analysis of Attitude Towards Students READY Programme

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ABSTRACT

The 5th deans committee of ICAR has framed a comprehensive student READY programme syllabus for all of the agricultural and allied disciplines. It is a crucial component of the four-year bachelor's degree programme in agriculture offered by all colleges. It shows a lot of promise for producing better agricultural technocrats with a high degree of expertise combined with a contemporary approach and improved managerial abilities. This study was done to find out how students felt about the Student READY programme and how it related to the student's character attributes. The three collage of agriculture university Jodhpur i.e. Jodhpur, Nagaur, and Sumerpur were purposively selected and data were collected from 140 undergraduate students. The results indicated that most students have a positive opinion of the Student READY programme and that there is a strong correlation between the programme and personal characteristics. The study's findings indicate that this program improved people's capacity for interpersonal and professional problem-solving as well as their communication and personality development.

INTRODUCTION

Personality development is a path of self-awareness that involves focusing on areas where you believe you can do better. Some courses can aid in improving personality development and soft skills like attitude, problem-solving, public speaking, teamwork, work ethic, career management, communication skill, flexibility, and adaptability. Kobba et al., (2020) & Singh et al., (2019) also suggested that entrepreneurs can be developed and nurtured through suitable interventions in the form of entrepreneurship development programmes and strategies rather than being born. The Student READY programme is one of the most recent endeavour of the Indian Council of Agricultural Research. Its goal is to reorient graduates of agriculture and related fields to ensure their employability and foster the growth of entrepreneurs for new knowledge in intensive agriculture. As per the Randhawa Committee's (1992) proposal, the efforts are done through the

Rural Agriculture Work Experience (RAWE), afterward known as the Students READY program. Undergraduate students interested in practical agriculture and related sciences can participate in the READY programme to gain real-world experience. The curriculum aids in boosting self-assurance, enhancing abilities, and acquiring Indigenous Technical Knowledge (ITK) of the area, thereby preparing graduates for self-employment. It also intends to offer chances for people to develop practical experience and entrepreneurial abilities. All of the fields in agriculture and related sciences have a specific curriculum for the student READY programme, according to the Fifth Deans' Committee. The course curriculum has been changed to help graduates acquire the necessary skills and entrepreneurial mindset to start their businesses, enhancing food security and rural livelihoods, sustain agriculture, and serve as catalysts for agricultural transformation. The program was introduced by the honorable prime minister on July 25, 2015, to assist students in starting their businesses and changing from

being job seekers to job creators. Students READY to offer B.Sc. (Hons.) Agriculture final year students in all of its constituent colleges, including the College of Agriculture, Jodhpur, Sumerpur-Pali, and Nagaur, have been adopted by the Agriculture University, Jodhpur. While on the village visit they gain an understanding of rural life, become familiar with farmers' socioeconomic circumstances and problems, receive diagnostic and remedial information that is pertinent to actual field situations, develop effective communication skills with farmers using the most recent extension methodologies for technology transfer, gain confidence and competence in their ability to solve complex agricultural problems and become acquainted with ongoing extension and research projects. It was believed that the following questions should be researched to understand the role of Students READY. How does this scheme help in changing the attitude of the students, what is the relationship between attitude and socio-personal, socio-economic, and communication characteristics of students, and what is its effect on the student's attributes. Considering the above queries in mind the present study entitled "Attitude and Association with personal traits of undergraduates towards Student READY at Agriculture University, Jodhpur" was undertaken at the Agriculture University, Jodhpur, Rajasthan.

METHODOLOGY

The present investigation was undertaken in three constituent colleges of agricultural university, Jodhpur, Rajasthan i.e. college of agriculture, Jodhpur, Sumerpur-Pali, and Nagaur. The students of B.Sc. agricultural fourth year academic year 2021-2022 and registered in the Students' READY programme were selected purposively for the study. The total students enrolled in B.Sc. agricultural fourth year academic year 2021-2022 at agricultural university Jodhpur was sixty, and Sumerpur-Pali was forty, and Nagaur was also forty. Thus the total sample size of respondents for present study was 140. A structured interview schedule was developed for collection of information from respondents. The relevant information were collected through personal interview method with the help of RAWE coordinators of respective colleges through the modified scale of Jakhar et al., (2017). The data were analyzed by using the mean score, standard deviation, MPS, rank, and correlation coefficient using SPSS V.18.

RESULTS AND DISCUSSION

The attitude of students toward the student READY program

Attitude is an important factor and is responsible for the adoption or rejection of any Innovation. It has to do with how much a psychological object has a favourable or negative effect. The attitude of the students has a critical role in the implementation of any innovation or new technology. This section of the study aims to know the level of attitude towards the Student READY programme. Based on the mean and standard deviation of the responses, the respondents were divided into three categories: most favourable, favourable, and unfavourable. The Table 1 revealed that the 60.72 percent of the students had a favorable attitude towards the student READY program followed by the most favorable (20.57%) and unfavorable attitude (10.71%) respectively. These results were supported by Lal et al., (2021); Jakhar et al., (2017) & Sharma (2018).

Table 1. Attitude of students toward the student READY program

Categories	Frequency	Percentage
Most favorable attitude (>65.61 score)	40	20.57
Favorable attitude (53.08 to 65.61 score)	85	60.72
Unfavorable attitude (< 53.08 scores)	15	10.71

Mean: 59.36, S.D.: 6.25

Further, based on the Mean Percent Score (MPS) of all 28 attitudinal statements, 15 statements were positive and 13 were negative. Each statement was assigned a rank based on calculated MPS. Those statements secured more than 50 per cent MPS counted as positive and the statement which has less than 50% score was named negative attitude.

Table 2 indicates that the statement "Students READY has helped me to learn about rural life" had ranked first by the respondents as it obtained the highest MPS (96.00), the statement "It has helped me to increase in knowledge about agriculture" assigned second rank with MPS (90.00), apart from this the statement "READY programme help student to develop favorable attitude towards farming enterprise and the farmers" had ranked third with 85.33 MPS. The findings can align with the major objective of the student-ready program that allows agriculture graduates to transform themselves into job providers rather than job seekers and the same trends were reported by the Jakhar et al., (2017); Sharma (2018) & Kumar et al., (2013). Low mean percent scores i.e. 42.33, 41.33 and 40.33 were obtained for the statements i.e. "READY has not helped me to reduce cost of cultivation", "READY has not helped me to know about the socio-economic condition of farmers" and "READY has not helped me to develop the ability of cooperation and teamwork skill". Singh et al., (2018) also reported the lack of teamwork and poor coordination among the constraints in RAWE and experiential learning programs. As is evident from the results above, students' readiness to acquire confidence and professional ability to solve field problems was evaluated as the most achieved aim, followed by improvement in communication skills. The major reason for the improvement of the confidence level of the students can be attributed to extensive extension activities that were part of the program. This allowed the students to develop a set of skills that allow expressing themselves in a better manner. Similar kind of findings reported by the Jakhar et al., (2017); Mahadik et al., (2011) & Kumar et al., (2013). They found that READY has helped students to familiar with rural life followed by READY has helped me to increase in knowledge of crops/ enterprises were the major statement attitude of students towards village attachment program. Lal et al., (2021) also observed similar findings where the student READY program helped in improving the confidence level as well as diagnostic skills of the students and made them competent to troubleshoot farm-based problems. Furthermore, it helped them formulate the farm plans for their household farms.

Relationship between attitude and Socio-personal, Socio-economic and Communication Characteristics of students towards Student READY Programme

Table 3 indicates that the education (R-value: 0.674), media exposure (R-value: 0.584), and extension agency contact (R-value:

Table 2. Attitude of students towards READY Programme

S.No.	Attitudinal statements	MPS	Rank
1.	READY has helped me to learn about rural life.	96.00	I
2.	It has helped me to increase in knowledge about agriculture.	90.00	II
3.	READY programme help student to develop favorable attitude towards farming enterprise and the farmers.	85.33	III
4.	READY improved my skills in the agricultural and allied area.	74.66	IV
5.	READY programme provide opportunity to student to meet with progressive farmers.	73.00	V
6.	It has helped me to improve my communication skills.	72.33	VI
7.	READY has helped me to learn real life experiences of rural condition.	71.00	VII
8.	READY has developed positive attitude toward self-employment among myself	70.33	VIII
9.	READY has helped me to gain practical experiences about agriculture.	69.66	IX
10.	READY has helped me to understand existing farming system prevailing in the village.	69.33	X
11.	READY has helped me to enhance technical proficient in performing variety of agricultural operations.	69.00	XI
12.	READY has helped me to know better about farmer's real life problems.	68.33	XII
13.	READY has helped me to gaining knowledge about rural population pattern of time utilization.	68.00	XIII
14.	READY has helped me to develop and improve managerial skills.	67.66	XIV
15.	READY is not useful for gaining experience of social system and rural institutions.	66.66	XV
16.	I haven't learned anything from READY about need analysis and programme planning.	53.33	XVI
17.	READY has not helped me to understand the sentiments of farmers.	50.33	XVII
18.	READY programme has not helped me to improve the marketing skill.	49.66	XVIII
19.	READY has not helped me to developing right attitude towards farming community.	48.00	XIX
20.	READY has not helped me to develop professional competence and confidence.	47.66	XX
21.	READY has not helped me to develop favorable attitude about the agricultural enterprise.	46.33	XXI
22.	READY has not helped me to enhance the yield of crops/ agricultural enterprises.	46.00	XXII
23.	READY has not helped me to gain exposure of rural livelihood security and survivability.	45.00	XXIII
24.	READY has not helped me to develop and improve leadership skill.	44.00	XXIV
25.	READY has not helped me to getting knowledge of rural culture background.	43.33	XXV
26.	READY has not helped me to reduce cost of cultivation.	42.33	XXVI
27.	READY has not helped me to know about the socio-economic condition of farmers.	41.33	XXVII
28.	READY has not helped me to develop ability of cooperate and teamwork skill.	40.00	XXVIII

0.525) factors were positively connected with students' attitudes regarding the student READY program, and the association was found to be significant at the 1% level of significance. This relationship met expectations, as it is believed that systematic learners will responsibly complete their work in a real-world setting to enhance their performance. Therefore, the alternative hypothesis was accepted and the null hypothesis was rejected. A similar kind of finding was reported by Lal et al., (2021). Background, occupation, annual income, and information-seeking activity all had non-significant correlations with students' attitudes regarding the Student READY program, according to the R-values. Therefore, the alternative hypothesis was disproved and the null hypothesis was accepted. Table 3 shows a positive link between education and attitude, which can be explained by the fact that people with greater education have wider horizons and are therefore exposed to more information, leading to a better grasp of the various concepts. The background of the students showed a negative correlation with the study READY program owing to the less exposure to the concepts of development by the virtue of the study READY program. Parental occupation demonstrated a negative association and can be seen in an individual's awareness that results from having a higher social position. Additionally, there was a bad association between the students' attitudes and their annual income. The clear impact of media exposure was seen as a very positive association between attitude and it. This outcome may be due to extensive information consumption and improved assimilation of emerging ideas that shaped attitudes. Due to the

Table 3. Correlation analysis between different variables with the attitude of students about student READY program

Variables	Correlation coefficient (r)
Socio-personal	
Education	0.674**
Background	-0.197
Socio-economic	
Occupation	-0.001
Annual income	-0.060
Communication Pattern	
Massmedia exposure	0.584**
Information seeking behavior	0.216
Extension agency contact	0.525**

student's strong commitment to studying, information-seeking behavior also shows a favorable link. Due to the methodical distribution of the material to the students, high extension agency contact showed a strong positive association. This connection demonstrates that registering for Kids READY is primarily done to help students get ready for the real world. Much of what college students learn influences how they will behave while placed in the villages through KVK. Students' ability to have a healthy relationship with farmers will serve them well throughout their careers and adult lives. This study will provide crucial proof that a person's personality, including academic drive and career desire, affects the kind of employee they become.

CONCLUSION

The program was established by the guiding ideas of “learning by doing” and “seeing believes,” which encourage independent thought and behavior. The majority of pupils come from rural backgrounds with parents who work in agriculture, have low levels of education, and have an annual income of fewer than two lacks per year. Positive attitudes toward students who develop personalities, communication skills, and the confidence to tackle practical obstacles were expressed by the students. Parental education, media exposure, and contact with extension organizations all had a good correlation with students’ attitudes. Instead of a single semester, a full crop season should be included in the program’s duration. Students profited from exposure to real-world field situations. They developed abilities in local problem identification and problem solutions in conjunction with scientists and professionals from KVKs and colleges due to their social ties to the farming community.

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Enhancing Effectiveness of Farm School through Community Wall Magazine (CWM): A Field Experimental Study

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ABSTRACT

A field experimental study was conducted in Aligarh District of Uttar Pradesh to assess the feasibility of enhancing the effectiveness of Farm Schools (FS) through Community Wall Magazine (CWM). Four treatments with two replications were taken in the study. Treatments were information sharing through CWM (T_1), information sharing through FS (T_2) and supporting information sharing through FS with CWM (T_3). Treatment T_0 was taken to eliminate the effect of extraneous variables. Before and after treatment score of gain in the knowledge level of farmers regarding paddy cultivation practices was measured with the help of a knowledge test developed for the study. Matching in terms of the general profile of the farmers under all the replications was ensured before exposure to the treatments. Total farmers under the study were 200. Through CWM 21.83 per cent enhancement in knowledge level regarding rice cultivation practices of the farmers was observed. Due to the effect of FS on rice, 47.18 per cent enhancement in knowledge level was observed. The FS on rice which were supported with the information sharing through CWM 61.02 per cent enhancement in the knowledge level of beneficiary farmers was observed.

INTRODUCTION

Communication is an essential prerequisite for development, which is getting the attention of development professionals in recent times. Communication for Development is a social process based on dialogue using a broad range of tools and methods. It is also about seeking change at different levels including listening, building trust, sharing knowledge and skills, building policies, debating and learning for sustained and meaningful change. It is not public relations or corporate communication (FAO, 2006). The communication for development process goes beyond information dissemination to facilitate active participation and stakeholder dialogue. It highlights the importance of raising awareness, the cultural dimensions of development, local knowledge, experiential learning, information sharing and the active participation of rural

people and other stakeholders in decision making (FAO, 2011). It is a tool for social and political transformation. It promotes participation and social change using the methods and instruments of interpersonal communication, community media and modern information technologies (SDC, 2016).

Under the Agricultural Technology Management Agency (ATMA) Scheme, Farm Schools (FS) are being operationalised at the Block/Gram Panchayat level. In general, one or two FS are organised in each block of the district. FS are set up in the field of outstanding or achiever farmers. Front Line Demonstrations in one or more crops and/or allied sectors is the core activity of the FS with focus on Integrated Crop Management (ICM), Integrated Pest Management (IPM), Integrated Nutrient Management (INM) etc. FS provides season-long learning to the target farmers (Directorate of Extension, 2018). It is based on the concepts of

experiential learning, information sharing and active participation of rural people. Learning in FS occurred through hands-on experience, observation, analysis and discussions. Farmers Field School (FFS) is a dynamic process that is practiced and controlled by the farmers to transform their observations to create a more scientific understanding of the crop/livestock agro-ecosystem (Khisa, 2004). There are two major outcomes of FFS, i.e., experiences gained by the farmers through learning by doing and analyzing the farm situations and identification of appropriate technology suitable for the local ecological, economic, social, cultural sub-systems of the farming community. However, the benefits of outcomes of FFS remain restricted to the group members of FFS. This limitation of FFS might be overcome by disseminating the outcomes of FFS in the farming community having similar situations through Community Wall Magazine (CWM). A CWM can be perceived as a group of inter-related articles (essay, story, poem, question-answer, etc.) designed and developed with the participation of the community members, displayed and read in public places, such as walls. CWM is a participatory communication tool that connects the farming community with experts in the dialectic process of understanding the conception of location specific farming. Participatory processes can lead to more inclusive and democratic perspectives of collective knowledge sharing and appropriation (Metcalfe et al., 2022). Participatory science communication promotes a positive cooperation of trust that extends the scientific-technological applications to the socio-economic level (Lin, 2022). The present field experiment was conducted to analyse effectiveness of farm school through community wall magazine.

METHODOLOGY

The study was conducted in Aligarh district of Uttar Pradesh as an On Farm Trial (OFT) activity of Krishi Vigyan Kendra (KVK), Aligarh with the four treatments:

T_0 : No treatment (Farmers were receiving agricultural information from the sources available in their information environment), T_1 : T_0 + information sharing through CWM, T_2 : T_0 + information sharing through FS organized by the Department of Agriculture (DoA) under the Agricultural Technology Management Agency (ATMA) scheme and T_3 : T_0 + Information sharing through FS and CWM

FS of aromatic/basmati paddy crop were selected for the study. There are twelve blocks in the district. Two FS in different villages were being organized in each block of the district under the ATMA Scheme. The villages from *Kheir* and *Iglash* blocks selected by the Department of Agriculture (DoA) for organizing FS on paddy were taken for T_2 and T_3 of the study, respectively. Keeping in view the farming situations of T_2 and T_3 treatment villages of *Kheir* and *Iglash* blocks, two villages from *Jawan* and *Dhanipur* blocks were selected for T_1 and T_0 treatment, respectively. In nutshell, there were four treatments, each replicated twice, having 25 farmers per replication, thus, in total data was collected from 200 farmers.

A knowledge test on aromatic/ basmati rice cultivation practices was developed for the study. To develop the knowledge test sixty-six items were selected from package of practices for aromatic/ basmati rice cultivation. Each selected practice was put in question

form. The correct answer was given a score of 'one' and incorrect responses 'zero'. The maximum and minimum obtainable score from each respondent was 66 and 0, respectively. The test was applied on all the selected farmers irrespective of the treatments before giving exposure of the treatment. Pre-test was done before sowing of seed in paddy nursery. Under each treatment scores of all the selected farmers were added, and it was taken as cumulative pre-test knowledge level score of the respective treatment. Thereafter, as per the design of experiment, information on paddy cultivation practices was shared among groups of selected farmers at different stages of the crop through CWM, FS, and both FS+CWM. CWM was mounted at the commonplace in selected villages, ensuring accessibility to all the farmers of the village. Articles of the CWM were changed as per the information needs of the farmers that emerged with the stages of paddy crop. Content of the message was kept similar in all the treatments of the study. After the crop harvesting, same knowledge test was applied on all the selected farmers under each treatment. Scores of all the farmers under the respective treatment was added. It was taken as cumulative knowledge level score of post-test of the respective treatment. On the basis of cumulative pre-test and post-test scores of the farmers under each treatment, enhancement in knowledge level was calculated using percentage. General profile of the farmers under each treatment was also studied for ensuring matching of the subject in each treatment.

RESULTS AND DISCUSSION

General profile of the farmers

Data presented in Table 1 indicates that the maximum number of farmers under the study were between the age of 36 to 55 years, educated up to intermediate, having medium family size and land up to 1.6 hectares. Subcategories of the general profile of the farmers under all four treatments were also almost matching. Sastry et al., (2014) also reported that participant and non participant farmers of FFS were homogeneously distributed under medium socio-economic status.

Data presented in Table 2 indicates that 4.61 per cent enhancement in the knowledge level of farmers under the control group (T_0) was observed. This was taken as the effect of extraneous variables. This score was subtracted from the effect of all three treatments. The rest of the score was assumed as the effect of treatment. After subtracting the effect of extraneous variables 21.83 per cent enhancement in knowledge level was observed as effect of information sharing through CWM. Previous study also revealed that only 13 per cent of young farmers were using print for receiving agricultural information (Singh et al., 2021) and the farm periodicals need to be designed according to the personal and social needs of the readers (Nain, 2003). Further, the knowledge level of paddy farmers enhanced by 15 per cent through extension literature similar to that of Monikha et al., (2021). Additionally, Dominic et al., (2023) was in view that educational module (folder) was effective when it was developed keeping in the view content relevancy and quality of the module. Nain et al., (2019) opined that strength of relevance of information and need for agri enterprise creation was major concern for designing the entrepreneurial

Table 1. General profile of the farmers under each treatment

S.No.	Aspect of general profile	Percentage of farmers				Total (N=200)
		Control Group* (T ₀) (n=50)	Information sharing through CWM (T ₁) (n=50)	Information sharing through FS (T ₂) (n =50)	Information sharing through FS and CWM (T ₃) (n = 50)	
1.	Age					
	26 to 35 years	16	14	16	18	16.00
	36 to 45 years	36	40	36	36	37.00
	46 to 55 years	38	38	40	32	37.00
	56 to 65 years	10	08	08	14	10.00
2.	Educational level					
	Illiterate	04	0	06	04	03.50
	Primary	06	06	06	08	06.50
	Middle	24	26	20	24	23.50
	High School	32	34	28	26	30.00
	Intermediate	28	30	32	28	29.50
	Graduate	06	04	08	10	07.00
3.	Family Size					
	Small (Up to 4 members)	22	18	24	20	21.00
	Medium (5 to 8 members)	56	52	56	58	55.50
	Large (<8 members)	22	30	20	22	23.50
4.	Land holding					
	Up to 0.8 hectare	30	36	32	34	33.00
	>0.8 and ≤ 1.6 hectare	50	48	50	48	49.00
	>1.6 and ≤ 2.4 hectare	18	10	14	12	13.50
	>2.4 and ≤ 3.2 hectare	02	06	04	04	04.00
	>3.2 and ≤ 4.0 hectare	0	0	0	02	0.50

*Farmers were receiving agricultural information from the sources available in their information environment

Table 2. Gain in knowledge level of the farmers under each treatment

Treatment	Cumulative knowledge level score of 50 farmers		Increase in knowledge level score	% increase in knowledge level score	
	Pre-test	Post-test		Over pre-test	Over pre-test due to treatment
T ₀ : No treatment*	976	1021	45	04.61	-
T ₁ : T ₀ + Information sharing through CWM	1090	1328	238	21.83	17.22
T ₂ : T ₀ + Information sharing through FS	1006	1527	521	51.79	47.18
T ₃ : T ₀ + Information sharing through FS and CWM	996	1600	634	65.63	61.02

*Farmers were receiving agricultural information from the sources available in their information environment, FS=Farm School, CWM=Community Wall Magazine

technical information packages (ETIPs). Since the CWM was displayed at a common place accessible to all the farmers of the villages and the content and treatment of the message were kept as per the requirement and preference of the farming community, it was observed that CWM not only delivered the right information, at right time, at the doorstep of the farmers, it also created a dialogue among the farming community. The study by Panda et al., (2019) showed that access and usage on ICT tools have significance to influence on benefit extraction, which indicated that if we could able to increase the awareness level than access and usage of ICT tools possibly increase.

The cumulative enhancement in the knowledge level of the beneficiary farmers of the FS organised by the DoA under the ATMA scheme was 47.18 per cent. A study conducted in Sri

Lanka provided evidence that FFS can contribute to increasing farmers' skills and lowering insecticide use in rice (Tripp et al., 2005). Another study also showed that the rice farmers who attended the FFS have benefited higher levels of adoption and attitude toward biological control compared to those did not attend this course (Moumeni-Helali & Ahmadvour, 2013) Furthermore, studies showed that FFS positively affect the rice farmers' knowledge, attitude and practices, and the farm profitability of the rice enterprise (Red et al., 2021).

The fourth treatment of the study was running CWM with FS as a supporting information-sharing mechanism. Combined implementation of CWM and FS showed 61.02 per cent enhancement in knowledge level regarding appropriate paddy cultivation practices, additionally, 13.84 per cent enhancement in

the knowledge level of the beneficiary farmers. Previous study revealed that combined use of video-mediated learning and FFS, helps the farmers in effective learning and acquiring knowledge relatively faster than the individual approaches (Ongachi et al., 2018).

It is clear from the findings that CWM can be used as need-based location-specific information sharing tool with the farming community. It also has the potential of enhancing the effectiveness of FS being operationalised under the ATMA scheme. For harnessing the potential of CWM for sharing need-based location-specific information with the farming community, it can be run by line departments and/or NGOs involving local youth and farmers at the community level with the technical support of KVKs. Line departments of each district and NGOs have a vast network of extension functionaries up to the grassroots level. KVKs are functioning in almost all the rural districts of the country. These KVKs have technical expertise in agricultural technology and extension methodology. The KVKs might train the extension functionaries of their respective districts in implementing the FFS and running CWM in the villages. Properly implemented FFS might yield outcomes relevant for the farmers having similar farming situations. Their outcomes of the FFS and other relevant information might be shared with the farming community through CWM. Extension functionaries and scientists of KVKs jointly may identify the farming communities having similar situations, where outcomes of the FFS might be implemented. Due to limitations of human and non-human resources neither extension functionaries nor scientists of the KVKs can run the wall magazine in all the identified farming communities. In this situation, local youth/farmers for managing the wall magazine at the village level can be identified. KVKs of the respective districts may organise trainings for these youth/farmers on different aspects of management of wall magazine at the village level. In this way, farmers can get the right information at right time in their closer proximity.

CONCLUSION

Based on the field experimental study it can be concluded that Community Wall Magazine has the potential of sharing need-based, location-specific agricultural information with the farming community. When FS were supported with Community Wall Magazine the effect of FS on knowledge enhancement was accelerated. Community Wall Magazine can be used as a need-based location-specific information-sharing tool with the farming community in isolation. It can also be used for enhancing the effectiveness of FS being operationalized under the Agricultural Technology Management Agency (ATMA) scheme. It can be run in the villages by line departments involving rural youth and farmers with the technical support of KVK of the respective districts.

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Gender-based Variations in Perception of Flood Impacts- A Micro Study

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ABSTRACT

An attempt to understand the perception of flood impacts through a gender lens was executed in 2022 in the purposively selected Darbangha district of Bihar as it tops the list of the districts most severely affected by flood in the state. Data from 120 farmers were collected through a focused group discussion and an interview schedule developed specifically for the study. The findings revealed that the maximum percentage of farmers had a medium perception regarding the impact of floods. Variations were seen in the perception of the socio-economic and psychological impact of flood with women perceiving slightly higher than men whereas the opposite was seen for the perception of the environmental impact of the flood where men perceived slightly higher than women. Factors like age, household headship, social participation, decision-making, education, and family size significantly and positively affected the perception women and men had on the impact of the flood. The findings provide an in-depth understanding of the perception of the impact of floods by men and women farmers in the study area which would help the extension agencies and policymakers to plan and design locale-specific preparedness.

INTRODUCTION

Flood is the most prevalent and costliest natural disaster in the world which devastates life and economy on large extent. Globally, 44 per cent of disasters have been linked with floods (riverine floods 24%, general floods 14%) (WMO, 2021). Bihar is one of the most flood afflicted states in the nation, attributing to around 17.2 per cent of the flood prone area of the nation. 68,800 sq. km out of a total area of 94,160 sq. km, an approximate 73 per cent of the territory in Bihar is susceptible to flood (BSDMA). Annual floods and regular losses of agricultural production of wheat, rice, corn, and mango continue to have an impact on the state's food supply as well as employment opportunities (Kumar et al., 2016).

The effects of natural catastrophes and resilience differ between individuals and communities with gender emerging as a crucial distinguishing feature. The effect of flooding are not gender-neutral. As a result, various gender groupings interpret the impact of flood,

cope with or adapt to its effects in different ways. Flood affects the entire community, but pre-existing climate of discrimination against women and gender role learning in Bihar has intersected with the calamitous consequences of flood leading to an increase in the impact and vulnerability on women in many ways (Madhuri, 2016). Perception of changing climate in general and flood in particular, is a complex process involving a variety of psychological constructs like knowledge, beliefs, attitudes, and worries about whether and how the climate is changing. Characteristics of an individual, experience, information received, and the cultural and geographical context in which they live all influence and shape perception (Whitmarsh & Capstick, 2018). Perception of risks associated with climate change drives the farmers in search for new knowledge and practices (Raghuvanshi & Ansari, 2020). Farmers' perception of climate change is vital for effectively implementing any policy/ strategies on climate change in actual field situation (Arunachalam et al., 2020). Likewise, analysis of gender perception of flood impacts is a prerequisite for assessing their adaptation

decisions and for avoiding gender-blind rehabilitation policies. The fact that impact of natural disasters is gendered makes it crucial to understand how men and women perceive and interpret natural disasters so as to devise and advise on effective adaptation strategies that will assure their livelihoods.

METHODOLOGY

The current research investigation was conducted in Bihar, a state which is home to 14 of India's 50 most vulnerable districts to climate change, accounting for 17.2 per cent of the country's flood-prone land. Out of 38 districts in Bihar, Darbangha was purposively selected as it tops the list of the districts which are most severely affected by flood (Flood Hazard Index, Bihar). Darbangha district has a total of 18 blocks, out of which two blocks each, one, which is highly prone to flood i.e. Hanumannagar and the other which is moderately prone to flood i.e. Baheri was selected. Two villages were chosen from each block, Godhaila and Uchauli from Hanumannagar and Jhakra and Aadabon from Baheri. So, a total of 4 villages were selected for the study. From each of the four villages, 30 respondents were selected (15 men and 15 women), thus making total sample size as 120.

Modified scale of Koshti et al., (2013) was used to measure the perceptions about flood impacts which referred to the opinion men and women farmers had towards the impact of flood. The scale incorporated sixteen statements. A five point continuum stretching from "strongly agree" to "strongly disagree" was used and a score was assigned as 5, 4, 3, 2, 1 for each statements. Modification has been done according to the study area. The scale consisted of 16 statements under three sub headings viz. Perception of Socio-economic impact of flood having 6 statements, Perception of Psychological impact of flood having 5 statements and Perception of Environmental impact of flood containing 5 statements. These statements were selected and finalized in consultation with scientists, experts and after reviewing existing literature on impacts of flooding. The sum of score of all items of the flood impact administered to the farmers was computed which indicated the perceived flood impact score for particular selected farmer. The maximum score was 80 while the minimum score was 16. The raw score such obtained was converted into perception index for the above 16 main indicators in aggregate form, with the help of following formula:

$$\text{Perception index} = \frac{\text{Obtained perceived flood impact score}}{\text{Obtainable perceived flood impact score}} \times 100$$

On the basis of CSRF method, men and women farmers were categorized on their perceived flood impact perception index. Perception of socio economic impact of flood for men was categorized as - low (up to 72.40), medium (72.41–92.93) and high (above 92.94). For women, low (up to 85.30), medium (85.31–99.93) and high (above 99.94). Likewise, perception of psychological impact of flood for men, low (up to 61.58), medium (61.59–88.95) and high (above 88.96). For women, low (up to 83.99), medium (84.00–99.60) and high (above 99.61). Lastly, perception of environmental impact of flood for men, low (up to 51.86), medium (51.87 to 84.80) and high (84.81). For women, low (up to 58.55), medium (58.56–84.11) and high (above 84.12).

A statistical tool of Karl Pearson's simple correlation coefficient (r) was followed to estimate the nature of relationship between the selected variable and the gender centric perception of flood impacts. Multiple regression was carried to determine the effect of independent variable on the dependent one.

RESULTS AND DISCUSSION

Perception of men and women farmers on flood impacts

This refers to the opinion men and women farmers had towards the impact of flood under subtopics – socioeconomic, psychological and environmental. The results regarding the perception of women farmers towards the impact of flood are given in Table 1.

Table 1. Distribution of respondents according to their perception of flood impacts

Category	Women Percentage	Men Percentage
Perception of Socio economic impact of flood		
Low	8.34	18.33
Medium	58.33	60.00
High	33.33	21.67
Perception of Psychological impact of flood		
Low	11.67	10.00
Medium	68.33	73.33
High	20.00	16.67
Perception of Environmental impact of flood		
Low	15.00	3.33
Medium	73.33	76.67
High	11.67	20.00

Table 1 elucidates that maximum women (58.33%) and men farmers (60%) had medium perception of socio economic impact of flood. Further, 33.33 per cent of women and 21.67 per cent of men fell into the category of respondents who had high level of perception of socio economic impact of flood whereas 8.34 and 18.33 per cent of women and men fell into the low category for the same. With regard to perception of psychological impact of flood, majority 68.33 per cent women and 73.33 per cent men respondents had medium level of perception, 20 per cent women and 16.67 per cent men participants had higher level of perception succeeded by 11.67 per cent women and 10 per cent men who fell into the category of respondents having low level of perception. Further, 73.33 per cent of women and 76.67 per cent men had medium level of perception of environmental impact of flood, 11.67 per cent women and 20 per cent men were reported to have high level of perception for the same and 15 per cent women and 3.33 per cent of men farmers had lower level of perception.

Relationship between profile characteristics and perception about flood impacts

Table 2 shows that age was positively and significantly related (at 5% level of significance) with perception of psychological and environmental impact of flood. This could be attributed to the fact that more the age, more is the probability of having experienced serious floods therefore more likely to take on family safety

Table 2. Relationship between women's profile characteristics and their perceptions about flood impacts

S.No.	Variable	Karl Pearson's value "r"		
		Perception of socio economic impact of flood	Perception of psychological impact of flood	Perception of environmental impact of flood
1.	Age	.204	.297*	.303*
2.	Family size	-.126	.121	.002
3.	Household headship	.331*	.473*	-.233
4.	Social participation	.131	.324*	-.037
5.	Scientific orientation	.191	.103	.005
6.	Annual income	.102	-.168	-.128
7.	Extension contact	.054	-.064	-.125
8.	Risk orientation	-.011	-.067	-.235
9.	Social cohesiveness	-.284*	-.260*	-.026
10.	Awareness on flood	.025	-.074	.094
11.	Decision making	.088	.275*	.041

*Significant at 5 % level of significance

responsibilities. This also implies that younger respondents may not have faced flood events in the past and thus lacked the necessary skills and knowledge to help shield themselves and other family members from flooding. Similarly, older people may have a more profound comprehension of how to deal with various types of danger, which could illustrate their concern about flooding, leading to age having a significant and a positive relation with their perception. The findings of this study is in line with Shah et al., (2022). With regard to perception of socio economic impact of flood, age had a positive but statistically non-significant relation.

Household headship had a positively significant relationship (at 5% level of significance) with perception of socio economic and psychological impact of flood. This may be assigned to the fact that women belonged to socio economically disadvantaged group opposed to men and were more vulnerable when confronted with floods, causing women to be more inclined to seek flood information and pay closer attention to property losses. The findings of this study is in line with Wang et al., (2018) & Linden (2014). With respect to perception of environmental impact of flood, household headship was seen to have a negative and a statistically non-significant relation. Social participation had a positively significant relationship (at 5% level of significance) regarding perception of psychological impact of flood. Women owing to their multiple responsibility get involved in productive areas and organizations like Jeevika's and SHG's. More the participation, more is the perception. This maybe explained in a way that more socially active women exercise several dynamics to flood impacts. Likewise social participation showed positive but statistically non-significant relation with respect to perception of socio economic impact of flood and a non-significant negative relationship with perception of environmental impact of flood. Social cohesiveness had a negatively significant relationship (at 5% level of significance) with the perception of socio economic and psychological impact of flood. The negative coefficients of social cohesiveness among women respondents may be because women were landless, possessing insufficient assets, limited access to credit or financial support had a reduced strength of relationship and diminished sense of solidarity among members of a community. As regards to perception of environmental impact of flood, it had a non-significant negative correlation. Decision making had a positive

and a significant relationship (at 5% level of significance) with perception of psychological impact of flood. With regard to perception of socio economic and environmental impact of flood, decision making had a positive but statistically non-significant relationship.

Relational analysis

Table 3 indicates that age had a negatively significant relationship (at 5% level of significance) with perception of psychological impact of flood. This may be explained as men respondents in the study area were relatively strong mentally as compared to women. They attributed this behavior to having experienced and grown accustomed to flooding events and its impact to the extent that they feel little pressure mentally. They have learnt to live with it. Age had a negative correlation with perception of socio economic impact of flood whereas it was positively related with perception of environmental impact of flood. Education of the men respondents had a positive and a significant relationship (at 5% level of significance) with perception of psychological and environmental (at 1% level of significance) impact of flood. This implies that farmers with higher educational attainment were more likely to perceive flood impact than less-educated or illiterate farmers. Educated farmers clearly have more knowledge, the capacity to comprehend and adapt to expected changes, the capacity to anticipate future scenarios, and more access to information and opportunities than others. The findings are in line with Türkkan & Hrca (2021); (Bharat et al., 2022). With regard to perception of socio economic impact of flood, education had a positive but a non-significant relationship. Family size had a positive and a significant relationship (at 1% level of significance) with perception of psychological impact of flood. This may be because larger family size usually have more interaction, sharing among themselves thus leading to a better perception of psychological impact of flood by all of the members. The findings differ with Uddin et al., (2017) who reported that family size had a negative and a significant relationship with farmer's perception of climate change. With perception of socio economic and environmental impact of flood, family size had a positive but a non-significant relationship. Scientific orientation had a negative and a significant relationship (at 5% level of significance) with

Table 3. Relationship between men's independent variables and their perceptions about flood impacts

S.No.	Independent variable	Karl Pearson's value "r"		
		Perception of socio economic impact of flood	Perception of psychological impact of flood	Perception of environmental impact of flood
1.	Age	-.100	-.268*	.106
2.	Education	.064	.298*	.525**
3.	Family size	.230	.437**	.229
4.	Social participation	-.104	-.123	.048
5.	Scientific orientation	-.081	-.273	-.256*
6.	Annual income	-.263*	-.184	.293*
7.	Extension contact	-.255*	-.255*	-.087
8.	Risk orientation	-.051	-.061	.088
9.	Social cohesiveness	-.127	-.027	-.111
10.	Awareness on flood	-.065	-.001	-.248

*Significant at 5 % level of significance and **Significant at 1 % level of significance

perception of environmental impact of flood. It was also found to have a negative correlation with perception of socio economic and psychological impact of flood but it was statistically not significant. Annual income had a negatively significant relationship (at 5% level of significance) with perception of socio economic impact of flood. This implies that poorer households might have a greater perception as compared to well to do households. This may be attributed to the reason that most of the poorer households belonged from extremely flood prone areas that relied more on agriculture as their primary source of income. They experienced damages incurred by flood to a greater extent and since experience is one of the factors that influences perception, respondents from lower income group perceived the socio economic impact of flood in better way. The findings are in line with Liu et al., (2022). However, with regards to perception of environmental impact of flood, it had a positive and a significant relationship (at 5% level of significance). As revealed from the Table 3 annual income had a negative and a statistically non-significant relationship with perception of psychological impact of flood. Perception of socio economic and psychological impact of flood had a negatively significant relationship (at 5% level of significance) regarding extension contact. This may be because personal experience with

disaster events weighs more in any perception studies. In addition to that, it is also to be noted that low level of extension intervention was seen in the surveyed villages. Extension contact had a negatively but statistically non-significant relationship with perception of environmental impact of flood.

Impact of independent variables on dependent variable

Table 4 elucidates that 38, 54.30 and 37.60 per cent variance on women farmer's perception of socio-economic, psychological and environmental impact of flood were as a result of explained factors that were included under the present study. Education was found to be significant at 10% level of significance with respect to perception of socio economic impact of flood. As regards to perception of psychological impact of flood, education, household headship and scientific orientation was found to be significant at 5% level of significance whereas annual income was significant at 10% level of significance. In case of perception of environmental impact of flood, age was significant at 5% level of significance followed by risk orientation significant at 0.05 level of probability and annual income had a significant relationship at 0.01 level of probability.

Table 4. Impact of independent variables of women on dependent variable

Factors	Perception of socio economic impact of flood			Perception of psychological impact of flood			Perception of environmental impact of flood		
	b value	t value	significance	b value	t value	significance	b value	t value	significance
Age	.058	.403	.689	.160	1.420	.162	.342	2.412	.020**
Education	-.273	-1.791	.080***	-.315	-2.628	.012**	.057	.379	.707
Family size	-.118	-.886	.380	.174	1.669	.102	-.101	-.770	.445
Household headship	.179	1.042	.303	.330	2.452	.018**	-.256	1.151	.138
Social participation	.018	.119	.905	.225	2.132	.038**	.084	.560	.578
Scientific orientation	.088	.632	.530	-.071	-.645	.522	.012	.088	.930
Annual income	.119	.848	.401	-.212	-1.932	.061***	-.203	-1.46	.151
Extension contact	-.007	-.049	.961	-.177	-1.477	.146	-.094	-.621	.537
Risk orientation	.023	.158	.875	-.027	-.236	.841	-.269	-1.83	.073***
Social cohesiveness	-.221	-1.449	.154	-.080	-.664	.510	.024	.161	.873
Awareness on flood	.063	.427	.672	-.630	-.551	.584	.160	1.103	.276
Decision making	-.039	-.947	.349	.028	.241	.810	.110	.755	.454
R ² = .380				R ² = .543			R ² = .376		

*significant at 1% level; * *significant at 5% level; ***significant at 10% level

Table 5. Impact of independent variables of men on dependent variable

Factors	Perception of socio economic impact of flood			Perception of psychological impact of flood			Perception of environmental impact of flood		
	b value	t value	significance	b value	t value	significance	b value	t value	significance
Age	-.238	-1.675	.100	-.344	-2.579	.013**	.089	.614	.524
Education	-.032	-.230	.819	.105	.807	.424	-.130	-.918	.363
Family Size	.053	.422	.675	.408	3.448	.001*	.253	1.959	.056***
Social Participation	.086	.597	.554	.048	.357	.732	-.003	-.018	.986
Scientific Orientation	-.053	-.386	.715	-.092	-.678	.501	-.377	-2.554	.014**
Annual Income	-.251	-2.053	.046**	-.132	-1.156	.253	.336	2.688	.010*
Extension contact	-.247	-1.597	.117	.010	.068	.946	-.042	-.265	.792
Risk Orientation	-.406	-2.66	.010*	-.300	-2.104	.041**	.123	.788	.435
Social Cohesiveness	.181	1.314	.195	.091	.707	.483	-.147	-1.040	.303
Awareness on flood	-.501	-3.063	.004*	-.281	-1.834	.073***	-.004	-.023	.982
Decision making	-.130	-1.014	.316	.038	.321	.749	.117	.896	.375
	R ² = .352			R ² = .433			R ² = .321		

*significant at 1% level; * *significant at 5% level; ***significant at 10% level

Table 5 indicates that 35.20, 43.30 and 32.10 per cent variance on men farmers' perception of socio-economic, psychological and environmental impact of flood were as a result of explained factors that were included under the present study. Annual income was found to be significant at 5% level of significance followed by risk orientation and awareness on flood which were significant at 0.01% level of significance in case of perception of socio economic impact of flood. As regards to perception of psychological impact of flood, family size showed a significant relationship at 0.01 level of probability followed by risk orientation and age which were significant at 5% level of probability. Awareness on flood was found to be significant at 10% level of significance. With respect to perception of environmental impact of flood, family size was significant at 10% level of significance followed by scientific orientation significant at 0.05 level of probability and annual income had a significant relationship at 0.01 level of probability.

CONCLUSION

Floods are one of nature's most destructive acts, affecting human life in a variety of ways. It is among the most common causes of social unrest since it can directly impact the socioeconomic state of local populations. This study was conducted to assess and examine the gender based variations in perception of socio economic impact of flood. From the findings it can be inferred that maximum of the women and men farmers showed medium level perception with women having slightly higher perception as compared to their male counterparts. A very few or negligible interference of government organizations in farming activities in the areas has aggravated risk perception. So appropriate measures need to be taken. Government should take initiative to focus on livelihood diversification activities like alternating crop, flood resilient livestock breed, floating parks. It is also recommended to launch sustainable knowledge empowerment programmes so as the risk community could upgrade the social views on gender discrimination.

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Objectives of Extension Education: An Analysis of Perception of KVK Professionals

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ABSTRACT

Krishi Vigyan Kendra provides training to various stakeholders as a means of delivering technology. As a profession, the KVK professionals should have the holistic understanding and appropriate perception towards objectives of extension education. The objective of study was to analyze the perception of KVK professionals towards objectives of extension education. The study was conducted during March-August, 2021 using structured questionnaire. The sample of the study included 150 KVK scientists from 145 KVKs spread over 24 states and Union territories. The study assessed the perception of the KVK professionals towards the objectives of Extension. This Perception towards objectives was measured by using 5 point continuum on Likert scale with the help of 34 statements. The objective “*Communicating the research information that is useful for economic and practical purposes*” scored first rank with 66.67 weighted mean score and also revealed that majority of KVK professionals were having favorable Perception regarding objectives (74.67%) of extension followed by equal number of respondents (12.66%) were having both highly favorable and unfavorable perceptions towards objectives of extension. Additionally, it was shown that information seeking behaviour had positive and significant relationship with the perception of KVK professionals regarding objectives of extension education. Step-wise regression model revealed that information seeking behavior contributed about 2.70 per cent of total of variances in perceptions toward objectives of extension. Hence, it can be concluded that KVK professionals need to have favourable perception towards objectives of extension for executing mandates of KVK more successfully.

INTRODUCTION

An institutional project of ICAR, Krishi Vigyan Kendra, acts as “the lighthouse for farmers in India,” and demonstrates the utilization of science and technological input in agricultural research and education in the fields of farmers in rural regions. The focus of Agricultural Technology Application Research Institutes (ATARIs) is to coordinate the activities KVKs in their respective region (Acharya et al., 2020). KVKs offer a wide range of technical solutions to help farmers manage their farms sustainably and holistically (Sinha et al., 2021). In India, Krishi Vigyan Kendras

(KVK) is crucial for the transmission of agricultural technologies (Kumbhare, 2009). Extension programmes must adapt to the recent changes in global agriculture and assist farmers by enhancing their management and decision-making skills (Singh et al., 2018; Singh et al., 2020). For empowering the stakeholders an innovative idea created and supported by the Indian Council of Agricultural Research is called Krishi Vigyan Kendra (ICAR) (Patil & Kokate, 2011). KVKs are designed to apply technology via evaluation, improvement, and demonstration of tried-and-true methods in various types of “micro-farming” in every district (Das, 2007). The majority of Krishi Vigyan Kendras’ training initiatives are

focused on providing services to unjust communities for both men and women (Karak, 2019).

In accordance with amended mandate Technology Assessment and Demonstration for its Application and Capacity Development by KVK, offers need-based vocational training to rural youth, women, farmers, and extension professionals and extension service providers (Sahoo et al., 2021; Paul, 2016). It is well acknowledged that the competence and experience of the extension personnel to quickly communicate and route information to the clientele system at the proper time in the most appropriate manner is essential to the success of any extension programme. These institutes get substantial budgetary allocations as well as a considerable number of highly skilled workers. Despite all of these efforts, there is still an unwanted technological gap between the technology that has been produced and the technology that has been embraced by the end users. The recommendations made by KVK authorities must be carefully considered in order to effectively disseminate technology (Bashir & Narmatha, 2016). As of May 2021, there are 731 KVKs throughout India. The purpose of the study was to determine how KVK professionals perceive the objectives of extension education. An objective means a direction of movement. KVK professionals must keep in mind a set of basic objectives of extension when working in the field since extension concepts are founded on these objectives (Ray, 1998). The principles, objectives, philosophy of extension are the part of curriculum at graduation and post graduation level.

The research question was ‘whether extension professionals in general and KVK professionals in particular remember/recall the objectives of extension? If so how they perceive the objectives of extension?’ Perception is defined as the way you think about something and your idea of what it is like; the way that you notice things with your senses of sight, hearing etc.; the natural ability to understand or notice things quickly (Qiong, 2017).

METHODOLOGY

The study was conducted in 2021 in which Extension service providers working in Krishi Vigyan Kendra’s all over India were considered as the respondents of the study. According to Ministry of Agriculture and Farmers Welfare (2022) 731 Krishi Vigyan Kendras (KVKs) are presently working in the country (<https://www.pib.gov.in/PressReleasePage.aspx?PRID=1843884>). These KVKs are operated by state agricultural universities, Indian Council of Agricultural Research institutions, central universities, government agencies, and non-governmental organizations. The structured questionnaire was mailed to extension professionals serving in 721 KVKs out of which 150 professionals responded from 145 KVKs.

Socio-personal variables viz., age, sex, caste, education, experience, background, position in KVK like- Head/PC, SMS, socio-economic (job satisfaction), and communicational characteristics (Information Seeking Behavior) of KVK professionals were the independent variables of the study. While KVK professional’s perception towards objectives of extension education was considered as dependent variable. With the assistance of specialists, a thorough structured questionnaire was developed to examine how KVK professionals perceive the objectives of extension education.

Collected data were analyzed with the help of percentage, frequency, mean and standard deviation, as well as relational statistics like chi-square, correlation and step-wise regression coefficients. The respondents indicated their agreement or disagreement and the scores are given accordingly strongly agree-5, agree-4, undecided-3, disagree-2, and strongly disagree-1 in case of positive statements while reverse score were given for negative statements in which strongly agree-1, agree-2, undecided-3, disagree-4, and strongly disagree-5. The maximum score assigned was 5 and the minimum score assigned was 1. The respondents had given their level of agreement and disagreement on 34 statements. The questions were framed to assess the perception of KVK professionals regarding objectives of extension education. Based on their scores, mean and standard deviation was calculated and accordingly the respondent’s perceptions toward objectives of extension education were categorized into unfavourable, favourable and highly favourable.

RESULTS AND DISCUSSION

Perception of KVK professionals toward objectives of extension

The objectives of extension education (listed in Table 1) were presented to respondents with the help of a uniquely designed index to examine how these objectives was perceived.

Overall perception regarding each objective of extension

Table 1 heralds the findings of objectives of extension education, which are ranked according to the weighted mean score. The objective of extension “*To disseminate research information of economic and practical importance in a way people would be able to understand and use*” weighted mean score was 66.67 and was ranked I. It was because KVK professionals provide location specific information in their regional languages. Any efforts of dissemination of information deviating the local needs are not accepted by the stakeholders. Hence, introduction of innovations in the field setting is a challenging task. The extension professionals must focus on economic and practical aspects of innovation. The

Table 1. Dispersion of KVK professionals apropos to overall Perception toward each objective of extension

Objectives of Extension Education (adopted from Ray 1998)	Weighted mean score	Rank
<i>To assist people to discover and analyze their problems and identify the felt needs</i>	59.11	V
<i>To develop leadership among people and help them in organising groups to solve their problems</i>	66.22	II
<i>To disseminate research information of economic and practical importance in a way people would be able to understand and use</i>	66.67	I
<i>To assist people in mobilizing and utilizing resources which they have and which they need from outside</i>	63.55	III
<i>To collect and transmit feedback information for solving management problems</i>	63.33	IV

next issue is medium of presentation, the local language/dialect is always preferred and recommended. The only logic is the stakeholders can understand the innovation in holistic manner.

The objective “*To develop leadership among people and help them in organising groups to solve their problems*” scored weighted mean score was 66.22 and was ranked II. The processes of extension develops leadership among stakeholders. Extension professional as an intervention can be with the stakeholders for a limited period of time. Once the skills are accumulated by the members of community / stakeholders, the effects are going to be long lasting. Local leaders are the custodians of local thought and action. The involvement of local leaders and legitimization by them are essential for the success of a programme and perception toward extension. In Indian context, as the number of people dependent on agriculture are more and agriculture is part of Indian culture, the stakeholders need to be organized into groups. As we form groups, we need leaders also. Hence extension focuses on group approach. The decisions taken by the members of the group are effective as every member has the commitment to practice it.

The objective “*To assist people in mobilizing and utilizing resources which they have and which they need from outside*” weighted a mean score of 63.55 and ranked III. The adoption rate of an innovation was more if the innovation is involving more of local resources. In the rush of adoption of green revolution innovations, the dependency on external inputs is more than locally available resources. Off late the agricultural research and extension fraternity is realizing the issue. On the contrary the objective of extension emphasizes on exploitation of locally available resources. To achieve this, the communities should have an inventory of the locally available resources. In this context, indigenous technical knowledge is the most potential resource. The base of ITK is local resources. Even though it was neglected during green revolution period, in post 1990's due attention is being given to indigenous knowledge systems.

For the objective “*To collect and transmit feedback information for solving management problems*” weighted mean score was 63.33 and was ranked IV. It is because, the feedback system helped in evaluation of programmes executed by the KVK professionals. Feedback evaluation helps KVK professionals to determine what works well and what could be improved in the program or initiative. Also the outcomes of feedback are inputs for research system and the outputs of research system are inputs for extension system. The cycle continues.

The fifth objective “*To assist people to discover and analyze their problems and identify the felt needs*” the weighted mean was 59.11 and it ranked V. KVK professionals work directly with stakeholders and are aware of many common problems faced by them. The objective of extension emphasize on the role of KVK professionals in educating the stakeholders on identifying the needs and problems as well as providing solutions. The needs may be ‘felt needs’ or ‘unfelt needs’. Translation of unfelt needs to felt needs related to agriculture and an allied science is the prime responsibility of KVK professionals.

Distribution of KVK professionals based on perception regarding objectives of extension education is presented in Table 2. It is evident from the Table that slightly less than three-fourth

Table 2. Distribution of KVK professionals according to their Perception regarding objectives of extension education

S.No.	Degree of perception	Range	Frequency	Percentage
1	Unfavorable	<109.97	19	12.67
2	Favorable	109.97 to 126.03	112	74.67
3	Highly favorable	>126.03	19	12.66

(Mean: 118, SD: 8.03)

(74.67%) of KVK professionals revealed favorable perceptions towards the objectives of extension education, equal number of respondents (12.67%) expressed ‘unfavorable’ and ‘highly favorable’ perceptions towards extension education. The regular and continuous interaction of KVK professionals with various stakeholders helps in forming appropriate perceptions about the basics of extension education. The objectives of extension education act as instruments of navigation for extension professionals in order to deal with varied needs and issues associated with diverse categories of stakeholders. Similar findings were reported by Singh (2016); Singh et al., (2018). The studies revealed that slightly less than three-fourth of respondents (73.30%) were having favorable attitude followed by 17.30 per cent having highly favorable and 8.60 per cent having unfavorable attitude toward objectives of extension education.

The correlation analysis between Information seeking behavior of the KVK professionals and their Perception towards objectives of extension education revealed the ‘r’ value of 0.165 (Table 3). Based on the co-efficient of correlation, the following observations were made about the relationship between socio-personal variables and perception of KVK professionals towards objectives of extension education. Relationship divulge tendency towards the positive direction at 0.05 level of probability. Hence the relationship was significant. Thus it can be concluded that those who had higher level of information seeking behaviour had more favorable Perception toward objectives of extension education. But the findings reported by Singh (2016); Singh (2018); in their study reveal that Education, Communication Behaviour and Extension

Table 3. Correlation and Chi square analysis of Socio-economic variables with perception of KVK professionals toward objectives of extension

S.No.	Independent variable	r value	P-value
1	A	0.137	0.095
2	B	0.095	0.250
3	C	0.058	0.480
4	D	0.165*	0.043
S.No.	Independent variable	Chi square value	P-value
5	E	3.133 ^a	0.209
6	F	2.967 ^a	0.227
7	G	1.285 ^a	0.526
8	H	4.582 ^a	0.598
9	I	3.040 ^a	0.219

(A= Age, B=Experience, C= Job satisfaction, D= Information Seeking Behavior, E=Education, F= Sex, G= Background, H= Caste and I= Position), * Correlation is significant at 0.05 level (2-tailed)

Table 4. Summary of the model's quantum effects of independent variables on how KVK professionals perceive the objectives of extension (Stepwise Regression)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Model Summary ^b					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	0.165 ^a	0.027	0.021	7.94501	0.027	4.157	1	148	0.043	1.876

a. Predictors: (Constant), Information Seeking Behaviour

b. Dependent Variable: Perception (Perception toward objectives of extension)

System Link were positively and significantly associated with attitude of extension professionals towards objectives of extension education. For the Education calculated value of 'r' (0.186*) was found to be less than tabulated value 'r' (0.178) with 0.05 level of probability and for Communication Behaviour and Extension System Link calculated value of 'r' (0.243**) and (0.467**) was found to be less than tabulated value 'r' (0.210) and (0.210), respectively with 0.01 level of probability. While in case of chi-square analysis, it was observed from the above table that calculated P-value of independent variables were education (0.14), sex (0.14), background (0.09), caste (0.17) and position (0.14). Hence it is reported that there was no significant relation between independent variables with the dependent variable i.e. perception of KVK professionals towards objectives of extension education. While the findings reported by Singh (2021); Singh (2022); in their study indicate that education level has shown significant relation with Perception toward principles of extension education at 1% level of significance. Position and background of professionals has shown significant relation with Perception of KVK professionals at 5% and 10% level of significance, respectively (Table 4).

To determine the degree to which specific independent variable affected extension service provider's (Krishi Vigyan Kendra Professional's like Head/Programme Coordinator and Subject Matter Specialists) perceptions towards objectives of extension education and to identify the major factor contributing to the regression model, step-wise regression was used. It was found that the sole variable viz., information seeking behaviour was responsible for the 2.70 per cent variance in perception of KVK professionals towards objective of extension education. The regression model's significance was also assessed to be within an acceptable range of multi-collinearity (p value=.000). It may be determined that behaviours related to information seeking that were included in the study contributed only 2.70 per cent and about 96.30 per cent were not included in the research. The studies conducted by Singh (2021); Singh (2022) observed that job satisfaction and position in KVK contributed around 12.30 per cent of the variances in perceptions of KVK professionals' towards the principles of extension education. Additionally, it was determined that the regression model's significance (p value=.000) fell within an acceptable range of multi-collinearity.

CONCLUSION

Krishi Vigyan Kendra, as the lighthouse for farmers in India, demonstrates the utilisation of science and technological input in agricultural research and education in the fields of farmers in rural areas. The results of the study reveal that, Krishi Vigyan Kendra

personnel had a positive perception regarding objectives of extension education. It may be argued that for Krishi Vigyan Kendra programmes to be more effective, Krishi Vigyan Kendra personnel need to transform their unfavorable perception towards objectives of extension education into a highly favorable one. The way in which information seeking behaviour is sought for directly influences how Krishi Vigyan Kendra professionals perceive the objectives of extension. Therefore, high job satisfaction and regular exposure to official, informal and mass-media sources are definitely required to improve the perception of Krishi Vigyan Kendra professionals regarding objectives of extension.

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Professional Competence of Extension Personnel in Karnataka State of India

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ABSTRACT

The study examines the level of professional competence among agricultural extension personnel in the Karnataka state of India. The study population was composed of agricultural extension personnel in development departments and Krishi Vigyan Kendra's (Farm science center). During 2021-2022, 285 extension personnel completed self-administered surveys. The design for the data collection instrument was based on a literature review and focus group recommendations. The findings showed that respondents thought they were highly competent in the areas of program evaluation, organizational skills, human relations skills, and communication skills and moderately competent in the areas of knowledge, administration, teamwork, leadership, program planning, and implementation. Respondents' competency differed by their cadre also; ADAs, ADHs, and SMSs had high competence levels than their counterparts- AOs, AAOs, and AHOs. The findings imply that there is a need for in-service training of extension professionals in all core competency areas. Pre-service extension education curricula need to be reviewed and updated, incorporating the core competencies highlighted in the study.

INTRODUCTION

Agricultural systems and practices are changing across the world and producers' needs are changing too, farmers of the developing world are increasingly aware of new technologies and improved practices. They are demanding credible information about the benefits of adopting these improved practices. Specifically, they are demanding services such as quality seeds, timely supply of inputs such as fertilizer, credit to buy needed inputs, and access to market information and services. These challenges put pressure on extension professionals to be more knowledgeable, skillful, and able, not only in technical subject matter but also in process skills (Suvedi, 2015). David McClelland proposed the concept of competency for the first time in the 1970s, challenging traditional assessment criteria that emphasized intelligence evaluation in the higher education system. Competency is a skill,

a personal quality, or a motivation displayed via a variety of behaviors that contribute to exceptional job performance. In general, competency refers to the attribute of being sufficiently or highly competent to accomplish a task (Cernusca & Dima et al., 2007).

Professional competence can be defined as the employee's general knowledge and abilities used to carry out both specified and unspecified tasks leading to the satisfaction of all stakeholders' current and future desired standards (Khadayata et al., 2019). In this era of globalization, a knowledgeable and skilled individual can play a vital role in the success of an organization. According to Seevers et al., (1997), future extension professionals need to be more skillful and futuristic to serve the needs of a diverse audience. Extension staff must learn new knowledge and skills since it is only a knowledgeable and skillful individual can play a vital role in the success of an organization in today's technological environment (Rohit et al., 2020). To be a successful extension

agent today, one must be competent not only in technical matters but also in areas such as management, programming, communication, human relations, and leadership (Graham, 2009). With this consideration, an attempt has been made in the present investigation to know the professional competency of the extension personnel.

METHODOLOGY

The study sought to assess the professional competence of extension personnel working in public extension organizations-developmental departments (Department of Agriculture and Department of Horticulture) and Krishi Vigyan Kendra's (KVKs) in Karnataka state, India. The study population comprised of extension personnel –Assistant director of agriculture (ADA), agriculture officer (AO), assistant agriculture officers (AAO), Assistant director of horticulture (ADH), assistant horticulture officers (AHO), and subject matter specialist (SMS). Five respondents from every nine KVKs and 240 respondents from development departments were selected following a simple random sampling technique. Hence, the total sample size was 285. The data was collected from October 2021 to February 2022 through face-to-face contact (interview) and by mailing the questionnaire. A scale was developed to assess the professional competence of extension personnel. The professional competence index of the respondents was determined by using the following formula.

$$\text{Professional competence index} = \frac{\text{Actual score}}{\text{Maximum score}} \times 100$$

RESULTS AND DISCUSSION

Professional competence of extension personnel

Nine components of competence namely; knowledge, administration skill, program planning skill, program implementation skill, program evaluation skill, organizing skill, human relation skill, communication skill, team work, and leadership were separately measured for each respondent (Table 1). The majority (56.14%) of the extension personnel were found to have a medium level of knowledge competence, followed by 26.31 and 10.87 percent with a high and very high level of knowledge competence respectively. whereas a very less percentage (6.66) of respondents belonged to the low knowledge competence category. While none of them belonged to the very low category of knowledge competence. This may be because most of the extensionists had M.Sc. degrees. So they considered them selves to have adequate knowledge of their subject matter. This implies that extension agents were better prepared for serving the technical information needs of clients. About three-fifths (60.70%) of the extension personnel had a medium level of administration skill, while 34.74, 2.81, and 1.75 per cent of the extension personnel had high, very high, and low levels of administration skills respectively. This denotes that they must have digested the lesson that effective development of the organization cannot be done without proper administration skills among the other extension personnel and departments.

The majority (63.50%) of the extension personnel had a medium level of program planning skill, followed by 14.73 per

Table 1. Component-wise professional competence of extension personnel

S.No.	Category	f	%
A.	Knowledge		
1	Very low (7.0-12.6)	0.00	0.00
2	Low (12.7-18.2)	19	6.66
3	Medium (18.3-23.8)	160	56.14
4	High (23.9-29.4)	75	26.31
5	Very High (29.5-35)	31	10.87
B.	Administration		
1	Very Low (5.0-9.0)	0.00	0.00
2	Low (9.1-13.0)	5	1.75
3	Medium (13.1-17.0)	173	60.70
4	High (17.1-21.0)	99	34.74
5	Very High (21.1-25.0)	8	2.81
C.	Program planning		
1	Very Low (9.0-16.2)	0.00	0.00
2	Low (16.3-23.4)	26	9.12
3	Medium (23.5-30.6)	181	63.50
4	High (30.7-37.8)	42	14.73
5	Very High (37.9-45.0)	36	12.63
D.	Program implementation		
1	Very Low (7.0-12.6)	0.00	0.00
2	Low (12.7-18.2)	24	8.42
3	Medium (18.3-23.8)	154	54.03
4	High (23.9-29.4)	62	21.75
5	Very High (29.5-35)	45	15.78
E.	Program evaluation		
1	Very Low (8.0-14.4)	0.00	0.00
2	Low (14.5-20.8)	35	12.28
3	Medium (20.9-27.2)	145	50.88
4	High (27.3-33.6)	67	23.50
5	Very High (33.7-40)	38	8.77
F.	Organizing		
1	Very Low (8.0-14.4)	11	3.85
2	Low (14.5-20.8)	16	5.61
3	Medium (20.9-27.2)	72	25.26
4	High (27.3-33.6)	163	57.19
5	Very High (33.7-40)	23	8.07
G.	Human relation		
1	Very Low (7.0-12.6)	5	1.75
2	Low (12.7-18.2)	29	10.17
3	Medium (18.3-23.8)	43	15.08
4	High (23.9-29.4)	182	63.85
5	Very High (29.5-35)	26	9.13
H.	Communication		
1	Very Low (8.0-14.4)	0.00	0.00
2	Low (14.5-20.8)	38	13.33
3	Medium (20.9-27.2)	21	7.36
4	High (27.3-33.6)	191	67.01
5	Very High (33.7-40)	35	12.28
I.	Teamwork and leadership		
1	Very Low (8.0-14.4)	34	11.92
2	Low (14.5-20.8)	49	17.19
3	Medium (20.9-27.2)	171	60.00
4	High (27.3-33.6)	20	7.01
5	Very High (33.7-40)	11	3.85

cent of them with a high level of program planning skill. Whereas (12.63, 9.12) per cent of the extension personnel were observed with very high and low program planning skills. None of them was found in the category of very low program planning skills. The insufficiency of resources particularly manpower might have made them cautious and improved their planning skills of that targets can even be achieved with limited resources (Rigyal & Wangsamun, 2011). Slightly higher than half (54.03%) of the extension personnel had a medium level of program implementation skill, while 21.75 and 15.78 per cent of extension personnel had a high and very high level of program implementation skill. Only 8.42 per cent of the extension personnel had low program implementation skills, while none was found in the category of very low level of program implementation skills. This might be due to, the majority of them had developed a calendar of work showing which activity will be implemented when, where, and with which partners. Also, they have established a strong relationship with agriculture research organizations.

The majority (86.66%) of the extension personnel had a high to a very high level of program evaluation skills. Extension personnel were able to conceptualize and design an appropriate evaluation plan, use qualitative and quantitative tools in data collection and analysis, and write a simple evaluation report attributed to high program evaluation skill. Two third (57.19%) of the extension personnel were found with high organizing skills, while 25.26 percent with medium levels of organizing skills. Further, it was also observed that 8.07, 5.61, and 3.85 per cent of the extension personnel belonged to the very high, low, and very low categories of organizing skills. It can be concluded from the above result that the majority (82.45%) of the extension personnel had a high to a very high level of organizing skills. The extension personnel at all levels might have understood the fact that in absence of proper organization of work, the tasks pile up, resources are wasted and goals are not met effectively and this, in turn, might result in aggravating job stress. Slightly less than two-thirds (63.85%) of the extension personnel had a high level of human relation skill followed by 15.08 with a medium level of human relation skill further it was also observed that 10.17 and 9.13 per cent of the extension personnel were found with low and very high human relation skill respectively. Very less (1.75) per cent of the extension personnel belonged to the very low category of human relation skill. It is quite natural that differences of opinion might be there on different issues in the work place, but such differences of opinion should not take the form of obstacles to achieving organizational objectives. The extension personnel might have understood the significance of this and might have developed the knack to have better interpersonal and intergroup adjustment.

The majority (67.01%) of the extension personnel had a high level of communication skills, followed by 13.33 and 12.28 per cent with a low and very high level of communication skills respectively. Interestingly none of the extension personnel were observed with a very low level of communication skills. It means a majority of them had fairly enough ability to express their ideas to others as well as listen to the ideas of others, understand them properly, and avoid misunderstandings in communication. A high level of education and medium to the young age of extension

personnel might have helped them to develop good communication ability in them. This result is partially in line with findings of Scheer (2011).

The majority (60.00%) of the extension personnel had a medium level of teamwork and leadership skills followed by 17.19 and 11.92 per cent of extension personnel were observed with a low and very low level of teamwork and leadership skills, further, it was also observed that a very less percent (7.01 and 3.85) of the extension personnel belonged to a high and very high category of team work and leadership skill respectively. In the department and KVKs, various types of extension activities/programs are carried out which provide opportunities to extension personnel at different levels to influence or direct their subordinates or farmers to the accomplishment of targeted goals. Apart from this, their attributes like higher education, higher self-confidence, higher achievement motivation, and good experience might also have helped to some extent in the development of team work and leadership quality among extension personnel.

Overall professional competence of extension personnel

Based on data on different components, the overall professional competence index was calculated for each respondent and based on their average composite index score; they have grouped arbitrarily into five categories. Table 2 indicates that the majority (52.28%) of the extension personnel had a high level of overall professional competence with an average composite index value of 75.86 followed by 20.70 per cent of them with a medium level of overall professional competence. The result is line with the findings of Ramjee (2016). A considerable percentage (15.08) of the respondents belonged to the low competence category. A very less percentage of the extension personnel belonged to very high (7.02) and very low category (3.85) categories of professional competence. As discussed earlier, the majority of the extension personnel were observed at high or medium to high levels on different components of professional competence. The aggregate effect of all these components is reflected in a high to a very high level of overall professional competence. The result of the study is in line with Debnath et al., (2014).

Stepwise multiple regression analysis presented in Table 3 indicates that all the independent variables considered in the study together exerted significant influence on the professional competence of the respondents. It implied that the variation in professional competence was due to the combined influence of all the 12 variables studied for this purpose. An analysis of the coefficient of determination revealed that independent variables contributed to the extent of 74.5 per cent variation in the

Table 2. Distribution of extension personnel according to their overall professional competence

S.No.	Category	<i>f</i>	%
1	Very Low (0-20)	11	3.85
2	Low (21-40)	43	15.08
3	Medium (41-60)	59	20.70
4	High (61-80)	149	52.28
5	Very High (81-100)	20	7.02

Average composite index = 75.86 (High)

Table 3. Multiple regression analysis of independent variable and professional competence of extension personnel

S.No.	Variables	Coefficient	Standard error	't' value
1	Age	0.001556	0.019649	0.079179
2	Education	0.697691	0.328059	2.126725*
3	Experience	0.168891	0.029637	5.698591**
4	Social participation	0.286665	0.168593	1.700341
5	Training received	0.13542	0.050826	2.66445**
6	Mass media exposure	0.13408	0.09718	1.37971
7	Achievement motivation	0.225478	0.100637	2.240517*
8	Organizational climate	0.537746	0.091282	5.891024**
9	Workload	-0.98862	0.329273	-3.00244**
10	Facilities available	0.13542	0.050826	2.66445**
11	Job satisfaction	0.729027	0.108075	6.7455818**
12	Job involvement	0.30976	0.048621	6.370966**

R square value = 0.745; F value = 6.440; *significant at 0.05 per cent level

professional competence of extension personnel. The results presented in the table, also pointed out that independent variables like education, experience, training, achievement motivation, organizational climate, facilities available, workload, job satisfaction, and job involvement contributed significantly towards the variation in the professional competence of the extension personnel.

With increase in the level of education, the professional competence of extension personnel also increased as the higher level of education might have increased their power of understanding and learning new things. It is quite obvious that experience makes man learn many new things, increases his technical know-how and skill and thus gradually leads him towards perfection. Achievement motivation of an individual is the basic character upon which other motives and drives are built. When one develops high level of achievement motivation, he would try hard to find out the ways and means to achieve the desired thing. This will foster in him higher level of professional competence. It is natural that a person would derive high job satisfaction only if he can accomplish his task/job with efficiency and effectiveness and this is possible only if he has high level of professional competence.

Further, in light of the significant contributions made by the above-mentioned variables toward the professional competence of the respondents, these variables can be considered good predictors of the professional competence of extension personnel (Neda 2010). These results reinforce the findings of factors influencing the professional competence of extension personnel with the various characteristics of extension personnel. This result is in line with the result found by Borah & Devarani (2022).

Results of the Kruskal-Wallis rank sum test as presented in Table 4 reveal that the Kruskal-Wallis chi-squared value and p-value were 0.11579 and 0.9438 respectively. Since the p-value was greater than 0.05, the test was found to be not significant, that is there was no significant difference in the level of professional

Table 4. Kruskal-Wallis test statistics for the comparison of professional competence among the three groups (KVK, SDH, SDA)

S.No.	Category	Value
1	Chi-square	0.11579
2	df	2
3	p-Value	0.9438

competence of extension personnel of KVK, SDA, and SDH. This result is partially in line with findings of Prabhavati and Badiger (2013).

Table 5 shows category wise average composite index of extension personnel it is clear from the table that, there is no significant difference between the level of professional competence of extension personnel of KVK, SDA, and SDH. Both KVKs and Departments (SDA & SDH) are primarily focus on the extension activities like conducting training, advisory works, field visits, demonstrations etc. This maybe the major reason for their same level of professional competence. This result confirms the result obtained through the Kruskal-Wallis rank sum test.

Table 5. Average composite index for professional competence

S.No.	Composite index	%
1.	KVK	88.38
2	SDA	87.89
3	SDH	87.45

CONCLUSION

The study observed that most of the extension personnel had a high overall professional competence. Extension personnel possessed a high level of program evaluation, organizing, human relation, & communication skills. In contrast, knowledge competence, administration skill, program planning skill, program implementation skill, and teamwork and leadership skills were found to be medium. These skills and competence could be used for multiple programming functions. The findings indicated that training is one of the prominent variables influencing professional competence. Therefore, policymakers, planners, and executives should concentrate on providing more training to increase the competence level of employees. The extension personnel working in KVKs also need training on capacity building and stress management issues. The pre-service extension education curricula must be reviewed and updated, incorporating the core competencies.

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Farmers' Awareness of Agricultural Schemes under *Saansad Adarsh Gram Yojana* in Varanasi, Uttar Pradesh

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ABSTRACT

The study was conducted to analyse the effect of *Saansad Adarsh Gram Yojana* (SAGY) on farmers' awareness of different agricultural schemes during 2021. The centre and state government-sponsored schemes under the SAGY were taken into consideration. As per the need of farmers, 25 schemes were included as the indicator for awareness in the study. The investigation was carried out in two blocks of the Varanasi district of Uttar Pradesh state. A significant difference was seen in awareness among the farmers of model and non-model villages. Among crop-based schemes, almost 70 per cent of farmers of model villages were aware of the soil health card followed by Paramparagat Krishi Vikash Yojana (66%) and financial assistance for improved seeds (65%). Sixty percent of farmers of model villages were aware of the artificial insemination of animals scheme which was highest followed by the national livestock mission (18.67%). In model villages, the majority of the farmers were in the category of high and medium levels of awareness. Only 14.67 per cent of farmers were in the category of low level of awareness but from the non-model villages, the majority of farmers were in the category of low level of awareness.

INTRODUCTION

According to census 2011, 68.85 per cent of the total population of the country lives in rural India. Among this huge population, almost 65 per cent depend on primary sector (agriculture) for their livelihood. Due to the lack of basic amenities in their own village, people are migrating to another places. For the welfare of farmers, a large number of schemes have been initiated by the state as well as the central government, but the progress is not as much as we predicted. Infrastructure, education, health, sanitation, and employment have all improved as a result of development programmes and technological breakthroughs in rural India. Although the Indian economy has risen significantly in all fields of development in rural areas during the previous two decades, its growth has been shown to be unequal when comparing

different social and economic categories, geographic regions, and rural and urban locations. When the global development agenda is inclusive development, as it has been since the adoption of the Millennium Development Goals and, more recently, the Sustainable Development Goals by the United Nations in 2015, it is critical to shift our focus away from hard core income and economic growth and towards more sustainable and equitable development, which is impossible to achieve by ignoring rural India.

The *Saansad Adarsh Gram Yojana* (SAGY) was launched with the concept of developing model villages, so called *adarsh grams*, in every constituency of the country. All the Members of Parliament (MP) will be engaged in developing model villages from 11th October 2014, which will further lead to expansion of more model villages by the nearby villages itself with the help of respective gram panchayats. In Varanasi constituency, a total of 4 villages were adopted

from 2014 to 2019 (first tenure of the then Prime Minister Narendra Modi and Varanasi MP). They were Jayapur (2014); Nagepur (2016); Kakarahiya (2017) & Domari (2019). Two more villages were adopted by our Prime Minister in 2021 namely Pura Bariarpur of Sewapuri Block and Parampur of Arajiline block but a formal announcement about the adoption of the villages was not made. In his second tenure, initially no village were adopted due to COVID-19 pandemic, hence this year two villages will be adopted to make model villages (Hindustan Times 16 February 2021).

METHODOLOGY

The study was conducted in Varanasi district, eastern plain zone, of Uttar Pradesh Province. In Varanasi district, there are total 8 blocks. Arajiline (Jayapur and Nagepur) and Kashi Vidyapeeth (Kakarahiya) blocks comprise all the 3 adopted villages which were the study area. Again, two control villages Chandapur and Hapur was selected randomly from Arajiline block and one control village Anantpur was selected randomly from Kashi Vidyapeeth. Hence these two blocks were selected purposively. A total 150 respondents were selected from all the six villages (25 respondents from each village) to analyse their knowledge related to awareness of the schemes. After discussion with officials of agriculture department, farmers and a booklet called SAMANVAY (compilation of central sector, centrally sponsored and state

schemes for convergence under Saansad Adarsh Gram Yojana), twenty-five schemes were selected for this study.

It is deduced that three different types of primary data collection may be used to test theoretical models and concepts: survey methods, observational techniques, and experimentation. In the current study, information was gathered using an organized interview schedule. For the analysis and interpretation of the data, frequency, percentage, means correlation coefficient, and Mann-Whitney U statistics were produced.

RESULTS AND DISCUSSION

Table 1 includes all the schemes selected for the study which is also incorporated in SAGY were divided into five major enterprises viz. crop based schemes, dairying & animal husbandry schemes, fish & poultry development schemes, other agricultural schemes, and rural development schemes. In crop based schemes, 82.67 per cent of the respondents from model villages were aware about Weather Based Crop Insurance Scheme followed by 70.67 per cent about Soil Health Card. After that Paramparagat Krishi Vikash Yojana (66.67%), financial assistance for improved seeds (65.33 %) and Pradhan Mantri Krishi Sinchai Yojana (53.33%) were prevalent in model villages in terms of awareness. In non-model villages, 46.67 and 36.00 per cent respondents were aware about Weather Based Crop Insurance Scheme and Soil Health Card

Table 1. Scheme wise awareness of respondents from Model and Non-Model Villages

S.No.	Scheme	Model Villages (%)	Non-Model Villages (%)
I.	Crop Based Schemes		
1	Pradhan Mantri Krishi Sinchai Yojana	53.33	28.00
2	Weather based crop insurance scheme	82.67	46.67
3	Rashtriya Krishi Vikash Yojana	34.67	0.00
4	Soil Health Cards	70.67	36.00
5	Financial Assistance for Improved Seeds	65.33	32.00
6	Integrated scheme on agricultural marketing	9.33	0.00
7	Paramparagat Krishi Vikash Yojana	66.67	20.00
II.	Dairying & Animal Husbandry scheme		
1	National Programme for Dairy Development	5.33	0.00
2	Dairy Entrepreneurship Development Scheme	5.33	0.00
3	Kaamdhenu/Mini Kaamdhenu Dairy Scheme	8.00	0.00
4	National Programme on Bovine Breeding and Indigenous Breeds	12.00	1.33
5	Livestock Health and Disease Control Programme	17.33	2.67
6	Artificial Insemination of Animals Scheme	60.00	32.00
7	National Livestock Mission	18.67	4.00
III.	Fish and Poultry Development Schemes		
1	Blue Revolution - Inland Fisheries	80.00	22.67
2	Duck culture	54.67	4.00
3	Backyard Poultry Scheme	80.00	4.00
IV.	Other Agricultural Schemes		
1	Solar Irrigation Pump Scheme	26.67	1.33
2	National Mission on Agricultural Extension and Technology	4.00	1.33
3	Oilseeds Development	12.00	2.67
4	Sericulture Development Programme	8.00	0.00
V.	Rural Development Schemes		
1	Indira Awaas Yojana	100.00	100.00
2	Pradhan Mantri Gram Sadak Yojana	100.00	94.67
3	MNREGA	100.00	100.00
4	Godown and Warehouse Creation	32.00	0.00

respectively. Only 34.67 per cent respondents were aware about Rashtriya Krishi Vikash Yojana from model villages whereas no one of the respondent was aware about this scheme from non-model villages.

In dairying & animal husbandry schemes, 60.00 per cent respondents from model villages and 32.00 per cent respondents from non-model villages were aware about Artificial Insemination of Animals Scheme. The reason for less awareness in non-model villages could be less animals at respondent's farm and rare camps related to information dissemination regarding animal husbandry practices. Here, 18.67 per cent respondents were aware about National Livestock Mission and 17.33 per cent respondents were aware about livestock health and disease control programme from model villages. 12.00, 8.00, 5.33, & 5.33 per cent, respondents from model villages were aware about national programme on bovine breeding and indigenous breeds, kamdhenu/mini kamdhenu dairy scheme, dairy entrepreneurship development scheme and national programme for dairy development respectively. None of the respondent was aware about Kamdhenu/Mini Kamdhenu Dairy Scheme, Dairy Entrepreneurship Development Scheme and National Programme for Dairy Development from non-model villages. Only 1.33 per cent respondents were aware about national programme on bovine breeding and indigenous breeds. Very low awareness about maximum schemes related to dairying & animal husbandry in model as well as non-model villages was observed. The major reason found during survey and observation were less numbers of animals at respondent's farm, dairying and animal husbandry that too for consumption purpose not as commercial purpose, dairying & animal husbandry was not adopted as a primary occupation by most of the farmers in the study area and lack of interest of farmers to establish dairy farms at large scale was observed.

In fish & poultry development schemes, 80.00 per cent respondents from model villages were aware about Blue Revolution - Inland Fisheries and Backyard Poultry Scheme and 54.67 per cent were aware about Duck culture. Whereas from non-model villages 22.67 per cent respondents were aware about Blue Revolution - Inland Fisheries and only 4.00 per cent were aware about Backyard Poultry Scheme and Duck culture. The reasons for low awareness in non-model villages could be lack of willingness of state department officials or any other officials responsible to dissemination of technologies related to fish & poultry development.

In other agricultural schemes, 26.67 per cent respondents from model villages were aware of Solar Irrigation Pump Schemes compare to 1.33 per cent from non-model villages. Respondents were not much aware about these schemes from model as well as non-model villages both. Twelve percent respondents from model villages were aware about Oilseeds Development scheme whereas 2.67 per cent respondents from non-model villages. Eight percent respondents from model villages were aware about Sericulture Development Programme whereas no any respondents were aware of this scheme from non-model villages. And only 4.00 per cent respondents from model villages were aware about National Mission on Agricultural Extension and Technology whereas only 1.33 per cent from non-model villages.

In rural development schemes, 100.00 per cent respondents were aware about the schemes like IAY, MNREGA from model as well as non-model villages. Cent percent of the respondents from model villages and 94.67 per cent respondents from non-model villages were aware about PMGSY. Only 32.00 per cent respondents were aware about Godown and warehouse creation scheme from model villages whereas no any respondent was aware about this scheme. The reason for the high awareness of schemes like IAY, MNREGA, and PMGSY was not related to the adoption of the villages under SAGY because it has been observed that respondents from non-model villages were also aware of these schemes. The reasons could be proper implementation, reached to the needy one, higher frequency of occurrence throughout the year.

Table 2 divulged that awareness level of respondents was significantly correlated with education, land holding, annual income at 1% level of significance and with herd size and source of information at 5% level of significance in model villages, whereas, education and source of information of respondents were significantly correlated with awareness level at 1% level of significance in non-model villages. However, remaining variables namely, age, family size and social participation did not show any significant correlation with awareness level of respondents of model as well as non-model villages.

Comparison of awareness among the respondents from model villages and non-model villages was done using Mann-Whitney U Statistics on awareness score of selected villages and Z value as well as P value were calculated at 5 per cent level of significance. Now, as per a critical look on Table 3, significant difference

Table 2. Correlation between farmer's socio-economic status and farmer's awareness of different agricultural schemes

S.No.	Variables	Model villages		Non-model villages	
		Pearson correlation coefficient	p value	Pearson correlation coefficient	p value
1	Age	0.132	0.259	-0.020	0.862
2	Education	0.573**	0.000	0.803**	0.000
3	Family size	0.227	0.051	-0.050	0.670
4	Land holding	0.558**	0.000	0.150	0.200
5	Annual income	0.534**	0.000	0.146	0.210
6	Herd size	0.249*	0.031	0.195	0.093
7	Source of information	0.255*	0.027	0.576**	0.000
8	Social participation	0.129	0.271	0.032	0.783

* Correlation is significant at the 0.05 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed)

Table 3. Comparison of awareness among respondents from model and non-model villages

Schemes	Model Villages (n=75) Mean±SD	Non-Model Villages (n=75) Mean±SD	Mann-Whitney U Statistics	P value
Crop based schemes	0.54±0.28	0.23±0.27	-6.211	0.00
Dairying & Animal Husbandry schemes	0.18±0.24	0.04±0.06	-4.696	0.00
Fish & Poultry Development schemes	0.71±0.33	0.10±0.22	-9.086	0.00
Other Agricultural schemes	0.12±0.24	0.003±0.028	-4.613	0.00
Rural Development schemes	0.82±0.14	0.73±0.10	-3.732	0.00

*Multiple comparison between model and non-model villages at 5 % level of significance.

($p=0.00$), between model and non-model villages, was found in terms of awareness of different agricultural schemes. The mean value of model villages for all the schemes was significantly higher from non-model villages. We could also see that the mean value of rural development schemes was highest and mean value of dairying & animal husbandry schemes was lowest in model villages. The reasons for higher mean value for different schemes in model villages as compare to non-model villages could be, frequent intervention of scientist from Banaras Hindu University and officials of agriculture department in model villages, farmers of model villages approach more frequent than non-model villages to the agricultural institutions like KVK/ATMA, IIVR etc. Farmers of model villages were having more land holding compare to non-model villages farmers and participation of model village's farmers in different training programmes, exhibitions, Krishi mela etc., has increased their awareness level.

CONCLUSION

Awareness of respondents from model village was higher than non-model villages which pointed towards a development of the rural villages with certain interferences. The SAGY and other schemes, intended to develop more model/ideal villages in the country, are the remarkable approaches to achieve sustainability. The nearby villages of model villages will also become sustainable along with adoption of the newly launched schemes and technologies. The study concluded that the awareness among farmers of model villages towards different agricultural schemes were higher than the non-model villages. Although, many farmers were still not aware of some of these schemes (especially dairy and animal husbandry schemes), so the awareness camp can be organized for dissemination of information related to various schemes.

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Documentation of ICT Initiatives of Agricultural Research Institutions in Telangana: Application of Nudge Theory

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ABSTRACT

The application of ICT offers excellent possibilities for empowering stakeholders and establishing appropriate communication between research and extension systems. This paper attempts to document and analyze selected ICT initiatives of three Agricultural Research Institutes in Telangana. Nudge Theory, is employed to identify specific nudges in this ICT initiatives of Research and development institutions. A relatively new concept, Nudge theory proposes positive reinforcement and indirect suggestions as ways to influence behavior. These are simple, low-cost interventions that alter behavior in predictable ways. A descriptive research design was adopted for the study. A nudging framework was developed and nudges were classified under 8 groups viz., internally imposed- mindful encouraging, mindful discouraging, mindless encouraging, and mindless discouraging and the externally imposed- mindful encouraging, mindful discouraging, mindless encouraging, and mindless discouraging.

INTRODUCTION

Agricultural extension is an educational service which brings information and new technologies to farming communities to enable them to improve their production, income and standard of living. The application of ICT offers excellent possibilities, for empowering stakeholders and establishing appropriate communication between research and extension system (Rathore, 2021). Use of Information and Communication Technology by various agricultural research institutions in the dissemination of information to the stakeholders is in vogue. Stakeholders are receiving the information on various ICT platforms but what are the attracting efforts to accept both means and technologies? ICT tools are utilized mostly for social media and video calling but less for computer, global positioning system, web camera and radio (Panda et al., 2019). lack of training on ICT tools (Singh et al., 2020), diversified occupation, education, annual income, farming system/ allied agricultural activities, mass media exposure, and extension contact (Anand et al., 2020), landholding, family income,

cosmopolitaness-localiteness, social participation, extension participation (Mishra et al., 2021) are some of the determinants reported in general. Need for improving the awareness and infrastructure of ICT tools in rural areas is always felt (Mishra et al., 2020).

Nudge theory is a concept in behavioral science that proposes positive reinforcement and indirect suggestions as ways to influence behavior. These are simple, low-cost interventions that alter behavior in predictable ways (Yanbo et al., 2020). One of its major proponents, Richard Thaler was awarded the 2017 Nobel Prize in Economics Sciences for bringing nudge theory to mainstream attention. The idea is a subtle policy move that motivate people to make decisions that are in their broad self-interest. It's not about punishing people if they don't behave in expected way. It's about making it comfortable for them to make a certain decision (Sinha, 2018). "By knowing how people think, we can make it easier for them to choose what is best for them, their families and society," wrote Richard Thaler and Cass Sunstein in their book Nudge, which was published in 2008. In the layman's language two examples were given such as: Nudge for

Cashless Economy. Incentives such as bonus points, cash back, top-ups, and further discounts encourage customers to use cashless systems of payment. People are being encouraged to adopt it by banners highlighting the advantages of becoming cashless and by earning points for every transaction' *The punch line for encouraging people to use less cash in eliminating black money and the elimination of corruption*'.

Nudge for increasing attendance to library; Encourage more people to visit the library by placing a beverage station at the desk, create a space for collective dialogue, plan a variety of events for the library, supplying digital study resources, Give out audio books. Characteristics of nudging framework involve; self imposed nudges i.e. voluntarily adopted by people to enact a behavioral standard that they feel is important, the externally imposed nudges that do not require people to voluntarily seek them out, the mindful nudges i.e. behavioral standard that people would like to accomplish but have trouble enacting, the mindless Nudges which includes the use of emotion, framing or anchoring to sway the decisions that people make, the encouraging nudges which facilitate the implementation or continuation of a particular behavior and the discouraging nudges which hinder or prevent behavior that is believed to be undesirable. Keeping these in mind a study was conducted to document the ICT initiatives of Agricultural Research Institutions and find out the nudges in popular ICT interventions.

METHODOLOGY

Descriptive research design was adopted for the study. An effort was made to document the ICT initiatives of institution

describing the characteristics of the ICT initiatives. The methodology focused more on what are the ICT initiatives and deliberate effort was made to describe. Telangana state was selected purposively as there are many ICT initiatives and projects that are being taken up. ICAR Institutions, State Agriculture University were considered for the study to document the initiatives. An attempt was made to apply qualitative tool - nudge theory in the field of extension education and to pen down the nudges in most popular ICT related activities which were started by different agricultural research institutions in Telangana.

RESULTS AND DISCUSSION

Electronic media wing- PJTSAU

Professor Jayashankar Telangana State Agricultural University, pioneer in the service of the farmers strive to deliver the latest technologies to the farming community through different means of digital platforms. The Electronic wing has been immensely useful in production of Video capsule programmes; Digital Video Discs (DVDs), Jingles (catchy rhyme) and YouTube live.

The activities involved were; production of DVDs (to develop interactive and descriptive DVDs on various crops and technologies), documenting success stories (documenting the success stories both at research station and in farmer's fields, recording of visuals, voice over of scientists, farmers and experts at different stages of the crop, finally editing and uploading to YouTube channel). These were utilized in the documentation and popularization of technology. This can be acting as a future nudge to motivate other farmers in adoption of new practices (Table 1).

Figure 1. Conceptual model for nudge theory framework of documenting ICT initiatives of agricultural research institutions

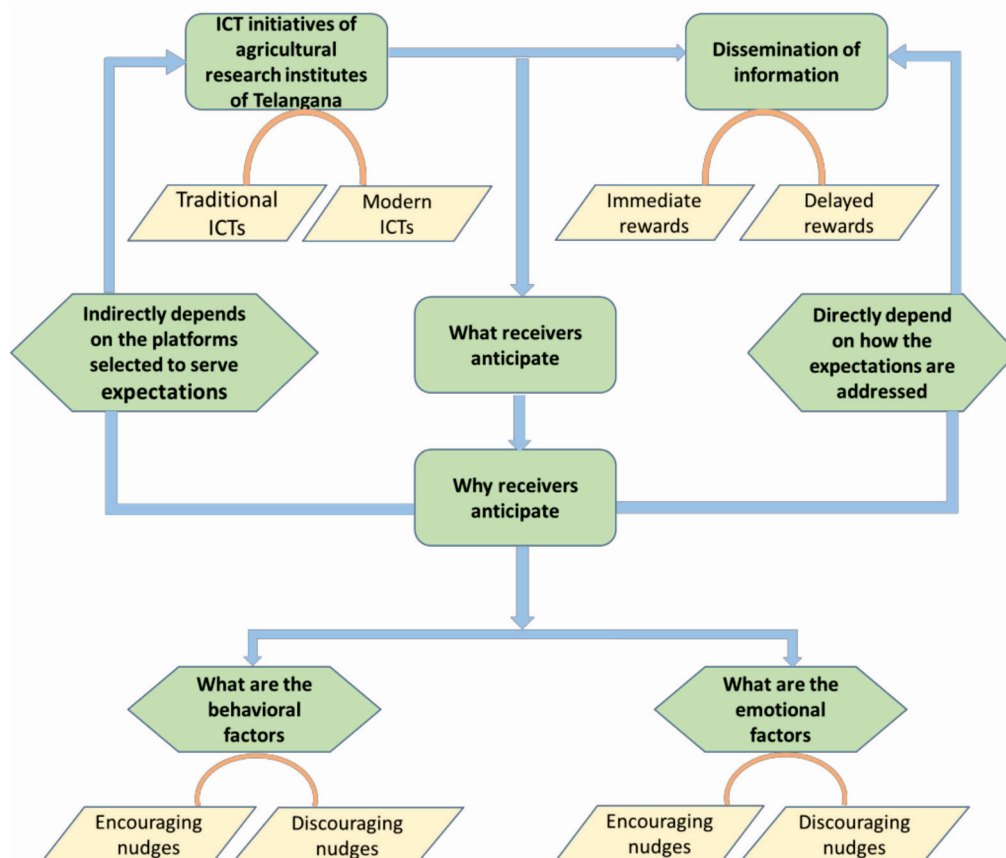


Table 1. Nudges identified in ICT Initiatives of PJTSAU

S.No	ICT Initiatives of PJTSAU	Nudges
1	Phone-in Live programme (Raithu Nestham) T-SAT	Toll Free call Instant Solutions Quick tips for burning issues
2	Radio-Chenu Kaburlu Akashavani-Vyavasaya varthalu Vyavasaya Patashala	Updated agriculture news Timely advice
3	Modern ICTs DVD YouTube Channel Whatsapp Groups	Suitable for literate & illiterate, access anywhere Local language/dialect, Diverse topics alert, Repeated views, Search with key words, Exposure to ocean of information Instant Solution, Accurate advice Scope for further clarification

Chenu Kaburlu is another innovative student radio programme initiated on 26 January, 2015. The programmes are broadcasted on every Wednesday from 1.30 am to 2.00 pm in the name of *Vyavasaya Vignana Tarangini/Gruha Vignana Taringini* in Hyderabad 'A' Station. Phone-in- live programmes of Doordarshan (Raithu Nestham) and Phone in Live programmes in T-SAT are other initiatives. Phone in live programmes on Agriculture and allied subjects is being organized on every Monday to Friday of the week for the duration of 60 minutes from 6.00 to 7.00 pm in the name of *Raithu Nestham* by Doordarshan in which a scientist from the university answer the questions of farmers on a pre-informed topic for the day. The Electronic Wing identifies the topics and the resource persons for Doordarshan phone in live programme and coordinates for the successful completion of the programme whereas T-SAT initiated phone in live programme in December 2017 as a part of Agricultural Programme. The programme is being telecasted on every Monday from 4.00-5.00 PM in the name of *Rhythu Mithra*. The topic and the resource persons for T-SAT phone in live programme are identified by the Electronic Wing. Electronic wing is actively participating in all agricultural programmes of *Aakashavani*. Electronic wing has supplied radio scripts to broadcast as *vyavasaya varthalu* for 10 minutes duration every day from 6.50–7.00 PM. *Vyavasaya Patashala* programme broadcasting on every Monday from 7.15–7.45 PM. is also being coordinated by electronic wing. It also imparts and enriches the knowledge base on the farm tele advisors of Kissan Call Centre by providing training on relevant topics. It also supports in preparation of video modules on Village Adoption Programmes, AELP programme and student activities.

In the form of other ICT Initiative Programmes/Innovative programmes; developed Digital Agricultural Knowledge Management portal for video repository for sharing visuals with Extension Centre's of PJTSAU, WhatsApp groups for students participating in *Chenu Kaburlu* in the name of radio club PJTSAU and exchange of ideas in agriculture and sending alert messages to the farmers. The nudge underlying here is the easy operation of WhatsApp by farmers and regular, timely information from the university.

To benefit the farming community, electronic wing has started YouTube Channel in the name PJYSAU Agricultural Videos. It has been running successfully with the subscriber count of 72,000 and 309 videos till date. The success for YouTube videos and the possible nudges can be described as it is created with total 10 playlists and categorized under crop production, crop protection, community science, farm mechanization, success stories, university activities, PJTSAU initiatives, NAHEP and general videos, farmers can easily view video of their own interest.

National Academy of Agricultural Research Management

The ICAR-National Academy of Agricultural Research Management (NAARM) has developed an application called Agriprioritize, which is a problem Prioritization Technique in Agriculture, used to prioritize problems in a scientific manner. It is calculated through a Value Based Index. Agri Prioritize helps in Prioritizing problem statements of one/multiple locations. Systematic and step by step data entry helps in analysis and to get accurate ranking. Comprehensive Summarization of results based on customized needs (Table 2).

AHP Analyzer- Analytic Hierarchy Process (AHP) analyzer is online tool that facilitates the group decision making by pair wise comparison based on expert judgment values. The Decision Support System (DSS) by web based AHP methodology is converted to Expert System.

a-IDEA is a Technology Business Incubator of NAARM initiating several activities like student sensitization programs, FPO-farmer immersion programs, providing platform to startups for showcasing their ideas having access to 65 ICAR Institutes/ Researchers/Scientists, 722 KVKs, 63 State Universities, 15 Research Institutes. The nudges responsible for successful running of a-IDEA include well equipped laboratories with strong association and networking, having an access to various institutions/scientists, providing funds for innovative ideas and encouraging agripreneurship among students who are really interested. NAARM is also conducting various MOOCS courses for the learners to access from anywhere in the country and enhance their knowledge. They have their own YouTube channel with a subscriber count of 13,000 and also present on all the social media platforms regularly posting the information related to the organization activities and agriculture needs.

Table 2. Nudges identified in Initiatives of NAARM

S.No.	NAARM Institute	Nudges
1	Agriprioritize	e-mediated Prioritize problems based on value index
2	AHP Analyzer	e-mediated Group Decision making
3	a-IDEA Incubator	A lab to try ideas Access to Infrastructure Access to networking Seed Capital support
4	MOOCS	An educational handholding tool Synchronous/Asynchronous mode Nurtures the hidden potentials Tool for re-skilling and Up skills

Indian Institute of Millets Research

Indian Institute of Millets Research coordinates and facilitates millets research at national level through All India Coordinated Research Projects on millets, pearl millet and small millets and provides linkages with various national and international agencies. With regard to ICT usage in the millets promotion, the institute has developed an application called MILLETS FIRST, MILLET MARKET android applications. The farmers can upload the visuals of produce and sell. Success of this application and the nudges in their initiatives include providing marketing access to the producer directly and one can negotiate the price until both satisfy. Institute also has WhatsApp groups for millet farmers across the nation in various languages such as Telugu, Tamil, Kannada, Marathi so that timely information regarding trainings, marketing is communicated through this platform. Nudge underlying here are seeds of various varieties availability, crop management practices were informed directly to millet growers, so they don't miss out relevant information (Table 3).

An effort was made to classify the nudges into a framework. The identified nudges in the ICT initiatives were placed in appropriate divisions based on their merit. The nudges in the initiatives of phone in and use of radio for addressing the issue of stakeholder by PJTSAU which are internally imposed mindful behavioral patterns and encouraging are toll free call and quick tips for burning issues (Table 4). The internally imposed mindful behavioral patterns which are discouraging the undesirable behavioral patterns in the initiative of WhatsApp groups of PJTSAU are to provide instant solution to the stakeholders to discourage procrastination. The a-IDEA and Agriprioritize of

NAARM, Hyderabad which are externally imposed mindful behavioral patterns which encourage a-IDEA acts as lab to try ideas, provides access to networking and seed capital support. The externally imposed mindful behavioral patterns were discouraging the undesirable behavior patterns like discouraging only production and promoting secondary agriculture. The internally imposed mindless behavioral patterns which are encouraging nudges in the initiatives of PJTSAU like YouTube and DVD are appropriate for both literate/illiterate, stakeholders, they can access anywhere, local language/dialect helps in better understanding the issues under discussion, there is further scope for clarification and stakeholders can search the contents with the help of key words. The internally imposed mindless behavioral patterns which are discouraging nudges are the exposing the stakeholders to an ocean of information where there are possibilities of confusion. The externally imposed mindless behavioral patterns which are encouraging include MOOCs as an educational handholding tool, nurtures hidden potentials of active learners, MOOCs can be a potential tool for re-skilling/up-skilling of professionals. The externally imposed mindless behavioral patterns which are discouraging are linkage with market (which has the potential to prevent distress selling) by the stakeholders.

CONCLUSION

The paper made an effort to document usage of ICTs in transfer of technology by three institutions and to identify the nudges that were contributing to the success of these initiatives. The Nudge theory can be used to promote positive behaviors and keep a strategic distance from negative ones without resorting to extreme mediations. The identified nudges shall help the policy makers to frame effective dissemination strategies. The nudges are just like the pulse of stakeholders. If it can read the pulse, it can design a better programme and policy for dissemination of innovations. It aids individuals in making wise decisions. Based on the impact key decisions can be made while designing the programmes with nudges to benefit the farmers. A healthy amalgamation of behavioral science and emerging technology would add another feather in the effective usage of ICTs.

Table 3. Nudges identified in ICT initiatives of IIMR

S.No	IIMR	Nudges
1	Millet first, Millets Market	Linking producer with market Promotes Secondary agriculture
2	Whatsapp groups	Instant Solution, Accurate advice, Scope for further clarification, Multiple languages

Table 4. Overall Nudge framework of Agricultural Research Institutions of Telangana

	Mindful		Mindless	
	Encourage	Discourage	Encourage	Discourage
Externally Imposed	a-IDEA, Agriprioritize, NAARM • e-Mediated prioritization of problems • A Lab to try ideas • Access to networking • Seed capital support	Marketing App IIMR • Promotes secondary agriculture (discourage only production)	MOOCs • Educational handholding tool • Synchronous/asynchronous mode • Nurtures hidden potentials • Tool for re-skilling/up-skilling	IIMR Portal • Linkage with market (discourage distress selling)
Internally Imposed	Phone-in, Radio, PJTSAU • Toll free call • Quick tips for burning issues	WhatsApp, PJTSAU • Instant solution (discourage procrastination)	Youtube, DVD, PJTSAU • Apt for literate/ illiterate • Access anywhere • Local language/dialect • Search with key words • Scope for clarification	Youtube PJTSAU • Exposure to ocean of information

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Exploring the Entrepreneurial Climate and Attributes of Agripreneurs and its Determinants

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ABSTRACT

The entrepreneurial climate is a set of tangible and intangible factors that shape and create a climate for agripreneurship in a region or area. An attitude scale was developed with 44 items (36 items positive and 8 negatives) during 2022. It was administered to 120 agripreneurs of Uttar Pradesh and it was found that the majority of the factors namely institutional, psychological, cognitive, sociological, economical, and managerial were contributing significantly to creating and shaping the entrepreneurial climate. Among these major factors, managerial factors were contributing most prominently with the highest total mean score of 2.83. The possible relation between socio-personal, socio-psychological, and entrepreneurial variables was explored considering the various dimensions of entrepreneurial climate as dependent variables. It was found that the majority of characteristics was associated with entrepreneurial climate and was able to define to the extent of 62.30 per cent.

INTRODUCTION

Currently, major issues in Indian agriculture are declining producer share in consumer prices, significant post-harvest losses, a low percentage of agro processing, and value addition in agricultural commodities. Alongside lack of accessibility and availability of food anywhere/anytime across the globe indicate that there is a need of focusing on the promotion of secondary agriculture. Secondary agriculture is the biggest private agrienterprise as a majority of rural people are engaged in agripreneurial activity. Development of the agro-processing industry for value addition is the need of the hour to expand the market globally to enhance the accessibility and availability of food everywhere. There is a need to pay attention to issues other than agricultural productivity and output. In the wake of the government's focus on increasing the income of farmers, among other possible options, one of the strategies is the promotion of secondary agriculture (NITI Aayog, 2020). Despite many promotional schemes and incentives

agripreneurship has not taken off with the speed which was envisaged. What kind of entrepreneurial climate these schemes/policies have resulted in, needs to be probed. Agripreneurship development may be visualized as a process whereby individual's motivations and aspirations trigger it and their entrepreneurial competencies, adoption of best practices and facilitative socioeconomic factors play sequential role in reaching agripreneurial success (Singh et al., 2016) and well developed effective linkages among all the stakeholders resulted in higher profits for producers and consolidated production sites for marketing and supply chain agencies (Singh et al., 2014). The set of tangible and intangible factors shaping/influencing the performance of agrienterprises in a geographically defined area such as a village or blocks (Roxas et al., 2007) needs in-depth analysis. One notable manifestation of agripreneurs attitude is agripreneurship and the agripreneurs do not act in a vacuum, but react to entrepreneurial climate surrounding them (Peters & Waterman, 1982). A lot of attitude-based research avoids long-term development techniques. In many cases, researchers

modify an existing standardized scale for their current research (Nikam et al., 2014; Meena & Singh, 2013) or collect a pool of statements from the literature review and administer them to the respondents in Likert form for their level of agreement (Siebert et al., 2010; Badola et al., 2012; Ward et al., 2016; Singh et al., 2021; Kumar et al., 2021; Gupta et al., 2022).

The entrepreneurial climate is defined as factors that are critical in developing entrepreneurship in certain regions (Gnyawali & Fogel, 1994). Hence it is needed to find out and assessed the factors influencing the entrepreneurial climate. Thus, the entrepreneurial climate for promoting secondary agriculture may be conceptualized to be comprised of the factors viz., institutional factors, psychological factors, cognitive factors, managerial factors, sociological factors, and, economical factors aspects within the boundaries of the firm and are of direct interest to an individual decision-making behavior in the system. The importance of an entrepreneurial climate for various stakeholders and agripreneurs is critical in stimulating occupational culture and agripreneurship to enhance the income of agripreneurs and helps in stimulating economic growth. There was increased need to understand what factors influence the development of a promotional entrepreneurial climate.

METHODOLOGY

The study was conducted in the state of Uttar Pradesh. The agripreneurs were selected on a cluster-based approach from districts and Mandal based on the availability of agrienterprises constituting 120 samples (Anonymous, 2022). The developed and standardized scale (Gupta et al., 2022) was used to measure on a five-point continuum from strongly agree to strongly disagree (SA-strongly agree, A-agree, NA-not agree, D-disagree, and SD-strongly disagree) with a score of 5,4,3,2, and, 1, respectively, for positive statements and reverse for negative statements. For further analysis mean, standard deviation, frequency and percentage were used. Further, the total mean score (TMS) was used for prioritizing the factor creating/shaping the entrepreneurial climate. The entrepreneurial climate was taken as a dependent variable and selected profile characteristics of agripreneurs were taken as

independent variables to find out the relation between them. The logistic regression model was used for regression analysis with its correlates with the help of SPSS20.0 and Excel Stat software to draw a valid conclusion.

RESULTS AND DISCUSSION

The standardized and developed scale was administered to 120 sampled agripreneurs for their responses towards the factors for creating/shaping/influencing entrepreneurial climate. Further, it was interpreted from the analysis of the responses given by agripreneurs for all major dimensions, namely, institutional factors, psychological factors, cognitive factors, managerial factors, sociological factors, and economical factors, which are contributing significantly to the creation/shaping of entrepreneurial climate as they have shown significant results on the distribution of central tendency (mean was > 2.5). From Table 1, it can be interpreted that all the major dimensions have been significantly contributing/shaping to entrepreneurial climate. The overall mean score of managerial factors is highest that depicts that the major factors for creating or shaping entrepreneurial climate are managerial factors (2.83) followed by sociological factors with a total mean score of 2.34. It was found that the majority of the factors namely Institutional, Psychological, Cognitive, Sociological, Economical, and Managerial were contributing significantly for creating/shaping the entrepreneurial climate. Among these major factors, Managerial factors were contributing most prominently with the highest total mean score of 2.83. The Agripreneur's basic managerial skills were the most prominent contribution as compared to sub-dimensions. The agripreneurs' basic managerial skills that contributed significantly were "unethical practices to get the work done from workers" (75%) and "scientific and rational in labor-management for an agrienterprise" (50%). It was followed by the "Good relation with the international agripreneurs" (77%) contributing significantly from among the business network. Among the marketability factors as "supply of product on time was depending upon the credibility and profitability of respondents". Among the sociological factors, most prominent contribution was from among the social factors (nearly 80%) as the respondents had recognized to be socially for

Table 1. Dimensions of entrepreneurial climate perceived by the respondents

Major factors	1. Institutional (Mean)	2. Psychological (Mean)	3. Cognitive (Mean)	4.Sociological (Mean)	5.Economical (Mean)	6. Managerial (Mean)
Sub-dimensions	A. Governmental factors (2.90) B. Administrative policy-related factors (1.86) C. Infrastructure-Related Factors (1.85) D. Regulatory legal/Bureaucratic factor (1.64)	A. Psycho-behaviour Factors (2.62) B. Intention for entrepreneurship (2.41) C. Strategic orientation (1.98) D. Perception of desirability (1.29) E. Perception of viability (1.91) F. Entrepreneurial orientation (2.78)	A. Level of knowledge (2.37) B. Human Resource Development (1.38) C. Educational Factors (2.41)	A. Social factors (2.44) B. Family, relatives, and friends (2.50) C. Religious Factors (2.63) D. Cultural factors(2.13) E. Social acceptance-related factors (1.50)	A. Marketability factors (2.43) B. Financial Factors (1.89) C. Ease of Doing business (2.72)	A. Agripreneur's basic managerial skills (3.01) B. Business network (2.81) C. Competitiveness (2.35)
Total Mean	2.25	2.23	1.95	2.34	2.27	2.83

their agrienterprise development followed by “Agrienterprise set by ancestral required less effort” and “Development of agroproduct as per need of festival”. Among the cognitive factors majority of the factors were not contributing much to the creation/shaping of entrepreneurial climate as the respondents have not shown much significant score on central tendency (mean score is less than 2.5). The most prominent contribution was from among level of knowledge, nearly 50 per cent of the agripreneurs were using their knowledge for the establishment of agrienterprise as well as production of agro-product based on their local people’s needs followed by the Educational Factors (nearly 45%) as the respondents were updated by the current scenario of secondary agriculture through various events of Seminar/Conference/Chaupal/Exhibition/Krishi Melas. Among psychological factors; majority of the factors contributing significantly to the creation/shaping of entrepreneurial climate as they have shown significant results on the distribution of central tendency (mean is greater than 2.5). Among the subdimensions, the most prominent contribution was seen in Entrepreneurial Orientation and Psycho-behavior Factors as both were strongly contributing (nearly 70%) to the best distribution on a mean score greater than 2.5. Among the Entrepreneurial Orientation “calculated risk for agrienterprise to get expected outcome” and “adoption of novel technology for enhancing the efficiency of agrienterprise” with nearly 70 per cent contribution. Perception of desirability had the lowest score on the mean as the respondents reported that they do not desire agripreneurship much compare to another profession (only 20%).

Among the sub-dimensions of institutional factors, governmental factors were strongly helping the creation/shaping entrepreneurial climate (mean score greater than 2.5) and among the governmental factors the items “Institutions provide help in expansion of agrienterprise” and “Provision of information about agro-processing is not adequate” (nearly 90%) were much significant in shaping/creation of entrepreneurial climate. The factor which was significantly contributing negatively to shaping/creation of the entrepreneurial climate was Regulatory legal/Bureaucratic factors i.e., “GST and its payment are not easy” (nearly 35%). The

Table 2. Correlation analysis between entrepreneurial climate and some selected socio-personal, socio-psychological variables, and entrepreneurial variables

S.No.	Socio-personal and socio-psychological characteristics	Correlation coefficients
1.	Age	-0.150
2.	Education status	0.032
3.	Entrepreneurial experience	-0.256**
4.	Work commitment	0.394**
5.	Social Norms	0.461**
6.	Social Capital	-0.139
7.	Contact with communication channels	0.257**
8.	Risk-taking	.262**
9.	Hope of success	.254**
10.	Persistence	.172
11.	Use of feedback	.248**
12.	Self-confidence	.227*
13.	Knowledgeability	-.179
14.	Persuability	.215*
15.	Manageability	.267*
16.	Innovativeness	.250**
17.	Achievement motivation	.186

**significant at 0.01 level of probability

lowest on the mean score was “Excess bureaucratic procedure while registration of agrienterprises disturbed” (1.35). The similar method of categorization of factors influencing/shaping entrepreneurial climate were found in the study of Gills (2015); Shruti (2018); Verma (2020). The skills in social processes of group management and enterprise management are mostly lacking among the farmers which can be enhanced through entrepreneurial and technical trainings led to income generating activities (Nain et al., 2019). Further, Nain et al., (2013) advocated that awareness, motivation, technical skill, the right assistance and support from family at extension level and government and other organizational at policy level can strengthen their capacities besides adding to the family income and national productivity.

Table 3. Multiple regression analysis of socio-personal, psychological, and entrepreneurial variables with entrepreneurial climate

S.No.	Independent variables	Unstandardized Coefficients Partial 'b'	t-value	Sig.
1	(Constant)	86.574	2.605	.011
2	Age	.051	.311	.710
3	Educational status	.096	.667	.510
4	Work commitment	-.113	-.984	.347
5	Social norms	-1.010	-1.888*	.049
6	Social capital	4.141E-8	.026	.974
7	Contact with localite channels	2.134	2.793**	.009
8	Contact with cosmopolite channels	1.212	2.822**	.007
9	Contact with mass media	.096	.763	.459
10	Achievement motivation	-2.785	-.979	.337
11	Risk-taking	4.506	2.128*	.038
12	Hope of success	-2.061	-.749	.451
13	Innovativeness	2.333	4.129**	.001

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

R² = 0.623; F Ratio at 12 and 107; degrees of freedom = 4.062**

An exertion has been made to know the possible relation between the perceived dimensions of entrepreneurial climate and socio-personal, socio-psychological, and entrepreneurial variables. Table 2 shows the association between the socio-personal, socio-psychological and entrepreneurial variables with the perceived entrepreneurial climate.

As revealed from Table 2, variables namely, social norms, social capital, entrepreneurial experience, work commitment, contact with communication channels, risk-taking, hope of success, use of feedback, self-confidence, persuasability, manageability, and innovativeness were found to be positive and significantly associated with the entrepreneurial climate. Other socio-personal variables namely educational status and frequency of use of communication sources were not significantly associated with entrepreneurial climate. However, age, social capital, and knowledgeability were negatively correlated.

The correlation analysis was done in the study, and only twelve independent variables were fitted in the multiple regression equation. It may be seen from Table 3 that all selected variables explained the variation in entrepreneurial climate to the extent of 62.30 per cent. Out of all the selected variables fitted in the multiple regression analysis few variables, namely, work commitment, social norms, social capital, contact with extension cosmopolite channels, achievement motivation, risk-taking, and innovativeness contributed significantly to the prediction of the creation of favorable entrepreneurial climate. It is interesting to note that social norms, social capital, contact with localite channels, contact with cosmopolite channels, risk-taking, and innovativeness were good predictors of the favorable entrepreneurial climate for agripreneurs. Out of twelve variables, few were showing negative relation with entrepreneurial climate namely work commitment, social norms, achievement motivation, and hope of success. The multiple regression analysis to test the hypothesis with correlates of entrepreneurial climate was also done by Hajong (2009); Ramesh (2009); Sinha (2011) and reported similar results.

CONCLUSION

As the government places a stronger focus on agripreneurship, the concept of entrepreneurial climate is gaining importance in India. The attitude of agripreneurs in shaping/influencing the entrepreneurial climate is critical to the success of agrienterprises. A scale was developed to assist researchers, policymakers, and interested persons to use in determining agripreneurs' attitude toward the entrepreneurial climate in certain area and thereby formulating strategies for facilitating agrienterprise development. Most of the dimensions are significantly contributing/shaping entrepreneurial climate and amongst all, major contributor was managerial factors followed by sociological factors. The attributes like work commitment, social norms, social capital, contact with extension cosmopolite channels, achievement motivation, risk-taking, and innovativeness have contributed significantly to the prediction of the creation of favorable entrepreneurial climate. Therefore, future initiatives of entrepreneurial extension service providers may consider these attributes for bringing an improvement in perceived entrepreneurial climate by agripreneurs.

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Efficiency of Pineapple Production and its Determinants: A Case Study of Manipur

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ABSTRACT

The study was conducted in the hills and valley regions of Manipur with the objectives of assessing the level of technical efficiency and determining the factors influencing the technical inefficiency of pineapple production in the state during the year 2022-23. A total of 240 farmers were interviewed in person to gather primary data. A stochastic frontier technique was used in the study to achieve the stated objectives. Results showed that pineapple production was a profitable business. However, the study's efficiency score of 0.603 indicated that farmers were operating inefficiently. The estimated stochastic production frontier model showed an adverse association between the cost of the sapling, transportation, fertilizer, and manure to the efficiency of pineapple production. According to the technical inefficiency effect model, the only factors that positively explained the technical inefficiency in pineapple production were the farmers' age and household size while factors like education, years of farming experience, credit availability, and contact with extension agents had a negative effect. Therefore, the study concludes that attracting youth in agriculture, extension services, and production inputs availability has to give due attention to augment the effectiveness of pineapple production across the state and nation as a whole.

INTRODUCTION

Pineapple is the third most important tropical fruit in the world after banana and citrus (Sivakkolundu, 2021). It is one of the best-known and most valuable commercial crops in India, ranking sixth with the production of over 7 per cent of the total global output of pineapple and yields of more than 15 t/ha lower than that of the global average of 21 t/ha (Roy and Gosh, 2022a). The most prominent nations in the world for the cultivation of pineapples are Thailand, Brazil, India, Nigeria, the Philippines, and China. With an output of 1774 thousand MT and a contribution of 107 thousand hectares, India is a significant player in the pineapple trade (GoI, 2021).

The diverse agro-climatic conditions of the North East region (NER) favour the cultivation of a variety of horticulture crops,

particularly the diversity of fruit crops (Marak et al., 2023), and pineapple is the most notable of them which was taken up since time immemorial (Das et al., 2015; Priyanka & Gosh, 2022b). The region contributes roughly 64.4 per cent and 46.81 per cent of the nation's pineapple area and production, respectively, with 57.3 thousand hectares and 662.49 thousand MT of production (GoI, 2021). Due to its favorable temperature and soil, Manipur is one of the top producing States for pineapples in the NER, contributing roughly 21.29 per cent and 16.69 per cent, respectively, of the region's pineapple area and production (GoI, 2018). The most widely grown pineapple varieties in Manipur are *Kew* and *queen*. From an economic standpoint, the fruit has become the main source of revenue for the large number of farmers. Therefore, it can be stated that Manipur's alternative industry for creating

significant employment opportunities and a significant source of income might be pineapple farming. The cultivation of pineapple opens up new avenues for employment and income to the farming folk in Manipur (Thingbaijam et al., 2015). However, the area and the production of pineapple in Manipur fluctuated over the study period of 2011-12 to 2020-21. The fluctuation in input utilization, which are *inter alia* the factors controlling crop productivity under the specific combination of ecological management and technical conditions at a certain point in time, may be the cause of the variation in the area and production of pineapple in Manipur. Keeping all these in views, the research problem is identified and taken up with the objectives to examined the level of technical efficiency and determines the factors influencing technical inefficiency of pineapple production using the stochastic frontier approach.

METHODOLOGY

The study was conducted in hills regions as well as the valley region of Manipur. A multistage sampling technique was employed in the study. In the first stage, one district from hills region and the other from the valley region was selected on the basis of area and production. Therefore, Senapati (hills) and Thoubal (valley) district were selected purposively as these districts have the highest area and production of pineapple in the regions. The second stage involved the selection of blocks. One block each viz. Purul and Thoubal blocks from senapati and Thoubal district, respectively were selected purposively. From each block, 6 villages from Purul block namely, Kapao, Khongdei Khuman, Khongdei Shimphung, Lakhomei, Lower Phaibung and Ngamju and from Thoubal block Chandrakhong, Charangpat Maklang, Charangpat Mamang Khangabok, Khoirom and Khongjom were selected. Finally a sample size of 140 farmers' from Senapati district and 100 farmers from Thoubal district to make a total sample size of 240 farmers in the study. For the investigation, primary data were collected through direct interview with pineapple farmers during the year 2022-23.

The technical efficiency/inefficiency was estimated using stochastic frontier production function developed by Aigner et al., (1977) and Meeusen and Van den Brock (1977). The general form of the stochastic frontier production function is

$$y_i = g(x_i, \beta) + \varepsilon_i \text{ for } i = 1, 2, \dots, N \quad \dots (1)$$

Where, y = output, x = input vector, β = parameter vector, ε = error term, i = firm or production unit. The error term β , consists of two independent components,

$$\beta_i = v_i - u_i \quad \dots (2)$$

Where, v_i is the random-error assumed to be identically and independently distributed $N(0, \sigma_v^2)$ and u_i is the inefficiency effect assumed to follow a truncated (at zero) normal distribution $N(u_i, \sigma_u^2)$.

This paper used the most appropriate functional forms by employing the log likelihood ratio test to the Cobb-Douglas models. The Cobb-Douglas specification is presented as follow:

$$y_i = \beta_0 \prod_{j=1}^n x_{ij}^{\beta_j} e^{\varepsilon_i} \text{ For } i=1, 2, \dots, n \quad \dots (3)$$

Where, y = output, x_j = the j^{th} input, $i = i^{\text{th}}$ farmer, $\varepsilon_i = v_i - u_i$ $\beta_0 \beta_j$ = parameter. Transforming into form yields;

$$\ln y_i = \ln \beta_0 \sum_{j=1}^n \beta_{ij} \ln x_{ij} + \varepsilon_i \quad \dots (4)$$

The detail model specification for the case of pineapple production is

$$\ln y = \ln \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 + \beta_5 \ln x_5 + v_i - u_i \dots (5)$$

Where, y = total output (Rs.), x_1 = farm size, x_2 = sapling/seedling cost, x_3 = transportation cost, x_4 = fertilizer and manure cost and x_5 = human labour cost.

$$u_i = \delta_0 + \sum_{m=1}^n \delta_m Z_m \quad \dots (6)$$

Where, Z_m = determinants affecting the efficiency of pineapple production (Z_1 = farmers' age, Z_2 = Education, Z_3 = Farming experience, Z_4 = Household size, Z_5 = Access to credit, Z_6 = Contact with extension agents).

RESULTS AND DISCUSSION

Sample characteristics

The mean and standard deviations of the variables used in the estimation of technical efficiency and its determinants are presented in Table 1.

Perusal of Table 1, it was found that the average farm size under pineapple cultivation in Manipur was estimated to be of 0.25 ha. The general characteristics of the sampled farmers such as their age, education level, farming experience and the household size were examined. The age of the respondents in the study area

Table 1. Mean and standard deviations of key variables

Items	Mean value
Farm size (ha)	0.25 (0.19)
Age of the Farmer (years)	44.23 (9.13)
Education of the farmer (Illiterate=1, Primary=2, middle=3, Secondary=4, Higher secondary=5, Graduate and above=6)	2.19 (1.09)
Experience in crop production (Years in farming)	23.23 (9.13)
Household Size (Number of family member)	6.04 (1.58)
Access to credit (yes=2 and no=1)	1.49 (0.50)
Contact with Extension Agent (yes=2 and no=1)	1.31 (0.46)
Sapling cost (Rs.)	21160.13 (14945.24)
Transportation Cost (Rs.)	2838.31 (1599.99)
Fertilizer and Manure Cost (Rs.)	687.55 (571.39)
Human Labour cost (Rs.)	23509.74 (7718.04)
Total Cost (Rs.)	48195.97 (23521.50)
Return from the Pineapple (Rs.)	66690.00 (53624.31)

Source: Authors' calculation, Figure in parentheses indicates standard deviations

was found to be at the average of 44.23 years. The estimate shows that the respondent attained a primary level of education with an average of 2.19 years. The farming experience that the respondents had in the study area was estimated to be of 23.23 years. The average number of the family members was found to be of 6.04 members. More than 50 per cent of the sampled respondents do not have access to credit in the production of pineapples, according to the reported access to credit value of 1.49 (2=yes and 1=no). Similar findings were found in the case of respondents' interactions with extension agents, where more than 50 per cent of respondents had no contact with extension personnel. Among the various cost incurred in pineapple production, human labour cost was observed to be highest with an estimate of Rs. 23509.74 followed by sapling cost (Rs. 2160.13), transportation cost (Rs. 2838.31) and fertilizer and manure cost (Rs. 687.55). The study depicted that the farmers in the study area used less amount of fertilizers and manure in the production of pineapple. The total cost and the total return of the pineapple work out to be of Rs. 48195.97 and Rs. 66690.00, respectively.

Production frontier estimates

The outcome of maximum likelihood estimate of stochastic frontier production function was elucidated in Table 3. The sigma square (σ^2) value of 0.022 which was positive and also significant at 10 per cent level indicates a good fit and the correctness of the independent variable specified. A value of 0.957 was obtained for the gamma (γ) which measured the influence of technical inefficiency on the recorded output. This suggests that technological inefficiency was responsible for 0.957 per cent of the volatility in the return from pineapple. The finding showed that the farm size coefficient (0.007) was positive which implies that there is an opportunity to expand pineapple production with an increase in the area dedicated to pineapple cultivation. Similar results were reported by Amarasuriya et al., (2010); Das et al., (2014); Thingbaijam et al., (2015); Balogun et al., (2018); Akter et al., (2020) were they found that area under pineapple cultivation had significant effect on the production.

The negative and non-significant coefficient of the planting material (Sapling) cost (-0.011) implies that with increase of investment in purchasing planting material (sapling) in pineapple cultivation it will result in diminishing return. Therefore farmer should be educated in identifying the planting material from their own field which will lead to reduce production cost of pineapple.

Transportation cost showed a negative coefficient (-0.044) which portrayed that high cost of transportation will reduce returns from pineapple. Similarly, the negative coefficient of fertilizer and manure cost (-0.058) also implies the reduction in returns of pineapple with the increase in fertilizer and manure cost. However the findings was in contrary with the finding of Amarasuriya et al., (2010) in which they stated that the amount of fertilizer used was closely related to the production of pineapples, and agronomic data confirmed that fertilizer use affects pineapple yields (Spironello et al., 2004). A positive coefficient for human labour (1.040) shows that the labour force was effectively utilized, along with other inputs, to prevent redundancy and a declining rate of return on labour.

Technical efficiency scores

Table 3 depicts the percentage distribution of the technical efficiency scores of pineapple growers in the study area. The scores run from 0.21 to 1.00, with a mean of 0.603 indicating that on average, producers are able to produce 60.30 per cent of their maximum yield using a certain combination of production inputs. The technical efficiency indices also show that average farmers might raise their output by about 38.78 per cent if they were to reach the technical efficiency level of their most efficient counterparts. Similar to this, an inefficient farmer implies a gain of nearly 74.62 per cent if the farmer could reach the same degree in technical efficiency as his or her most effective counterpart.

Table 3. Technical efficiency levels of pineapple growers

Efficiency Level	Frequency	Percentage
0.21-0.40	3	1.25
0.31-0.50	12	5.00
0.51-0.70	115	47.91
0.71-0.80	58	24.17
0.81-1.0	52	21.67
Total	240	100.00
Mean	0.603	
Minimum	0.25	
Maximum	0.985	
Possible yield enhancement for average farmers (%)	38.78	
Possible yield enhancement for most inefficient farmers (%)	74.62	

Source: Authors' calculation

Table 2. Maximum likelihood estimates of stochastic frontier model for pineapple farmers

Variable	Parameter	Coefficient	Standard Error	t-ratio
Intercept	β_0	12.037**	-0.992	12.133
Farm Size	β_1	0.007	0.513	0.013
Sapling Cost	β_2	-0.011	0.778	-0.015
Transportation cost	β_3	-0.044	0.616	-0.072
Fertilizer and manure cost	β_4	-0.058	0.456	-0.127
Human labour cost	β_5	1.040	0.665	1.565
Variance parameter	σ^2	0.022*	0.118	1.901
	γ	0.957	0.880	1.087
Log likelihood function	325.99			

Source: Authors' calculation, ** indicate significant at 5% level and * indicate significant at 10% level

Table 4. Determinant of technical inefficiency

Variable	Parameter	Coefficient	SE	t-ratio
Intercept	δ_0	0.001	0.998	0.001
Age of Farmer	δ_1	0.009	0.290	0.031
Education of Farmer	δ_2	-0.077	0.726	-0.107
Farming Experience of Farmer	δ_3	-0.014	0.342	-0.040
Household size of farmer	δ_4	0.027	0.824	-0.032
Access to credit	δ_5	-0.045	0.977	0.046
Contact with extension Agent	δ_6	-0.033	0.986	0.033

Source: Authors' calculation

The findings revealed that there is a production efficiency gap for pineapples and that improvement could be accomplished within the present system.

Factors of inefficiency in pineapple production

This section attempts to pinpoint the factors that contribute to the Manipur pineapple growers' technical inefficiency. The findings will serve as a foundation for developing agricultural policy regarding what must be done to increase pineapple producers' productivity. The result of technical inefficiency indicated that farmers' age and household size were the only determinants that positively explained the inefficiency whereas, the determinants such as education, years of farming experience, access to credit and contact with extension agents negatively explained the technical inefficiency in pineapple production (Table 4). The positive coefficient of the farmers age (0.009) indicates the older a farmer becomes, the less efficient they are at farming, and it's possible that older farmers are more risk-averse and reluctant to adopt new technology. Thus, it can be clinched that technical inefficiencies are lower for the younger farmers in the study area. This finding coincides with the results of Amao et al., (2011) and Adegbite and Adeoye (2015). The association between education and technical inefficiency has a negative coefficient (-0.077), indicating that more educated farmers will produce with more efficiency due to more effective skills, access to knowledge, and well-thought-out farm plans. Farmers with higher literacy skills are more inclined to adopt new production technology and are more competent to manage their farms' resources and agricultural activities. Similar results were attained in the works of Trujillo and Iglesias (2013). The years of farming experience of the farmers has negative coefficient (-0.014) means that farmers new in pineapple production business are less efficient compared to their counterparts with more years of experience. In the case of household size, the coefficient is positive (0.027) implies that household size contributed to technical inefficiency of pineapple production given that the youthful generation views farming as a poor man's profession and is unwilling to pursue it as a source of income. This is consistent with the Dolisca & Jolly (2008) that family size has a positive and significant relationship with technical inefficiency. The negative coefficient of the factor access to credit indicates that increase in the farmers' capital reduces the technical inefficiency which also implies that the ability of the farmers to get access to credit enable them to adopt necessary inputs in their farm and help them in enhancing the production efficiency. Technical

inefficiency has a detrimental influence on the frequency of extension contact. Extension contacts are a means of transferring useful information and technology to farmers. This suggests that regular interaction between the extension agent and the farmer promotes the flow of new ideas, leading to an increase in agricultural productivity. The findings support Haq's (2013) assertion that agricultural extension services can offer farmers chances to engage in productive activities.

CONCLUSION

The economic analysis indicated that pineapple production is a profitable business. It is thus recommended that awareness of business opportunities in production of pineapple should be highlighted and realised to the farming community by the state government. However, the study painted a low efficiency scores in pineapple production in Manipur which is a reflection of inefficiency that characterizes small-scale agriculture and in consideration with the factors determining the technical inefficiency the study suggested that the government should provide a favourable environment to encourage more youth to engage in pineapple production in a bid to increase productivity as well as alleviate poverty status and unemployment. In addition, government has to give due attention to the education, extension services, credit availability and production inputs which need to be made available to augment the efficiency in pineapple production in the state and country as a whole.

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Entrepreneurial Aptitude of Women of an Aspirational District of Uttarakhand

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ABSTRACT

A cross-sectional study was conducted for assessing the entrepreneurial aptitude of women in two blocks (Kashipur and Gadarpur) of Udham Singh Nagar, Uttarakhand. A purposive sampling technique was utilized for selecting the respondents. A structured questionnaire vetted by experts and pretested through a pilot study on 45 respondents was developed. Data on women entrepreneurs, self-assessment, and perception of farm women regarding entrepreneurial aptitude was collected from 214 women during the month of June 2022 to August 2022. Results revealed that only 28.50 per cent of women were running their own enterprises, whereas 40.98 per cent of them were engaged in vegetable production/commercial farming. 89.25 per cent of women were interested in running an enterprise and 84.11 per cent had a motto to earn money. 84.11 per cent of the respondents were interested in backyard poultry and 31.31 per cent in spice production. It was concluded that women in the study area had an aptitude for adopting enterprises for improving their quality of life, which needs to be nurtured.

INTRODUCTION

Entrepreneurship generates economic activity that is essential to a nation's development (Amurao et al., 2016). An entrepreneur is the main component of entrepreneurship, and women are now acknowledged as successful entrepreneurs because they possess traits that are desirable and relevant for the growth of a business (Nayyar et al., 2007). Women Entrepreneurship refers to a business or organization started by a woman or group of women (Rashmi, 2016). Due to improvements in education, urbanization, industry, and understanding of democratic values, women's roles have changed. Generally, when people are given the freedom to start and run their own businesses, it is feasible to produce wealth, jobs, and as a result individual and collective well-being becomes a reality. When everyone who can work is given the opportunity to do so, it becomes simpler for the government to redistribute wealth and income (Agrawal, 2018). In addition to the support their families and the government, women should develop some

core skills in order to succeed as business owners. Rural women who build their businesses improve not only their own capacities but also their role as decision-makers in their families and society (Sidhu et al., 2006). The goal of empowering rural women is to give them the skills they need to be financially independent and self-sufficient (Shinogi et al., 2021).

Problems with gaining direct access to the export market for raw materials, general psychological barrier from banks, suppliers, and customers are few draw backs for women entrepreneurs (Gupta et al., 2013; Mishra et al., 2014). According to Behara & Niranjana (2012) the biggest obstacles for female entrepreneurs in India include decision to prioritise family and work, poor educational level, lack of financial aid, and sociocultural hurdles. Sharma (2013) highlighted the means of fostering female entrepreneurship including establishment of specific target groups for female entrepreneurs, better educational facilities, suitable training programmes, and vocational training.

Both nationally and globally, the economic development of women entrepreneurs have been significantly impacted (Bonny et al., 2022). Aspirational district programme (ADP) mainly focuses on the problem of unemployment and poverty in rural areas by inculcating desirable skills and developing entrepreneurial ability (Kumar et al., 2021) The Aspirational Districts Programme of the Government of India aims to quickly and effectively transform 112 most under-developed districts across the country. This program closely focuses on improving people's ability to participate fully in the fast-expanding economy. The districts are encouraged to develop and replicate best practices that drive improvement across the socio-economic themes. According to NITI Aayog (2018) Udham Singh Nagar, the selected district for study is one of the aspirational district of Uttarakhand. The objective of our study was to assess the status for women's aptitude towards entrepreneurship in rural areas of Udham Singh district of Uttarakhand, India in order to empower them economically.

METHODOLOGY

The research work was taken up with underprivileged especially reverse migrant women of an aspirational district, Udham Singh Nagar, Uttarakhand. The operational definition of entrepreneurship as per the objective of the study was women desiring the ownership and management of self-owned business venture. The study was conducted in two blocks of Udham Singh Nagar district of Uttarakhand (i.e. Kashipur and Gadarpur). Support of Krishi Vigyan Kendra, Udham Singh Nagar situated in Kashipur was taken for conducting the research. Based on the outreach of the KVK, twenty-five villages were covered in two blocks. Rural women belonging to low socio-economic status were selected for the study. The consent of women was taken prior to starting the research work making the sample selection purposive. 214 respondents were selected based on their availability and interest. The study was carried out during the month of June 2022 to August 2022. The tools used was a well-structured interview schedule and interview method that was developed keeping in mind the objective of the study. The schedule was vetted by two experts and pretested with 45 respondents from the study area. The interview schedule had sections on entrepreneur information, self-assessment regarding entrepreneurial aptitude, and the perception of women regarding entrepreneurship. The data was tabulated and analyzed in MS Excel and MS office was also utilized.

RESULTS AND DISCUSSION

Women entrepreneurship information

Regarding the involvement of respondents in various enterprises, it was found that only 28.50 per cent of women were running an enterprise independently; of these 59.02 had very small-scale enterprises. Most enterprises (90.16%) were production based and sole proprietorship was reported by 95.08 per cent women (Table 1). The majority (40.98%) of women were involved in vegetable production/commercial farming. According to a study by Rathna et al., (2016) on the problems faced by women entrepreneurs in the Thanjavur area, financial need drives women

Table 1. Nature and Type of Entrepreneurship

Aspect				Percentage
A.	Women entrepreneurs			28.50
B.	Size of Enterprise	a)	Very small scale	59.02
		b)	Small scale	26.23
		c)	Medium scale	14.75
		d)	Large scale unit	0.00
	Entrepreneurial activity	a)	Production	90.16
		b)	Service	4.92
		c)	Production & Service	4.92
	Ownership status	a)	Sole proprietorship	95.08
		b)	Partnership	4.92
c)		Co-operative/ FPO	0.00	
C.	Enterprise wise distribution of respondents			
1	Dairy			19.67
2	Vegetable Production/ Commercial Farming			40.98
3	Grocery Store			1.64
4	Tailoring			8.20
5	Quilt Making			4.92
6	More than one enterprise (from option 1 to 10)			24.59
D.	Reasons for Establishing an Enterprise			
1	Unable to find employment			1.64
2	Belong to an entrepreneurial family			0.00
3	Want to run an enterprise			1.64
4	For increasing income			83.61
5	More than one reason (from option 1 to 4)			13.11

to choose entrepreneurship more than other factors like improving social position or improving family income. The outcome also demonstrated that difficult market conditions and strict legal and regulatory requirements have been more difficult than other issues. Similarly, in the present study, it was reported that the reason for establishing an enterprise by the majority (83.61%) of women was for increasing income.

Self-assessment of entrepreneurial aptitude

Data indicated that most women (96.26%) were not satisfied with their present quality of life. Majority of women who wanted improvement in various aspects of life included improvement in economic status (100%), social status (93.69%), assets (99.51%), educational facilities (96.60%), medical facilities (98.06%), market facilities (98.06%), transport facilities (99.51%) and recreational facilities (93%) (Table 2). Maximum (89.25%) women reported interest in running an enterprise and the reason for this (84.11%

Table 2. Self-assessment regarding entrepreneurial aptitude

Aspect	Response (%)
Satisfaction with Present Quality of Life	3.74
Improvement Expected in Various Aspects of Life	
Economic status	100.00
Social status	93.69
Assets	99.51
Educational facilities	96.60
Medical facilities	98.06
Market facilities	98.06
Transport facilities	99.51
Recreational facilities	93.69

women) was to earn money. Most (84.11%) of the respondents showed interest in backyard poultry followed by spice production (31.31%). Similarly, in a study reported by Devi et al., (2020) among women entrepreneurs of Coimbatore, they found that about majority (61%) of women had started their business in order to earn money.

Perception of farm women regarding entrepreneurial aptitude

Perception is a subjective response to a situation or stimulus. According to the respondent's perspective, 78.97 per cent of women perceived that there will be employment generation by establishing their enterprise, 87.38 per cent of respondents recorded that starting their enterprise will help their family in the long run and generate revenue. 86.92 per cent thought that their enterprise will create an impact on the standard of living of their family as well as others employed by them and 97.20 per cent of subjects felt that rural women should be encouraged for self-employment and entrepreneurship. The majority (64.95%) of respondents had a lot of space around their houses. 64.02 per cent of women had a positive perception regarding setting up their enterprise. 50.47 per cent of subjects disagreed that higher education is essential to start a business, 62.62 per cent of them disagreed that they do not have adequate knowledge to start a business, 3.83 per cent did not agree that poor people are not eligible to do business, 45.33 per cent agreed that they do not have the experience required to start a business, however only 17.76 per cent informed that they had confidence to start a business. Further, no experience (WMS=3.03) ranked first among perception about self of women entrepreneurs, followed by requirement of higher education (WMS=2.96) and lack of entrepreneurship knowledge (WMS=2.64), which ranked II and III respectively. Entrepreneurial skills improve the women's ability to start their own business. But, due to low educational levels and less exposure the rural women entrepreneurs lack in entrepreneurial skills. Absence of the entrepreneurial skills is a major concern for rural women entrepreneurs (Nain et al., 2013; Mishra & Kiran, 2014). Institutional mechanism and human resources base in rural ecosystem was lacking in social processes of group and enterprise management skills along with marketing and communication skills (Nain et al., 2019) (Table 3).

Perceptions about family and family members

The family may offer specific assistance to female entrepreneurs, which is frequently necessary for them to operate a business. This occurs, for instance, when a woman's family offers significant financial assistance or when it supports her psychologically by supporting her decision to start a business. Family can provide crucial organisational support at times, assisting women company owners in managing the home, the children, and occasionally even the firm (Cesaroni et al., 2016). In our study, the majority (93.93%) of women's disagreed that they do not have support from their family, and 83.18 per cent of them did not agree with the statement that they will not be able to spend quality time with their children if they start an enterprise, 92.99 per cent of women disagreed that people at home or their husband will scold them if they talk to them about their idea to start an enterprise and about 79.91 per cent of them did not agree with

Table 3. Perception of farm women regarding entrepreneurial aptitude

	Yes (%)	No (%)	May be (%)
1. Perception Regarding Entrepreneurship			
Generation of enterprise	78.97	11.68	9.35
Generate family income	87.38	3.74	8.88
Impact standard of living	86.92	0.00	13.08
Women Entrepreneurship to be promoted?	97.20	0.00	2.80
2. Availability of Basic Facilities for Enterprise Establishment of Respondent's Choice			
Basic Facility	Percentage		
Agriculture Land	32.9		
Pond	9.81		
Kitchen Garden	31.78		
Space around house	4.95		
Seed Money	20.56		
3. Perception Regarding Entrepreneurship			
Statement	WMS	Rank	
I. Perception about self			
Higher Education required	2.96	II	
Lack entrepreneurial knowledge	2.64	III	
Entrepreneurship not for the poor	2.25	IV	
No experience	3.03	I	
Lack confidence	2.17	V	
II. Perception about family and family members			
No family support	2.06	III	
Time with children will be affected	2.29	II	
Negative response from family	2.05	IV	
Family will not permit mobility	2.30	I	
III. Perception about People			
Product/ service may be unacceptable	2.52	V	
Reduce husband's status	3.07	II	
Rejection by consumers	3.05	III	
Jealousy	2.71	IV	
Lack of promotion of product/ service	3.11	I	
IV. Perception Regarding Establishment of Own Enterprise			
Failure	2.38	VII	
Unprofitable	2.97	IV	
Lack of funding	3.46	II	
Uncertain profit	2.72	V	
Difficulty in raw material procurement	3.07	III	
Limited reach of the product/ service	2.70	VI	
Many competitors	3.69	I	
V. Perception about Financial Institutions			
Loans difficult for women	2.20	VII	
Ineligible for loans	2.42	VI	
Loan sanctions lengthy process	2.79	IV	
Loan disbursement lengthy process	2.93	III	
Collateral security requirement	3.27	I	
Financial stability required for loans	3.26	II	
Immediate repayment of loans required	2.48	V	

WMS: weighted mean score

the statement that their family members will restrict their mobility required for the growth of the enterprise. In addition, family will not permit mobility (WMS=2.3) ranked I among perception about family and family members of women entrepreneurs, followed by time with children will be affected (WMS=2.29) and no family support (WMS=2.64), which ranked II and III respectively. 58.41 per cent of the respondents felt that customers may not accept women as entrepreneurs and reject their products/services. 16.36 per cent of the women felt that people will say that their husbands were not capable of earning, so they were forced to work and start a business. 41.12 per cent of women thought that they will be discouraged at the initial stage, and 53.74 per cent of them thought people may feel jealous of their start-up venture. 48.60 per cent of them were not sure if people would recommend them to others initially. Additionally, it was also noted that among perception about people by the women entrepreneurs, lack of promotion of product/service (WMS=3.11) ranked I, followed by reduced husband's status (WMS=3.07) and rejection by consumers (WMS=3.05), ranked II and III respectively.

Perception regarding establishment of own enterprise

69.16 per cent of women disagreed with the fact that if they start an enterprise, it may fail, 60.28 per cent of them said that they do not know whether starting an enterprise may not be profitable, and 64.49 per cent of respondents agreed with the statement that huge funding is required to start an enterprise, 51.40 per cent of them did not know that they are uncertain about returns from their enterprise, 39.25 per cent agreed with the fact that raw material procurement may be difficult and 50.47 per cent of them disagreed that selling of product/ service may be in a limited area and 78.98 per cent agreed with the statement that number of competitors in the market may affect the enterprise. Further, it was also noted that among perception regarding establishment of own enterprise by the women entrepreneurs, number of competitors (WMS=3.69) ranked I, followed by lack of funding (WMS=3.46) and difficulty in raw material procurement (WMS=3.07), ranked II and III respectively, whereas failure of the enterprise (WMS=2.38) ranked VII. In their study, Srividhya & Palanivelu (2013) focused on the social conditions in society and the level of success of women entrepreneurs. The survey discovered that women entrepreneurs lacked training and development abilities. They were unable to survive in the market for an extended period of time. They discovered that female business owners face financial challenges in establishing and maintaining their enterprises.

Perception about financial institutions

78.98 per cent, of women disagreed with the statement that financial institutions will not give them loans as they are women, 58.88 per cent said that they do not have the eligibility to avail loan from any financial institution and 52.80 per cent of women believed that banks will ask for immediate repayment of loan. 57.48 per cent of respondents were not aware that sanctioning of loan from the financial institution will take a lot of time. Similarly, 77.57 of respondents did not know that disbursement of loan from banks takes a lot of time. 44.39 per cent and 42.52 per cent of

women respectively agreed with the fact that banks may require collateral security to give loans and banks may provide loans only if they are financially sound. In addition, collateral security requirement (WMS=3.27) ranked I among perception about financial institutions of women entrepreneurs, followed by financial stability required for loans (WMS=3.26) and lengthy loan disbursement process (WMS=2.93), which ranked II and III respectively, whereas processing of loans was difficult for women (WMS=2.20) ranked last. In a study, when women were asked about the problem in availing government aid for entrepreneurship, majority of the respondents said that large number of official formalities is the biggest problem. Paperwork needs to be reduced and simplified to promote rural as well as urban entrepreneurship (Saraswat et al., 2020). One of the most crucial aspects of every organization is finance. Based on the numerous responses by women entrepreneurs of Himachal Pradesh it was determined that the respondents' financial issues included the lack of long-term financing, a consistent and frequent need for working capital, and a long application procedure for financial assistance (Nayar et al., 2007).

Chowdhury et al., (2016) conducted a study in Sylhet City, Bangladesh in order to investigate the perception of women entrepreneur and the study revealed that women entrepreneurs have highly positive perception about their family and friends as well as on their empowerment in family and society. On the other hand, they have very negative perception on political and legal environment and existing financial supports and moderate perception on society.

CONCLUSION

There were only a few respondents who were running their own enterprise and that too at a very small scale. Majority of them were not satisfied with their present quality of life and wanted improvement in every aspect of their life. Most of the respondent showed interest in running their enterprise. Promoting women entrepreneurship is crucial for the quick and overall growth of an economy. Encouraging women to take up business as a source of income not only will contribute in earning money but also will give them a sense of empowerment in society. There is an urgent need is to create a favorable atmosphere to increase self-employment of women for the overall development of the country.

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Measuring Women Empowerment in Aquaculture – An Empirical Study

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ABSTRACT

Development of index or tool for measuring social parameters has been a key area of research. This research was carried out during the year 2021 for the measurement and quantification of several variables warrants availability of valid tools. In aquaculture sector, gender mainstreaming efforts has been undertaken by several stakeholders. However, measuring the level of empowerment as a consequence of interventions could not be done in absence of such tools. The article describes the process of development of Women Empowerment in Aquaculture Index (WEAI) - selection of domains, assessing content validity through expert rating, screening of the domains using 't' value and assigning relative weights. The instrument, so developed, has 30 items under 6 domains (access to and control over resources and services, ability to decide independently, attitude towards aquaculture, control over use of income, knowledge on aquaculture, participation in social and economic activities). Using the index, comparison was made between three women SHGs from Odisha with level of empowerment varying between 69-80 per cent.

INTRODUCTION

Women's empowerment in all spheres of development is one of the most discussed subjects. When women are truly empowered, they may pursue their goals, make decisions, and have access to national resources. Economic progress can result from the empowerment of women, and this link can go both ways. When women are empowered, they have access to other components of development, such as health and education, as well as equitable employment possibilities and political engagement (Duflo, 2011). Bhattacharya et al., (2013) assessed women's empowerment and provided a framework exposition in which 'empowerment' was defined as enhancement of capability in health, knowledge, and autonomy. Sum score of these dimensions provide a quantitative measure of empowerment. In any society, redistribution of social power and change in resource control in favour of women is not possible unless they are healthy, educated, and given some gainful employment opportunities (Goswami, 2013). Working in Farmers Producer Company has resulted in enhanced women empowerment

of hill farm women (Mukherjee et al., 2020). According to Bhattacharya & Banerjee (2012) the degree of active participation in matters that promote her own well-being would be a clear indicator. For increasing agricultural productivity and reducing poverty, women's empowerment is recognised as an important tool by policymakers and practitioners Quisumbing et al., (2022). OPHI (Oxford Poverty and Human Development Index) and USAID (United States Agency for International Development) launched the Women's Empowerment in Agriculture Index, which tracks women's engagement in agriculture across five domains viz., production, resources, income, leadership, and time-use. It assesses women's empowerment in relation to men within households, allowing for a more thorough examination of gender dynamics. According to Mukherjee (2018) women's empowerment has six dimensions: social empowerment, political empowerment, economic empowerment, personal empowerment, psychological empowerment, and health and security empowerment. Every dimension must be addressed in order to reach one's full potential. Rural women gained significant empowerment in all five dimensions

through participation in aquaculture activities. They achieved a significant level of empowerment in aspects of ‘family decision-making’ and ‘ability to spend money’ across the five dimensions. Although the changes were positive, progress in the areas of ‘social participation,’ ‘access to assets and resources’ and ‘cosmopolitanism’ was slow (Rahman, 2005). Gupta et al., (2017) observed that women are disempowered in two major agricultural domains: resources (access and decision-making) and leadership (group membership). The development of this WEAI has opened up the possibility of computing sector-specific Women Empowerment Indexes in a variety of areas, incorporating sector-specific domains associated with empowering women in light of varying socioeconomic profile. The Women’s Empowerment in Aquaculture Index (WEAI) assesses women’s empowerment and their involvement in aquaculture contexts in order to identify ways to overcome obstacles and constraints. Additionally, the WEAI also enables projects to track the outcomes of Reach-Benefit-Empower-Transform (RBET) projects for women in fisheries and aquaculture McDougall et al., (2021). No such index is available to measure empowerment of women in aquaculture. The present study has made an attempt to develop Women Empowerment in Aquaculture Index (WEAI) and to assess the level of empowerment of women involved in aquaculture in Odisha, India.

METHODOLOGY

The Likert scale construction technique was used and a group of subjects is given the possible domains that may define or measure a variable. Respondents were asked to indicate whether they agreed or disagreed with the domains, for which responses of “strongly agree,” “agree,” “undecided,” “disagree,” and “strongly disagree” were given numerical scores of 5, 4, 3, 2, and 1, respectively. A total score is calculated for each respondent by adding his or her individual item scores. The summed rating method - also known as the frequency distribution method - is a way of scale construction that’s based on responses to domains. In this method, ratings for each domain are summed across all items. This is done in order to reject any domains or criteria that are irrelevant to the rating. To do this, the scores for each subject are compiled and then divided into a high group and a low group based on the total score. The t-ratio is calculated by comparing the responses of the high and low groups to the single item.

$$t = (X_H - X_L) / (S_H^2 / n_H + S_L^2 / n_L)^{1/2}$$

Where, X_H =the mean score on a given domain for the high group, X_L =the mean score on the same domain for the low group, S_H^2 =the variance of the responses of the high group, S_L^2 =the variance of the responses of the low group, n_H =the no. of

respondents of the high group, n_L =the no. of respondents of the low group

The development of the WEAI began with a selection of 12 domains that may influence women’s empowerment, followed by domain analysis using Likert’s summed rating method and indexing the domains based on weighting defined by the scale product method (Ghosh et al., 2010). In order to compile data for domain analysis, an online survey was carried out in 2021-22 involving 200 experts in the field of extension education. The survey contained 12 different domains which the respondents could rate on a scale from 1 to 5 in terms of agreement or disagreement. In total, there were 46 responses. The respondents were split into two groups - those with high scores (23 respondents) and those with lower scores (the remaining 23). Using the above formula, the t-value for each selected domain was calculated, and domains were screened by ranking them in decreasing order based on significant t-values at the 0.05 level of probability. The WEAI proposed six domains, viz., (i) access to and Control over resources and services, (ii) ability to decide independently, (iii) attitude towards aquaculture, (iv) control over the use of income, (v) knowledge on aquaculture and (vi) participation in social and economic activities. The t-values are presented in Table 1.

The WEAI’s six domains were subjected to the scale-product methodology in order to determine their importance for measuring women’s empowerment in aquaculture. Respondents were asked to assign a weightage to each domain in the range 0-100, based on the importance of the specific domain for measuring women’s empowerment in aquaculture, so that a total of 100 were obtained for all relevant domains identified. This process helped to identify the critical domains that are most significant in measuring women’s empowerment in aquaculture. The domain weighting clearly ranged from 10 to 25 per cent. The most important items in the WEAI were access to and control over resources and services, as well as control over the use of income, each with a weight of 25 per cent, followed by participation in social and economic activities and the ability to decide independently, both with a weight of 15 per cent, and knowledge of aquaculture and attitude toward aquaculture, both with a weight of 10 per cent. To assess each domain of the WEAI, a total of 46 experts were asked to rate the relevancy of nine items for domain 1; 11 items for domain 2; 12 items for domain 3; 9 items for domain 4; 13 items for domain 5; and 12 items for domain 6 on a 3-point continuum (2=most relevant, 1=relevant, 0=not relevant). The five items from each domain with the highest mean scores were chosen as being most relevant to the domain.

Access was referred to as women’s ability or opportunity to use and get benefit from using aquaculture resources in an effective and adequate manner, whereas Control means the ability to take

Table 1. Domains with their respective Mean, SD, and ‘t’ values

S.No.	Domains of empowerment	Mean	SD	‘t’ value
1	Access to and control over resources and services	4.77	0.42	5.99
2	Ability to decide independently	4.45	0.85	5.26
3	Attitude towards aquaculture	4.5	0.51	5.14
4	Control over use of income	4.45	0.67	5.03
5	Knowledge on aquaculture	4.5	0.51	4.75
6	Participation in social and economic activities	4.6	0.47	4.48

time-bound decisions over the specific use of aquaculture products and services. Both these domains act as key elements of women empowerment and accomplishment of gender equality. This domain is measured based on 5 items that specifically address the ability to effectively utilize the existing resource for fish production. Participation was referred to as women being actively involved in different types of socio-economic activities such as attending meetings, workshops, and seminars, as well as in buying inputs and selling produce. This domain is measured based on five items that address an individual women farmer's participation in meetings, discussions as well as engagement in the activity of buying and selling commodities, and goods to satisfy their household needs.

Ability to decide independently was defined as the wise decision to engage in various aquaculture activities. Before finalising any decision on carrying out activities related to fish farming, the responses of experts in this domain were taken on items to determine the level of judgement and decision-making power of women farmers among themselves by inviting other members' suggestions and decisions resulting in consensus and recognising the views of each individual. Control over the use of income was referred to the financial stability of the women farmer to withstand facing adverse situations in her life. Increased Control of their income helps the women to get a solid foundation for their lives and their children. This domain is assessed based on five items that reveal the existing status of their finances, exposing the strengths needed for their growth and survival.

Knowledge refers to the level of understanding gained through learning and experience. It also indicates the level of awareness about the different activities and practices involved in aquaculture, adding to the knowledge base of women farmers. This domain has been checked with five items enquiring about the existing knowledge required to carry out scientific fish farming by women farmers. Attitude implies a way of feeling and belief that affects women's behavior and conduct towards practicing different components of aquaculture and its practices. It shows the anticipated level of involvement of women farmers in growing fish by adopting scientific fish farming practices. Five items were taken to measure the various characteristics of women farmers that influence their attitude toward practicing aquaculture.

The level of agreement among women farmer-respondents on five related items was recorded for each domain. Responses for domains 1, 2, 3, and 5 are recorded in Yes/No format, with 1 for Yes and 0 for No. For domains 4 and 6, responses are recorded on a 5-point scale (Strongly Agree, Agree, Undecided, Disagree, and Strongly Disagree), with numerical scores of 5, 4, 3, 2, 1 assigned respectively. Each domain's mean value is calculated by averaging the scores of five items. Similarly, Kumari et al., (2021) used five domains of empowerment (agricultural production, asset creation, education, health-related decisions, and leadership quality) to estimate WEI (2021). Bhattacharya et al., (2013) selected a few indicators to estimate three domains of capability enhancement: health, knowledge, and autonomy. Food intake, anaemia, and body mass index (BMI) are chosen as health indicators. Educational attainment, functional literacy, and application of knowledge of family planning have been chosen as knowledge indicators, and the autonomy indicators include actual decision-making, perceived

freedom, and mobility permission (negative indicator). Ana Raj et al., (2022) measured empowerment in cassava cultivation using five domains: agricultural production decision-making, access to productive resources, control over the use of income, community leadership, and time allocation. Slathia et al., (2015) chosen the decision making capacity, social involvement, communication behaviour, psychological aspects and economic independence dimensions as measures of empowerment. Roy et al., (2022) created an index that uses seven dimensions and 47 indicators to assess the role performance of Farmer Producer Companies.

The mean value was used to calculate the aggregate of women's responses, and standard deviation values were used to determine differences in their opinions. As a first step, mean and standard deviation values for each domain were calculated, and then the overall women empowerment index (WEAI) was calculated using different weights for six different domains. Overall, women empowerment was calculated and expressed as a percentage using the formula shown below.

$$\text{Overall WEAI} = W1*D1 + W2*D2 + \dots + Wn*Dn$$

Where, $W1, W2, \dots, Wn$ represents the respective weights of domains; $D1, D2, \dots, Dn$ represents the mean score of each domain.

A semi-structured interview schedule was created for the study. The interview schedule included a slew of socio-personal and socio-economic variables, as well as an index to assess the level of empowerment of aquaculture women. The women empowerment in aquaculture index (WEAI) includes six domains: Access to and control over resources and services, Participation in social and economic activities, Ability to decide independently, Control over the use of income, Knowledge on aquaculture, and Attitude towards aquaculture. Data were collected during 2021-22 by randomly selecting three women SHGs from three districts of Odisha, namely Puri, Khordha, and Kendrapara. Subhashree SHG, Purohitpur, Khordha; Maa Harachandi SHG, Dahanigadia, Puri and Maa Durga SHG, Derabish, Kendrapara who were provided support under aquaculture development programs are selected. All the members of the selected SHGs were interviewed. Weighted mean and standard deviation were worked out, and overall WEAI was expressed as a percent.

The following equation calculated the index, prepared on the parameters mentioned above:

$$\text{WEAI} = W1*D1 + W2*D2 + \dots + Wn*Dn$$

Where, $W1, W2, \dots, Wn$ represents the respective weights of domains; $D1, D2, \dots, Dn$ represents the mean score of each domain.

RESULTS AND DISCUSSION

Using the index (WEAI) developed in this study, the level of empowerment of three women SHGs was calculated. All the SHGs were assisted under aquaculture development programs and are currently engaged in practicing aquaculture-related activities. Among the three SHGs studied, Khordha reported the highest overall empowerment (79.8%), followed by Puri (74%) and Kendrapara (69.2%). Abebe et al., (2016) worked out the overall gender parity index (GPI) in Ethiopia. GPI was 68 per cent, and the

Table 2. The final Women Empowerment in Aquaculture Index (WEAI) having 30 items

S.No.	Items
1	Access to and control over resources and services
i	Do you have a pond (s) of your own for fish farming?
ii	Are you able to get quality fish seed, fertilizer and other inputs for fish farming?
iii	Are you able to sell fish at reasonable price in the market?
iv	Have you attended skill development trainings on aquaculture?
v	Do you receive latest information on fish farming viz., new varieties, new technologies etc.?
2	Participation in social and economic activities
i	Are you a member in any agricultural institution/groups like Self Help Group, Farmer Producer Organisation and/or Cooperative, etc.?
ii	Do you attend community/ village meetings related to social issues?
iii	Do you take part in performing different farm activities (preparation of pond, clearing of weed and insects, manuring and fertilization, stocking of fish, feed preparation and feeding, monitoring of water quality, sampling, harvesting, post-harvest processing, and marketing)?
iv	Are you beneficiary of any fishery developmental schemes?
v	Are you aware about the Govt. schemes on fisheries that benefit small scale fish farmers?
3	Ability to decide independently
i	Do you take decisions on stocking, feeding and purchase of farm inputs?
ii	Do you take decisions regarding availing institutional credit for fish farming?
iii	Are you able to take decisions on how much produce to retain for home consumption or sell?
iv	Do you take decisions about disposing the surplus produce?
v	Are you able to decide how to spend money earned from fish farming?
4	Knowledge on aquaculture
i	Predatory and weed fishes are to be removed before stocking of fish seed
ii	Pond preparation is to be done for every crop cycle
iii	pH level of pond water is to be adjusted by liming
iv	Water inlet and outlet are to be provided with filters
v	Water exchange and aeration is required for maintaining water quality
5	Control over use of income
i	I have a say over income generated from fish farming
ii	I have the liberty to decide about investing on pond improvement?
iii	My opinion is important in decisions regarding the use of income generated by productive activities.
iv	I am able to participate in decisions regarding family business, crop and livestock raising activities
v	Additional money earned from fish farming is spent with my consent
6	Attitude towards aquaculture
i	Fish farming is a profitable venture
ii	Fish farming will secure household nutrition security
iii	Fish farming fetches additional income to the family
iv	Fish farming aids in gainful employment
v	Fish farming can secure livelihood

empowerment gap was 32 per cent. They also quantified the women's empowerment index in agriculture (WEAI) as 73 per cent. Israr et al., (2020) has estimated an overall empowerment index of 0.64 for women in Pakistan. Roy et al., (2022) had constructed an empowerment index for SHG women and applied the same on 290 SHG members of North 24 Praganas, West-Bengal and worked out the empowerment score that ranges from 0.6 to 0.8. SHG group leaders in rural West Bengal are true examples of empowerment. With access to financial resources, they are standing up to society's evils and have a say in family matters, such as deciding on their children's marriage or education. This has resulted in positive changes for the women and their families.

Table 3 indicates that in terms of domain-wise scores, Khordha SHG tops in 'access to and control over income' (4.58), indicating a greater control over their income earned as compared to the

counterparts in Puri and Kendrapara. SHG Puri scored high in terms of 'ability to decide' and 'participation in social and economic activities; however, in other domains, they scored less than Khordha.

CONCLUSION

The study has developed an index for measuring the empowerment of women in aquaculture, which is the first-ever attempt in the field of aquaculture. It followed the detailed procedure of scale construction and established the validity of the instrument. It is simple to administer and interpret. Further, using the index, the level of empowerment of three women SHGs who are engaged in aquaculture production was quantified and compared. It would help monitor the progress of developmental endeavors in terms of achieving women empowerment in aquaculture. It has the potential to be used for assessing the success of development

Table 3. Comparison of empowerment levels of three women SHGs

Domains	Subhashree SHG, Khordha (n=12)		Maa Harachandi SHG, Puri (n=14)		Maa Durga SHG, Kendrapara (n=12)	
	Mean	SD	Mean	SD	Mean	SD
Access to and control over resources and services	4.18	0.75	3.67	0.46	3.92	0.5
Ability to decide independently	3.56	0.46	4.27	0.46	3.54	0.82
Attitude towards aquaculture	3.20	0.70	2.9	0.83	2.63	0.92
Control over the use of income	4.58	0.78	3.82	0.64	3.54	0.83
Knowledge on aquaculture	3.12	0.40	2.86	0.50	2.36	0.50
Participation in social and economic activities	4.36	0.82	4.23	0.67	3.72	0.78
Overall WEAI (%)	79.8		74.0		69.2	

interventions aimed at mainstreaming women in aquaculture. This would be very useful for policymakers, research and academic institutions and donor agencies who want to measure and increase women's empowerment in the context of fisheries and aquaculture.

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Test to Measure Farmers' Knowledge on Management of Parasitic Infestation in Dairy Animals

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ABSTRACT

The test was developed during in 2022 in the Bareilly district of Uttar Pradesh state to measure farmers' knowledge on management of parasitic infestation in dairy animals. A total number of 86 items were subjected to experts for relevancy testing and finally selected 69 items for the item analysis. These 69 items were pretested on 36 respondents from other than the study area. Based on the item analysis score, difficulty and discrimination index were calculated. The items with difficulty index ranging from 30 to 80, discrimination index above 0.3 were selected. Ultimately, 30 items were selected for the final knowledge test for dairy farmers on management of parasitic infestation. The reliability of the developed test was measured by using Cronbach's alpha method and found to be 0.8. The overall test content validity index (CVI) was found to be 0.93 which considered fit for test. Thus, the reliability and validity of the current test indicate the consistency and precision of the results. The developed test will help in assessing the knowledge level of farmers regarding parasitic infestation management and accordingly, the awareness and training programs can be planned to enhance the knowledge level of farmers.

INTRODUCTION

India is an agriculture-based developing country owning vast livestock resources (535.8 million) and growing at a 6.48 Compound Annual Growth Rate (CAGR), which is significantly higher than the CAGR of the human population i.e., 1.29 per year (Vision-2022, 20th livestock census). A rapidly growing population's ever-increasing food demands have been met by the introduction of crossbreeds (Michael et al., 2022). Consequent to the government's sound interventions such as crossbreeding to upgrade the animal breeds, cognizable increase in production traits along with undesirable genetic changes led to higher disease incidence (Hare et al., 2006). As a result, on one hand, the livestock sector has put the country on the global map for being the world's largest milk-

producing nation, accounting for 22 per cent of global production (DADH&F Report, 2020-21). On the other side, disease-related losses, as well as their prevention and treatment expenses are a stumbling block to livestock's efficient growth. In addition to infectious diseases, parasitic infestation also causes significant economic losses as the prevalence of GIP in ruminants ranges from 44.2 to 93.4 per cent (Hirani et al., 2006). External parasites, particularly ticks, cause direct loss through blood loss, damage to hide, loss of body weight, and reduced milk yield (Sharma, 1984). Moreover, indirect losses are caused as these ticks' act as a vector for protozoa (Soulsby, 2006). Veterinary healthcare services play a significant role in the prevention of parasitic infestation as a study conducted by Kumar and Meena, 2021 revealed that 44.38 per cent of respondents were moderately satisfied with healthcare

services. For control of parasites, farmers have principally relied on the indiscriminate use of anti-parasitic drugs resulting in the development of resistance. Further, long-term use is often accompanied by contamination of the environment, milk, and meat with drug residues (Ghosh et al., 2006).

The most important variables attributing to the parasitic infestation are lack of knowledge and awareness as these affect farmers' perception and attitude towards decision making. The research by Sazmand et al., (2020) on parasitic disease and parasiticide resistance, evidenced that most farmers had no knowledge of the clinical signs allied with parasitism and never heard about resistance. Zvinorova et al., (2016) in their study in Zimbabwe reported that the majority of farmers had the knowledge and get health care services, despite this about 57.9 per cent of the farmer did not control the parasitic infestation. It has been presumed for a long time that a higher knowledge level helps in improving the health and efficiency of farms. If we want to advance dairy farmers or upgrade their status, then we have to modernize their knowledge, adoption and socio-economic status (Ghalawat et al., 2022). Therefore, it is important to measure the knowledge level of farmers regarding parasitic infestation in dairy animals and formulate a strategy to bridge this knowledge gap in order to prevent dairy animals from being infested by parasites and associated diseases. Till date, no instrument is available to measure the knowledge of farmers regarding parasitic infestation in livestock. Therefore, a knowledge test has been developed regarding parasitic infestation in dairy animals. This developed tool will help in assessing the knowledge level of farmers regarding parasitic infestation in dairy animals.

METHODOLOGY

The knowledge test on management of parasitic infestation was developed by using the standard methodology. The knowledge test comprised multiple choice questions (items) on parasitic infestation management. A total of 86 items were collected and edited following 14 informal criteria as suggested by Edwards (1957). The items were subjected to scrutiny by an expert panel of judges (50 Nos) to check their relevancy and a total of 25 responses were obtained in time. The relevancy score of each item was established by adding the scores on the rating scale for all the judges' responses. From the responses two type of scores viz., the relevancy weightage (RW) and mean relevancy score (MRS) were calculated for all the selected items individually by using the following formulas:

The total 69 items were selected accordingly based on the experts score. Item analysis was carried out using difficulty and discrimination index. These indices were calculated for all 69 items by using the following formulas:

$$\text{Relevancy weightage} = \frac{(\text{Most relevant} \times 5) + (\text{Somewhat relevant} \times 4) + (\text{Relevant} \times 3) + (\text{Least relevant} \times 2) + (\text{Not relevant} \times 1)}{\text{Maximum possible score}}$$

$$\text{Mean relevancy score} = \frac{(\text{Most relevant} \times 5) + (\text{Somewhat relevant} \times 4) + (\text{Relevant} \times 3) + (\text{Least relevant} \times 2) + (\text{Not relevant} \times 1)}{\text{Number of judges}}$$

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

Where, P = Item difficulty index in the percentage, n = Number of the respondents giving the correct answer to items, N = total number of respondents to whom the items were administered. The discrimination index calculated by using E1/3 formula:

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

Where, N = Total number of respondents to whom the items were administered. S1 and S2 are the frequencies of correct answers of the highest and higher scores, respectively. S5 and S6 are the frequencies of correct answers of lower and lowest scores, respectively. A similar methodology was followed by Kumar et al., (2016); Vijayan et al., (2022).

In the present study, Cronbach's alpha was used to test reliability with the following formula:

$$\alpha = \left(\frac{K}{K-1} \right) \left(\frac{S_y^2 - \sum S_i^2}{S_y^2} \right)$$

Where, K is number of items in test, S_y^2 Variance associated with total observed score, S_i^2 Variance associated with individual item score.

For standardization of developed test, the Item Content Validity Index (I-CVI) was calculated by using following formula:

$$\text{I-CVI (Item-content validity index)} = \frac{\text{No. of agreements per item}}{\text{Number of experts}}$$

Then, S-CVI was calculated for the overall test. It was determined to check for the stability of each dimension as well as the scale as a whole. The S-CVI was calculated from the following formulas:

$$\text{S-CVI (Scale-content validity index)} = \frac{\text{I-CVI}}{\text{Number of items}}$$

RESULTS AND DISCUSSION

For the current study, the construct was knowledge about the management of parasitic infestation in dairy animals. Finally, 86 pooled items were retained from various dimensions.

Relevancy weightage and mean relevancy score were calculated for all the 86 items based on the experts' responses. The items having relevancy weightage of more than 0.80 and mean relevancy score of 4.00 or more were selected. As a result, a total of 69 items were selected for the item analysis. A similar method was used by Shruti et al., (2022) for relevancy testing.

The selected 69 items were subjected to thirty-six dairy farmers of Kalapura village of block Shahgang in the non-sample area. Based on respondents' scores, the difficulty index and discrimination index were calculated. The difficulty index (P) was calculated as the percentage of respondents giving correct responses to that particular item. It was calculated with the objective to eliminate the items that were extremely difficult or extremely easy. The difficulty index is maximum at the range of 30 and 70 per cent and these items are considered excellent. The higher the P-value, the easier the items. In this study, the items having P value between 30 to 80 were considered and incorporated into the final knowledge test. Items with a discrimination index above 0.3 were selected for the final knowledge test. Eventually, 30 items were selected for the knowledge test which would differentiate the highly knowledgeable personnel from the less knowledgeable ones. Based on the results of difficulty and discrimination index, final selection of items was done. A total of 30 (Table 1) items were included in the final format of the knowledge test.

The developed knowledge test was standardized by testing the reliability and validity which were ascertained using Cronbach's alpha and content validity, respectively. Cronbach's alpha value was calculated and found to be 0.883 and the knowledge test constructed was highly stable and reliable. For content validity, I-CVI was computed through the panel of experts. The total 6 experts have been selected as with the increase in number of experts the probability of attaining total agreement decreases (Wynd et al., 2003). In order to do this, the final 30 items were given to experts and they were asked to respond on a four-point continuum viz., 1 = not relevant, 2 = somewhat relevant, 3 = quite relevant and 4 = highly relevant. The value of I-CVI of all the items was more than 0.79 which indicates that the developed test was highly consistent. Similarly, S-CVI is calculated using the number of items in a tool that have achieved a rating of "very relevant". The S-CVI/Ave is calculated by taking the sum of the I-CVIs divided by the total number of items. A S-CVI/Ave ≥ 0.9 have excellent content validity. For the current test, the calculated value of S-

Table 1. Difficulty index, discrimination index, and I-CVI of the knowledge items on management of parasitic infestation (final items)

S.N.	Items	Difficulty Index	Discrimination Index	Agreement between experts	I-CVI
1	The animal shed should have... Well ventilation and lighting/ Poor ventilation and lighting/Only proper ventilation/ No effect of ventilation and lighting on parasites	61.11	0.50	5	0.8333
2	Animal house should be free from..... Wildlife hosts/ Cracks and cervices/ Hidden spaces/All	69.44	0.42	6	1
3	Cattle and buffalo should be housed Mixed/ Separately/ Both/None	33.33	0.42	4	0.6666
4	Animals should be brushed..... Daily/Monthly/Once in 6 months/Yearly	38.89	0.42	6	1
5	Manure can be disposed of by..... Throwing in wasteland/Throwing in grazing land/Composting	69.44	0.42	6	1
6	Pasture should be..... Rotated/Alternated/Same pasture for all animals	55.55	0.58	5	0.8333
7	Pasture should have sufficiently.....grasses Long/Short/Mature/Immature	61.11	0.50	6	1
8	The dung of grazing animals on pasture..... Left as such/Pick and throw outside/Dragging or harrowing	69.44	0.42	6	1
9	Grazing time..... Start early morning (before 8 am)/During sunlight (after 9 am to 5 pm)/ Late evening (after 5 pm)	41.67	0.42	6	1
10	Parasitic infestation is more in..... Feedlot system/Grazing system/Same in both/None	69.44	0.42	5	0.8333
11	Animals that have heavy tick infestation should..... Isolate and treat/Cull/Left as such	36.11	0.33	6	1
12	Deworming schedule in calf (up to 6 months) First treatment between 14-21 days and repeat after 35-42 days/First treatment just after birth and repeat after 15 days/First treatment just after birth and repeat after 1 month	63.89	0.50	6	1
13	Deworming of the adult lactating animal should be done..... Only when an animal show symptom /Only after confirmatory diagnosis/ Always before monsoon season	69.44	0.42	6	1
14	Overdosing of anthelmintic may lead to Increases withdrawal times/Toxicity/ resistance in animals/Becomes costly/All	30.56	0.50	5	0.8333
15	The animal should be kept off feed..... anthelmintic treatment Before/After/Both before and after/No need of fasting	52.78	0.42	6	1

Table 1 contd...

S.N.	Items	Difficulty Index	Discrimination Index	Agreement between experts	I-CVI
16	Acaricides should be applied..... Once in rainy season/Twice in the rainy season (before and after)/ Always when see parasites/No application strategy	66.67	0.50	6	1
17	Overdosing of acaricide may lead to..... Contamination of environment/Toxicity in animals/Acaricide resistance/All	58.33	0.42	5	0.8333
18	Ticks, mites, lice and mosquitos are which types of parasites? Internal parasites/External parasites/Both/None	58.34	0.58	6	1
19	The diseases which are related to ticks? Trypanosomiasis/Theileriosis/Babesiosis/All	58.33	0.42	5	0.8333
20	The endoparasites cause type of losses in animals.... Milk production/Bodyweight/Growth rate/All	47.22	0.42	6	1
21	The ectoparasites cause type of losses in animals.... Blood loss and growth rate/Toxin production/Hide damage/All	72.22	0.50	5	0.8333
22	Which type of animal has more parasitic infestation? Poor body condition/Normal body condition/Well-nourished animals/All	58.33	0.50	6	1
23	Which type of breed have more parasitic infestation? Crossbred/Indigenous/Non-descript/All	72.22	0.42	6	1
24	Does the age of animals affect the infestation rate? Young animals have more endoparasites/Adult animals have more endoparasites/Both are equally affected/No idea	38.89	0.33	4	0.6666
25	The most favorable season for tick infestation.... Winter/Summer/Spring/No seasonal variation	44.44	0.33	6	1
26	Source of infestation for internal parasites Eating grasses contaminated with infected animals' faeces/Contaminated water and soil/Snail/All	36.11	0.42	6	1
27	Source of external parasites.... Animal shed/Contact with infected animal/Infected grazing pasture/All	41.67	0.58	5	0.8333
28	Effect of parasitic infestation on the reproductive system.... Delayed puberty/Low heat/Poor conceive/All	58.33	0.42	6	1
29	Effect of parasitic infestation in pregnant animals..... Abortion/Stress/Congenitally defected calves/All	72.22	0.58	6	1
30	If the animal is having distended abdomen, bottle jaw condition and oozing blood from the anus what could it be? GIP infestation/Some feed allergies/ toxins/Stress/All	52.78	0.42	6	1
S-CVI/Avg					0.9333
Total agreement					20

CVI/Avg of all the test items was 0.933. Hence the knowledge test constructed was highly stable and valid. The findings are in line with the result of Handage & Chander (2021) research on content validation process.

The final knowledge test comprised of 30 items that would measure the knowledge level of dairy farmers regarding parasitic infestation management in dairy animals. The test can be administered in dichotomous form viz., Yes or No. The overall score of the individual toward the knowledge level of dairy farmers regarding parasitic infestation management in dairy animals could range from 0-30.

CONCLUSION

The dairy farmers are not well equipped with the knowledge regarding the appropriate and effective management of parasitic infestation in animals. Because of these gaps, parasite infestations are the main obstacle to obtaining desired production and

productivity. Therefore, it is critical to know the parasitic management practices knowledge among dairy farmers that help in formulating needed policies and efforts to create alertness. Consequently, an effort has been made to develop the knowledge test with respect to parasitic infestation management in dairy animals. This developed knowledge test will help in assessing the knowledge level of dairy farmers accordingly awareness and training program would be designed. The provision of awareness and training programs to farmers with respect to parasitic infestation will enhance the knowledge level of dairy farmers. This increased knowledge level can prevent the animals from parasitic diseases load which will benefit animal health and the income of farmers ultimately.

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A Tool to Measure the Attitude of Farmers Toward Conservation Agriculture

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ABSTRACT

When assessing farmers' predispositions and developing a strategy for extension work in the region, the attitude of farmers toward conservation agriculture is a crucial consideration. The purpose of this study was to develop a valid and reliable instrument for assessing farmers' attitudes toward conservation agriculture. The scale product method is used to construct the scale. It is a hybrid of the Likert and Thurstone techniques. The study was conducted in March 2022. On a 5-point scale, 65 judges evaluated 25 statements. Finally, 18 statements including 14 positive statements and 4 negative statements were chosen to build a scale that would assess the attitude of farmers towards conservation agriculture. The scale was found reliable, with the reliability coefficient (r) (Guttman split-half Coefficient and Spearman-Brown Coefficient Equal Length) determined to be 0.917. The scale's validity was evaluated using expert judgement. Employing the scale in research will aid in knowing farmers' attitudes about conservation agriculture.

INTRODUCTION

India has recovered from a severe food shortage. In the last 57 years, the country has seen a significant transition, going from a condition of food shortage to an expected record output of 316.06 million tonnes of food grain in 2021-22 (Second Advance Estimates of Production of Major Crops for 2021-22). Similarly, the Green Revolution has helped several developing countries overcome food scarcity. However, the high rates of output growth in the early years of the programme could not be sustained continuously, prompting some to doubt the new style's "sustainability." In 1968, production grew at a 45 per cent faster rate. Wheat productivity has grown from 887.50 kg/ha in 1966-67 to 3177.10 kg/ha in 2011-12 (Mallapur, 2017). However, productivity growth has decreased considerably over the last decade (Rahman, 2015).

Some of the detrimental consequences of the over-adoption of production technologies by the farming community to make the Green Revolution successful include loss of soil fertility, soil toxicity, the salinity of underground water, underground water

pollution, diminishing water resources, global warming, and increased incidence of human and livestock diseases (Sharma et al., 2022). Chemicals such as nitrates, carbamates, organophosphates, organochlorine synthetic, and pyrethroids are present in food products, dairy products, water, livestock feeds, and fodder at levels higher than the permissible limit (Dumanski et al., 2006). As a result, more environmentally friendly farming methods must be implemented. Conservation agriculture is one of several environmentally beneficial farming methods available. In contrast to other farming approaches, conservation agriculture advocates a set of principles instead of a specific technology to achieve a sustainable farming system. This is because, worldwide, agriculture is practised in a variety of ecosystems, necessitating the careful tailoring of technology to ensure success (Bera et al., 2022).

Conservation agriculture is impactful in lowering land and water pollution, soil erosion, and long-term reliance on external inputs (Saha et al., 2022). It also improves environmental management, increases water quality and water use efficiency, and decreases greenhouse gas emissions by reducing fossil fuel consumption and enhancing the soil carbon sink.

Conservation agriculture is widely promoted as one of the few win-win approaches available to farmers in that it has the potential to increase farmers' yields (in the long run) while also conserving the environment. This is because conservation agriculture reduces soil nitrogen loss, promotes soil and water conservation, and enhances the agronomic use effectiveness of applied nutrients. However, some questions have been raised about the viability of conservation agriculture on small and marginal farms due to the biophysical and institutional constraints that smallholder farmers face (Mango et al., 2017). In this context, it is necessary to research opinions on conservation agriculture. Especially assessing farmers' attitudes will provide important information in developing government policy planning to meet feed and food demands. There was no scale in place to gauge farmer's opinion on conservation agriculture. As a result, the current study was designed to construct and standardise a scale to assess farmers' attitudes toward conservation agriculture.

METHODOLOGY

The degree of "positive or negative feelings and emotions connected with particular psychological entities" is referred to as attitude (Thurstone, 1946). The degree of favourable or unfavourable feelings that farmers have toward conservation agriculture may be operationally described as attitude in this study. To create a reliable and valid attitude scale, the Scale Product Method is applied (Chauhan et al., 2016). This approach combines Thurstone's (1946) equal-appearing interval scale for item selection with Likert's (1932) summated rating for determining the scale response. A systematic procedure was followed for the scale construction as followed by Kumar et al., (2016); Gupta et al., (2022); Vijayan et al., (2022). Possible statements concerning the psychological object 'conservation agriculture' were collected. The items were screened by following the informal criteria suggested by Edward's (1969) for editing the statements to be used in the construction of the attitude scale. Based on the screening, the items that formed the universe of content were selected. Totally 25 statements were collected, organised and structured in the form of attitude items. The 25 statements were then subjected to the judge's opinion on a five-point continuum, ranging from most unfavourable to most favourable.

The set of items was sent to the experts for judgement through an online medium. The judges were requested to read and analyse each item carefully. Experts were also requested to make necessary modifications in items. The list of statements was sent to 65 judges who comprised extension scientists and research scholars from the State Agricultural Universities of Gujarat. The Scale value or Median value (S value) of the distributions and the Quartile (Q) value for each statement were derived based on the judgement of 65 assessors for each statement. The S and Q values of each statement were then utilised to determine whether or not the statement should be included in the attitude scale. The scale values and Q values were computed for the 25 statements by applying the formula as suggested by Thurstone & Chave (1946).

Guttman split-half Coefficient and Spearman-Brown Coefficient Equal Length were used to determine the reliability of

the scale. The analysis was conducted in MS Excel. The content validity of the developed scale was tested, and the scale's content validity was confirmed by expert judgment, as was the content's representativeness of sampling adequacy.

RESULTS AND DISCUSSION

Initially, 30 statements were created utilising relevant research and expert opinion. The statements were refined using Likert and Edward's (1969) criteria. Twenty-five statements were retained. The set of statements was afterward assessed by 65 judges from agricultural universities in India, which included research scholars, specialists, extension educators, and social scientists. According to the judge's decision, 18 statements were considered important (14 Positive statements and 4 negative statements).

Scale reliability

The precision or accuracy of a surveying device is referred to as reliability. The split-half approach was used to determine the scale's dependability. Eighteen statements were separated into two halves, with 9 odd number statements in one group and 9 even number ones in the other. A group of 20 farmers was given these two sets of statements on a five-point scale "Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree". The positive statements received a score of 5, 4, 3, 2 and 1, while the negative statements received a score of 1, 2, 3, 4 and 5.

The reliability coefficient (r) (Guttman split-half Coefficient and Spearman-Brown Coefficient Equal Length) was determined to be 0.917, which is extremely significant. As a result, the attitude scale is reliable and expected to give consistent results.

Content validity

The scale's content validity was determined by talking to extension workers and academicians at Anand Agricultural University about how well the scale's contents were chosen. Experts determined that the scale's content may be used to assess farmers' attitudes toward conservation agriculture. As a result, the current scale was found to be content-valid.

Final Scale to measure the attitude of farmers toward conservation agriculture

The final scale to assess farmers' attitudes toward conservation agriculture included 18 statements (Table 1). Table 1 illustrates the scale value and interquartile range based on which the statements were chosen. The statements above are reliable and valid. Hence, these statements can be used to measure the attitude of farmers toward conservation agriculture in the research. The scale indicates a five-point continuum (strongly agree, agree, undecided, disagree, and strongly disagree) with weightage as 5, 4, 3, 2 and 1, respectively, while the negative statements receive a reverse score. Individual statement scores can be added together to get an attitude score. The score for attitude will range from 18 to 90. A higher score implies that the farmer is supportive of conservation agriculture and vice versa.

Table 1. The Scale to measure the attitude of farmers toward conservation agriculture

S.No.	Statements	Scale value (S)	Interquartile range (Q)
1.	I believe that conservation agriculture decreases the degradation of natural resources. (+)	2.78	1.88
2.	Conservation agriculture significantly reduces crop failure risk. (+)	2.25	1.32
3.	I don't think conservation agriculture will help with the pesticide residue problem. (-)	2.16	1.40
4.	I think conservation agriculture is better than conventional agriculture. (+)	2.09	1.36
5.	In my opinion, conservation agriculture will reduce long-term dependency on external inputs. (+)	2.05	1.28
6.	In my opinion, It is good to have an optimized and sustainable yield from the field through conservation agriculture. (+)	2.02	1.03
7.	Conservation Agriculture is a win-win situation for farmers and environment. (+)	1.97	1.01
8.	Conservation agriculture does not help in adequately distributing nutrients in the soil profile. (-)	1.95	1.39
9.	I would like to suggest conservation agriculture to other farmers. (+)	1.93	0.93
10.	In my opinion, conservation agriculture is not applicable to my field. (-)	3.25	2.11
11.	I believe that conservation agriculture improves production efficiency. (+)	1.90	0.95
12.	In my opinion, conservation agriculture requires new management skills. (+)	1.83	1.18
13.	Conservation agriculture balances the soil ecosystem by carefully managing residue and waste. (+)	1.80	1.10
14.	To practice conservation agriculture, appropriate technical packages and training programs are needed. (+)	1.79	1.00
15.	Conservation agriculture reduces the occurrence of pests and diseases by interrupting their life cycles. (+)	1.71	1.11
16.	Conservation agriculture is ineffective for weed control (-)	2.27	1.51
17.	Conservation agriculture reduces climate risk. (+)	1.68	1.12
18.	Conservation agriculture reduces soil erosion. (+)	1.52	1.14

CONCLUSION

The scale's development and standardisation aim to promote research into the behavioural aspects of conservation agriculture. Scale product method has been used to develop the attitude scale. Wherein 30 statements were initially drafted. After the refinement made by experts and criteria, 25 statements were retained. Further, based on the judges' responses, the statements were refined to 18 statements (14 positive statements and 4 negative statements). The developed tool has a reliability coefficient of 0.917, which may be described as highly consistent and thus usable in a variety of scenarios. The remarks cover a wide range of topics related to conservation agricultural attitudes. The findings will aid in changing farmers' attitudes about conservation agriculture. With appropriate changes, this scale can also be used to assess farmers' attitudes beyond conservation agriculture. It will also assist policymakers in developing a strategy for implementing sustainable agriculture practices.

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Attitude of Farm Families Towards Gender Equity: Development and Validation of a Scale

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ABSTRACT

Gender equity is the means to achieve gender equalities in farm families. According to their respective needs based on equivalency in terms of rights, benefits, obligations, and opportunities are considered fair in the treatment of farm women and farmers. Thus, it was very essential to measure the favorableness of farm families toward gender equity. It measures to reflect their acceptance and thought process regarding present gender dynamics in their house and farm. The present study focussed to devise an instrument and for that, a Likert's Summated rating technique was used in the year 2022 with a true standardized methodology to construct the attitude towards gender equity. A total of 94 items were constructed by reviewing related literature. Based on the 80 responses from experts, 16 items were screened through item analysis. A split-half technique was used to measure the reliability of the scale and the reliability coefficient was 0.861. The validity of the scale was also proved as per experts' judgments.

INTRODUCTION

Gender dimensions largely remained absent from mid of twentieth-century discussions of agriculture and rural development. However, the first thorough discussion on gender was brought by Ester Boserup (1970) with her 1970 book on Woman's Role in Economic Development. She has drawn explicit attention to the gendered division of labor that arises in both "traditional" and "modern" agricultural systems and to the fact that economic development could not be fully evaluated without the recognition of the hidden contributions of women throughout the world, particularly in the form of unpaid work. Further many evident social scientists have demonstrated the wide range of roles played by men and women in agriculture. Women, especially in many developing countries, comprise the largest percentage of the workforce in the agricultural sector. They play a predominant role and have an important economic contribution to agricultural

production. The extent of women involvement remains maximum in operations like transplanting, weeding, harvesting and storing (Nain & Kumar, 2010). Failure to recognize these roles, differences and inequalities affects the effectiveness of agricultural development. Thus, closing the gender gap in agriculture is essential to ensure higher productivity and food security in the nation. In rural societies and particularly in farming communities, the differences and inequalities between farm woman and farmer have been observed in assigned responsibilities, activities undertaken, access to and control over resources, as well as decision-making process. Many strategies are framed and policies drafted to combat these differences to utilize the full potential of farming community. Gender equity doesn't equate one gender with another; instead, it attempts to facilitate equal opportunities for all genders to overcome their historical and social disadvantages by ensuring fairness and justice in the distribution of resources to all genders. Therefore, it is essential to take measures that help to uplift the lagging gender of

society through measures based on gender equity. Thus, it is equally essential to have some idea about how these gender equity measures are considered by farming community. Thurston (1946) defined attitude as the degree of positive or negative affect associated with some psychological object like symbol, phrase, slogan, person, institution, ideal or ideas towards which people can differ in varying degrees.

Interest in gender and attitudes toward gender equity continues to provide a strong impetus for research and theory building. It is difficult to capture this complexity because most measures of gender are based on a dichotomous approach that merely set women and men in opposition and assumes that people believe that differences between them are normal and natural. Individuals' beliefs about gendered behavior in society are useful for determining people's thinking about equity among women and men, as well as relationships between gender attitudes and other variables of interest. Presently, there are very limited instruments for measuring attitude towards gender equity and therefore this attempt was made to develop a scale to measure attitude of farm families towards gender equity and this is first of its kind in agriculture discipline.

METHODOLOGY

The study was conducted in 2022 using exploratory sequential design with an instrument development model. The study design consisted of instrument development and analysing validity and reliability of developed scale using appropriate statistical methods. The methodology adopted by Pandya (2004); Mittal & Kaur (2021); Sharma & Mudgil (2021); Singh et al., (2021); Gupta et al., (2022); Kumar et al., (2022); Gautam et al., (2022) was followed. For developing statements for scale development after conducting a in-depth literature review, a list of indicators was circulated among 50 extensionists and their opinions were obtained on 10 point continuum to know its appropriateness for the study. The indicator wise frequencies were converted in to a master sheet. Weighted mean and standard error were calculated for each indicator. The values thus obtained were arranged in ascending order. Out of 19 indicators, those having less than 90 per cent value were omitted. In this way, 06 indicators were finalized for the study. With these selected 6 indicators, 94 statements regarding the attitude of farm families toward gender equity were identified. After consulting with experts and discussion among research committee members, items were discarded, revised, and mixed. They were also examined and edited based on criteria suggested by Edward (1957). Thus, a scale with 60 items was included in the study.

Further, the summated rating scale method developed by Likert (1932) was used in the development of the measuring instrument. Item analysis was carried out on 100 subject respondents and their response was taken on five point continuum. It was found that some of the subject have responded very carelessly, misunderstood the directions and not be aware about the concept under present study. Hence, 20 schedules were eliminated. Lastly, 80 schedules were kept for the construction of attitude scale. The score of the respondents was obtained by adding up all scores in the items in the scale. Based on total

summated scores, respondents were arranged in descending order. Respondents with highest total score (top 20%) and lowest total scores (bottom 20%) were made into two groups. The two groups provided the criterion group in terms of which item analysis was carried out. The 't' test was applied to measure the extent to which a given statement differentiates between the high and low groups

$$t = \frac{X_H - X_L}{\sqrt{\frac{S_H^2}{n_H} + \frac{S_L^2}{n_L}}}$$

Whereas,

X_H = the mean score on a given statement for the high group

X_L = the mean score on the same statement for the low group

S_H^2 = the variance of the distribution of responses of the high group to the statement

S_L^2 = the variance of the distribution of responses of the low group to the statement

n_H = the number of subjects in the high group

n_L = the number of subjects in the low group

If $n_H = n_L = n$

$$t = \frac{X_H - X_L}{\sqrt{\frac{\sum(X_H - X_H)^2 + \sum(X_L - X_L)^2}{n(n-1)}}}$$

Where,

$$\sum(X_H - X_H)^2 = \sum X_H^2 - \frac{(\sum X_H)^2}{n}$$

$$\sum(X_L - X_H)^2 = \sum X_H^2 - \frac{(\sum X_H)^2}{n}$$

The split-half technique was used to measure the reliability of the constructed scale. The 16 statements were divided into two equal halves with 8 odd numbered and 8 even numbered statements. These were administered to 30 farm families (30 men + 30 women) in the non sample area. Each of the two sets was considered as separate scales having two sets of scores. Co-efficient of reliability between the two sets of scores was calculated by Rulon's formula (Guilford, 1954). Content validity test approach was used to test the validity of developed instrument. This was accomplished by giving the established dependable attitude scale to 27 judges in the field of agricultural extension for feedback and suggestion

RESULTS AND DISCUSSION

Selection of item for final scale was done after calculating the 't' value for all items, the items with t-values equal to or greater than 1.75 were finally selected and included in the attitude scale. This selection was based on the criteria that statements with higher 't' value had higher discriminatory power to provide distinguishing attitudinal difference among farmers and farm women. It was observed from Table 1 that 16 statements were found to be having values more than 1.75. According to Edwards, the t-value above 1.75 of any item has high discriminating power which could be placed in the final attitude scale. Therefore, the attitude scale consisted of 16 (9 equitable and 7 non equitable items) which were finally included in the scale. Items not classified by the majority of respondents as either positive or negative with regard

Table 1. Final standardized scale to measure attitude of farm families towards Gender Equity

S.No.	Statements
1	Men have more farm experience
2	Separate budget allocation for both
3	Political participation is gender neutral
4	Discrimination among children in family
5	Social groups give space to grow
6	Gender equality is threat to values
7	Saving and expenditure gives equity
8	Family decisions are managed by women.
9	It is shameful when men engage in domestic work.
10	Sensitize for equal inheritance of property
11	Shared responsibility decreases burden of both
12	Gender equity is women oriented
13	Extension services are primarily based on equity
14	Man's ego disregards women's opinion.
15	One can justify keeping a part of income.
16	Ideal decisions for family are to be discussed.

to the attitudinal object were eliminated from consideration for use in the final scale.

The observed split half model reliability coefficient was 0.861, according to the reliability data for the developed attitude scale. The reliability coefficient revealed that the attitude scale devised had a high internal consistency which is the most important aspect of attitude scale creation because it demonstrates the scale's robustness. As the scale was developed with the help of 27 judges who reviewed all of the revised statements and the experts' recommendations were implemented into the scale. As a result, the content validity of the current scale was met. The scale was finalized considering the 16 items as shown in Table 1 to assess the attitude of farm families toward the gender equity. These statements were structured in such a way that positive and negative words appeared at random to avoid bias answer. Against each of 16 item there are five columns representing a five-point continuum of agreement or disagreement to the item as followed by Likert (1932). The points on continuum are strongly agree, agree, undecided, disagree and strongly disagree with respective weight of 5, 4, 3, 2 and 1 respectively for favorable (equitable) item and with weight of 1, 2, 3, 4 and 5 respectively for unfavorable (non equitable) item. The attitude score of each respondent can be calculated by summing the scores obtained by her/him on all the items. The maximum obtainable score according to the present attitude scale is 80, whereas minimum obtainable score is 16.

CONCLUSION

The developed scale is a comprehensive, valid, and reliable instrument for assessing attitude of farming community toward gender equity. It can be effectively utilized to determine the attitude across varied dimension of gender equity covering varied horizons of responses. As it is a novel instrument, it can be used in forthcoming researches in varied ways. Acknowledging the gender

inequalities persisting in rural communities especially of developing nations, the information obtained from this scale would help administrators and policymakers to make unbiased decision on planning programmes or projects to assess the gender equality. Effective gender equity means can be framed and implemented that would show better acceptance and adoption by the society. This scale with few modifications can also be applied in different fields outside agriculture. Furthermore, through the results obtained one can plan and implement strategies to mitigate gender bias in farming and rural community to lead towards a world providing equal opportunities and position to both genders.

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Climate Change Adaptation Constraints among Paddy Growing Farmers in Kalyana-Karnataka Region of Karnataka State

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ABSTRACT

To mitigate and cope with changing climate, adaptation strategies are essential. However, farmers are facing several constraints while adapting to the changing climate. The study was conducted during 2018-19 in three major paddy growing districts of Kalyana-Karnataka region of Karnataka state with 90 respondents. The Rank Based Quotient (RBQ) approach was used to assemble, tabulate, and evaluate the data. The farmers expressed the absence of a location-specific climate forecast and they couldn't able to rely on available climate forecasts. In addition, farmers opined about the non-availability of critical inputs and fair prices for their produce. It suggested the farmers of the study region should be provided with updated and reliable information on climate change as this could help in improving their awareness on changing climate. The improvement of field extension connectivity and timely assistance to the farmers are required for better utilization of resources and adoption of climate-related strategic innovations.

INTRODUCTION

Climate is changing negatively and rapidly as a development issue at global level affecting many areas and as a potential threat to sustainable development. Thus, agriculture and food security has influenced the impact of temperature change and livelihoods of huge sections of the urban and rural populations globally. India being a developing country with diverse agro-climatic regions, challenging geographies, growing economies, diverse agricultural cultivation systems and farm typologies is more prone to the consequence of temperature change because of more dependence on agriculture for livelihood (Ashoka et al., 2022). Adaptation, a complex, multidimensional, and multi-scale process, and defined as adjustments to behaviour or economic structures that reduce vulnerability of society within the face of scarcity or threatening environmental change (Adger et al., 2003). Adaptations is defined as adjustments in human or natural systems with response to real

or await climatic stimuli, which moderates harm or exploits beneficial opportunities (IPCC, 2007). It also refers to actions that individual countries and societies go for balance to the change in climate that has occurred.

The impact of changing climate on agriculture might be highlighted at regional level and created vulnerability to food security (Ravikumar et al., 2015 & Sujith et al., 2021). The potential impact is changing cultivation practices, management techniques of the critical inputs and to some extent adjustment of production system itself (Rai et al., 2018 & Shanabhoga et al., 2019). Hence, to sustain the crop productivity several efforts are made by adopting resilient management practices. Extreme events like floods, heat waves etc., will negatively impact on agriculture crops, livestock health and productivity and thereby threatening the food security like never before (Kumar & Shivamurthy, 2021). Increased rainfall intensity in some regions would cause more wearing away resulting in land degradation. Water requirement of

crops is additionally likely to travel up with projected warming. Extreme events like floods, cyclones, wave and wave are likely to extend (Meena et al., 2022).

The ample of studies (Shanabhoga et al., 2020; Brar et al., 2020; Boda Mahesh Naik et al., 2022 & Vijayabhinandana et al., 2022) advocated the adaptation strategies like modification in cultivation practices like shifting planting dates, water-saving techniques, judicious nutrient management, etc. Meanwhile, we have failed to think of the ground reality that most of the farmers are unfamiliar with climate-resilient production technologies. Constraints hampers the potential to find out, to approach and to handle the risk that decreases the adverse effect related to climatic event and also affects the development and application of adaptation into use. Farmers are facing number of constraints while adapting to the changing climate. With the help of proper planning, suitable strategies and efficient utilization of available resources it is possible to overcome the constraints. Hence, the present study was attempted to document the climate change adaptation constraints among paddy growing farmers in Kalyana-Karnataka region of Karnataka state through a primary survey.

METHODOLOGY

The study was conducted during 2018-19 in three major paddy growing districts of Kalyana-Karnataka region (earlier known as Hyderabad-Karnataka region) of Karnataka state. The cropping pattern of this region varies from district to district. Kharif and Rabi's crops are the 2 seasons during which crops are grown. Summer cultivation is completed only within the small area with assured irrigation. The paddy is cultivated predominantly within the command area of the Tungabhadra project which includes Ballary, Koppal and parts of Raichur districts. Based on the area and productivity of the paddy, Ballari, Koppal and Raichur districts were selected for the sampling process. From each of the chosen districts, one taluk representing the highest area under paddy cultivation viz., Siruguppa taluk from Ballari district, Sindhanur taluk of Raichur district and Gangavathi taluk from Koppal district was selected. A general rule of thumb for the large enough sample condition (Cohen, 1990) (i.e, $n \geq 30$, where n is your sample size) thirty farmers from each taluk comprising of total 90 major paddy growing farmers were opted as respondents for the study. A structured questionnaire was developed by consulting the academicians in the local settings. The questions were grouped into constraints faced by farmers in adopting mitigating strategies and suggestions from them to cope with changing climate. The farmers were asked to point their responses to every question as 'More Severe' 'Severe' and "Less Severe". The Rank-Based Quotient (RBQ) approach was used to assemble, tabulate, and evaluate the data that had been obtained. By rating the limitations based on the replies from the respondents and establishing the Rank Based Quotient, the data were quantified (RBQ) (Sabarathanam, 1988). The constraint with the highest RBQ score was considered the most serious one based on the rankings they gave to each constraint. Rank Based Quotient (RBQ) was calculated as follows:

$$RBQ = \frac{\sum_{i=1}^n fi(n+1-i) * 100}{N * n}$$

Where fi = frequency of the respondent for the i^{th} rank of the problem

N = total number of the respondent

n = Number of ranks

RESULTS AND DISCUSSION

Constraints faced by the Paddy growing farmers

The perceived constraints expressed by the paddy farmers while following adaptation strategies in response to the climate crisis are presented with RBQ scores and ranks in Table 1. The constraints were classified into six categories. Among technical constraints, paddy farmers expressed the absence of a location-specific climate forecast (I) and they couldn't rely on available climate forecast from KVKs and other mass media due to irregularities in getting the information (II). Further, they also expressed that, traditional forecast methods like some devotional and ritual places provide climatic predictions based on which farmers take-up cultivation practices in the study area are also failing (III). In addition, farmers opined the lack of water management techniques in the study area and lack of knowledge regarding adaptation strategies. This indicates that the weather forecasts for the local area are not a reliable source of information and for this, the development departments should make farmers aware of the available reliable sources for climatic information. Since paddy is a water-intensive crop, technological interventions on scientific water management need to be provided by concerned KVKs and other line departments. The paddy farmers are facing economic constraints like not getting timely credit/loans from the bank and not getting a proper price for their produce. Besides this, the high cost of inputs, no subsidies and timely availability of critical inputs like seeds, fertilizers, pesticides etc were the major challenges faced by the farmers. Despite the difficulty in getting the inputs, the farmers are facing challenges like the non-availability of labour and higher wages rate for labours. The timely availability of credit and critical inputs are essential for the access and adaptation of climate-induced strategies. This affects the farmer's capacity to harness the full potential production in the field. Similar findings can be seen in the studies by Dupdal & Patil (2019) & Pabba et al., (2021). The respondents expressed that, administratively the government had given less or poor attention to climate-related problems and there was no proper extension service given at the field level concerning climate prediction. Some personal constraints are also expressed by the farmers that, they are having cultural influence in their farming and due to this they are unable to give up their traditional cultivation. Further, their lack of awareness of technological advancement in adaptation strategies and inability to access available information were major setbacks in adopting climate-smart agricultural practices.

Suggestions expressed by the paddy growing farmers

The suggestions were asked from paddy growers to overcome the challenges in adopting adaptation strategies for changing climate is depicted in Table 2. Majority of the farmers opined that forecasting of weather needs to be more accurate, reliable and

Table 1. Constraints expressed by paddy farmers in adoption of adaptation strategies

S.No.	Constraints	Mean RBQ Value	Rank
1	Technical Constraints		
a	Absence of location specific climate forecasts	96.52	I
b	Poor reliability of climate forecasts	96.27	II
c	Traditional climate forecast methods failing	94.56	III
e	Absence of water management techniques	92.23	IV
f	Lack of knowledge regarding appropriate adaptations	92.13	V
2	Economic Constraints		
a	Lack of credit/ loan from the bank	86.27	I
b	Low price for the produce in the market	85.36	II
3	Inputs Constraints		
a	Higher cost of the agricultural inputs	96.35	I
b	No subsidies on planting materials	94.24	II
c	Non availability of timely inputs (seeds, pp chemicals, fertilizers etc)	93.15	III
d	Poor supply of uniform electricity	87.25	IV
4	Labour Constraints		
a	Non availability of labours	93.44	I
b	Higher labour wage rate	91.56	II
c	Labours facing difficult to work in the field due to severe temperature	63.56	III
5	Administrative Constraints		
a	Poor government attention to climate problems	88.24	I
b	No proper extension service in climate prediction	86.25	II
c	Absence of government policy on climate crisis	85.26	III
6	Personal Constraints		
a	Cultural influence	86.24	I
b	Inability to give up traditional values	85.63	II
c	Low awareness level	84.25	III
d	Inability to access available information	82.13	IV

Table 2. Suggestions expressed by Paddy growers to mitigate the ill effect of the climate change

S.No.	Suggestions	Mean RBQ Value	Rank
1	Forecasting of weather needs to be more accurate, reliable and timely	86.63	I
2	Necessary and timely support during natural calamities needs to be given by Government.	86.63	I
3	Crop insurance and timely credit facilities need to be given	85.25	II
4	Assurance of timely and subsidized farm inputs	83.61	III
5	Create awareness for farmers on effect of climate change consequences	82.12	IV
6	Field level extension services should be provided to the farmers	80.32	V
7	Timely irrigation has to be ensured by the concerned departments	75.23	VI

timely and necessary support during natural calamities needs to be given by Government. In addition, crop insurance and timely credit facility need to be ensured. As these were the major constraints faced by the farmers, the suggestions were expressed in line with the constraints (Shelar et al., 2021). Assurance of timely and subsidized farm inputs is crucial for better production and productivity by reducing the adverse effect of climate variability in the region. Creating awareness among farmers about the effect of climate change consequences has to go a long way.

CONCLUSION

Farmers are adopting different strategies to cope with changing climate on agriculture. However, during process farmers experience numerous constraints. The major constraints faced by sample farmers in the region were the absence of a location-specific climate forecast and they couldn't able to rely on available climate.

Forecasting of weather needs to be more accurate, reliable and timelier and necessary support during natural calamities needs to be given by Government. The farmers of the study region should be provided with updated and reliable information on changing climate as this could help in improving their awareness and adaptive capability to changing climate. The improvement of field extension connectivity and timely assistance to the farmers are required for better utilization of resources and adoption of climate-related strategic innovations. Hence the appropriate strategic policies need to be framed for the timely supply of inputs and stable communication facilities.

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Constraints Associated to Geographical Indication Usage: Experts and Producers Perspective

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ABSTRACT

The benefits associated with Geographical Indications (GI) are largely underutilized by most of the registered goods in India, with few exceptions. Therefore, an exploratory study was conducted with experts in the field of GI and also with producers of the GI registered agricultural and food products of Tamil Nadu in order to find reasons for poor GI usage and constraints perceived by the producers of the registered goods. The experts (n=14) reported, lack of awareness among producers about the GI and its benefits, lack of awareness among consumers about the uniqueness and originality of the good, and the absence of quality maintenance mechanism in the registered territory as reasons for poor usage. According to the producers (n=241), lack of awareness, narrow price difference between GI products and their non-GI counterparts and consumer's preference for low price over quality were the top constraints that pull the producers from using GI.

INTRODUCTION

Geographical Indication (GI) is the indications provided to a product which has specific characters viz, originality, reputation and uniqueness which are essentially attributed to the geographical territory on which the product is produced (Giovannucci, 2009). GI is associated to many benefits; these benefits can be related to social, economic and environment development of the region (Olivia, 2008; Bramley & Kirsten, 2007; Echols, 2003); thus it has the potential to achieve sustainable development in the region (Belletti et al., 2017). These benefits are subjected to usage of GI by the producers of the registered GI product. As per the information available on the GI registry website, so far, India has registered around 430 goods under five broad categories, 300 more new goods are waiting to be registered and many more have the potential to be registered (Nanda et al., 2013; Press Trust of India [PTI], 2013; Samaddar & Samaddar, 2010). Except few famous goods (Example: Basmati rice and Darjeeling Tea), many of the Indian GI goods lack brand image even inside India (Das, 2010). Though

reasons for poor GI usage are attributed to lack of awareness among the stakeholders; the claim lacks empirical evidence. The reasons can be the constraints that are the pulling factors which influence a person's decision to not engage in an activity. Studies on constraints related to GI in Indian circumstances are very limited or unavailable. Hence, the studies of constraints across the world were reviewed and summarized here. Faria (2010) in their study at Brazil found some major difficulties in GI registration process as, insufficient investments and actions from government side, lack of organizations among the producers, individualist culture in business, necessity to increase public awareness on G.I. as an IPR and bureaucracy. Another study in Portugal found the reasons why agricultural firms do not adhere to the Protected Destination of Origin (PDO) /Protected Geographical Indications (PGI) systems as, the economic and transactions cost of certification, the heavy bureaucracy related to the certification process, the small price difference in the prices between PDO/ PGI products and standard products within the same reference market (Rodrigo et al., 2015). Das (2006) reported the constraints in enforcement of rights of

Indian GI products in other countries as, technicalities involved in the registration process in various countries, exorbitant expenses involved in appointing a watch dog agency to get information on misappropriation and huge financial resources needed for fighting legal battles in foreign lands. Though these studies deal with the constraints in registration and maintenance of GI, they do not reflect the specific issues in India. And, the recent studies of constraint analysis in farming sector in India had focused on various issues like, entrepreneurship, adoption of technologies, use of ICT and covid-19 induced lockdown, but not GI (Kobba et al., 2020; Roy et al., 2022; Gupta et al., 2020; Chandran et al., 2021; Singh et al., 2021). Therefore, the present study was conducted in order to explore the specific constraints associated to GI usage in Indian scenario.

METHODOLOGY

For the study, exploratory sequential mixed method design was used. Qualitative research approach was used to capture the constraints in GI usage. Thematic analysis with the interview notes and verbatim of 10 Key Informant Interviews (KIIs) and 3 Focused Group Discussions (FDGs) was conducted to identify the broad themes and its related statements which are to be included in the quantitative study. The captured constraints were quantified from both experts in the field of GI and the producers of GI registered agricultural and food products. The selection of experts was made based on a strict criterion of having minimum five years of professional experience in GI in particular and IPR in general. The expert's response was captured using a questionnaire sent through email and social media. The primary producers of GI registered agricultural and food products were selected from Tamil Nadu as the state had more number of GI applications and had more agricultural to food products ratio at the time of the study (Geographical Indications Registry, n.d.). Out of registered agricultural and food products in the state, five products (3 Agricultural goods and 2 Food products) namely, Eathomozhy Tall Coconut, Kodaikanal Hill Garlic, Virupakshi Hill Banana, Srivilliputtur *Palkova* (a dairy product) and Kovilpatti *Kadalaimittai* (a sweet made of groundnut), were selected randomly. In each product, the sample of respondents was selected based on the Snowball Sampling Technique to make the sample size of 241. The constraints were documented in three point continuum of Very Severe (3), Severe (2) and Not Severe (1) and ranked based on Weighted Mean Score (WMS).

RESULTS AND DISCUSSION

Qualitative thematic categorization of constraints in GI usage

Thematic classification of constraints associated to GI usage, which were derived from the qualitative study, is presented in the Figure 1. The obtained constraints were categorized under four main themes viz, individual, institutional, market and product related. Most of the producer's individual constraints were related to their view on the business and their perception towards GI. The Second theme of institution related constraints were about the producer's unmet expectation from proprietor and government organizations. The third theme of market related constraints were

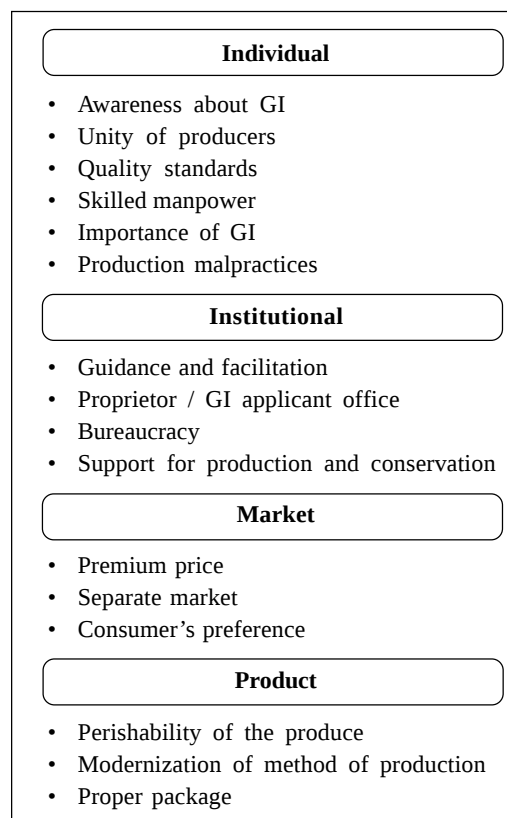


Figure 1. Thematic categorization of constraints in using GI

about the producer's view towards the produce market and the customer/ consumer. And finally, the product related constraints explain the producer's view on the product which they produce and its characteristics.

Experts' perspective

The experts who are working on Geographical Indications have confirmed the lack of awareness among producers as the major reason why GI is less visible in India. Further they agreed lack of consumer awareness as next major reason why GI is not popular in many registered products. Another major concern that

Table 1. Reasons for poor GI usage

S.No.	Reasons for poor GI usage	Percentage
1.	Lack of awareness about GI among producers	100.00
2.	Lack of awareness among consumers	85.71
3.	Dysfunctional proprietor office or inactive proprietor	57.14
4.	Lack of unity among the producers	57.14
5.	Absence of Separate market for GI goods	28.57
6.	Inability to adhere to quality production standards by the producers	42.86
7.	Absence of enough incentives to the producers	42.86
8.	Consumer's preference to price over quality	42.86
9.	Absence of quality and monitoring mechanisms in the GI territory	85.71
10.	Modernization of production methods	14.29

experts flagged is the absence of quality and monitoring mechanism inside the GI registered territory. Though there is a default solution prescribed in the GI rules for the constitution of an inspection committee, these committees are largely not functional in India (Vinayan, 2017). Lack of unity among the producers and inactive proprietor was also reported as major reason for poor GI usage by majority of the experts.

Producers' perspective

The producers' perspective on constraints in GI usage and their perception towards its severity is discussed in Table 2 & 3. The producers have perceived lack awareness about GI and its benefits as very severe constraint or pulling factor that hinders from using GI. This lack of enough details about GI and its benefits was perceived as an equal constraint by producers of the both agricultural and food products (Table 3). The second important constraint that discourages the producers from using GI is absence of premium price or narrow price difference between the GI registered products and non-GI counterparts in the market. The third constraint perceived was the consumer's preference to price over quality. In other words, the market is not segmented with the consumers with different needs.

While lack of awareness among the producers about benefits and absence of premium price or narrow price difference between GI goods and similar non-GI goods were common constraints for both agricultural and food products category, some specific constraints pertaining to each of the product category were observed (Table 3). Considering agricultural products, absence of separate market for the GI good is a primary constraint. The separate market for GI good would enable the genuine producers of the GI commodity to find a fair ground to market their unique and original goods. Also, the separate market would solve the constraint of consumer's preference of price over quality (Ranked 4th) as it makes segmentation in the market and

Table 2. Overall ranking of constraints as perceived by the producers of GI products

S.No.	Statements	WMS	Rank
1.	Lack of awareness about benefits of GI	117.33	1
2.	Lack of unity among the producers/ farmers	86.33	9
3.	Individualism in the business	81.67	12
4.	Absence of necessity to use GI	100	6
5.	Non-conformity & malpractices inside the territory	75.5	14
6.	Importance of GI is unfelt	102	5
7.	Inability to adhere quality standards	65	16
8.	Unavailability of enough skilled manpower	81.67	13
9.	Absence of guidance and facilitation	95.83	8
10.	Dysfunctional proprietor office	86	10
11.	Bureaucracy and red-tapism	55	17
12.	Absence of incentives for production and conservation	99.67	7
13.	Narrow price difference / Absence of premium price	114.83	2
14.	Consumer's preference of price over quality	111.5	3
15.	Absence of separate market	110	4
16.	Perishability of the produce	84.83	11
17.	Absence of proper package (Agricultural goods n=173)	53.33	18
18.	Modernization of method of production	69	15

attracts discerning consumers who can differentiate and consume. Meanwhile, the producers of food products have reported absence of guidance and facilitation for authorized user registration and presence of individualism in the business as the major constraints. Some of the unique constraints that categorically differentiate agricultural and food products are statements 7 and 17. The producer group of these categories differed from each other, in the aspect that producers of food products perceived GI as a necessary market tool

Table 3. Product wise ranking of constraints as perceived by the producers of the GI goods

S.No.	Statements	WMS		Rank	
		Agricultural (n=173)	Foodstuff (n=68)	Agricultural (n=173)	Foodstuff (n=68)
1.	Lack of awareness about benefits of GI	85.0	32.3	1	1
2.	Lack of unity among the producers/ farmers	59.8	26.5	11	6
3.	Individualism in the business	54.8	28.3	13	4
4.	Absence of necessity to use GI	80.0	20.0	6	15
5.	Non-conformity and malpractices inside the territory	52.0	23.5	15	11
6.	Inability to adhere quality standards	40.3	24.7	17	10
7.	Unavailability of enough skilled manpower	56.0	25.7	12	8
8.	Importance of GI is unfelt	80.2	21.8	5	12
9.	Absence of guidance and facilitation	68.7	29.2	8	3
10.	Dysfunctional proprietor office	66.5	19.5	9	16
11.	Bureaucracy and redtapism	37.3	17.7	18	17
12.	Absence of incentives for production and conservation	74.0	25.7	7	7
13.	Narrow price difference / Absence of premium price	84.0	30.8	3	2
14.	Consumer's preference of price over quality	82.7	27.2	4	5
15.	Absence of separate market	84.3	25.7	2	9
16.	Perishability of the produce	64.0	20.8	10	14
17.	Absence of proper package	53.3	NA	14	NA
18.	Modernization of method of production	48.2	20.8	16	13

while the producers of agricultural products perceived GI just as recognition to their product.

CONCLUSION

The lack of awareness of producers and consumers towards GI can be addressed by initiating mass awareness campaigns, presenting GI goods as souvenir in government and corporate functions, and branding GI goods through prominent personalities as GI ambassadors. The absence of price difference and consumers preference to low price over quality can be addressed by increasing awareness of consumers. Therefore, we conclude that increasing the awareness of producers and consumers would definitely address the most of the constraints associated to GI popularization and usage in India. And, as a community's intellectual property right, the GI demands more participation from all stakeholders of the registered product. Hence, it is suggested to improve cohesiveness and collective functioning for institutionalizing GI at field level.

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Wildlife Conflict and Prevention Strategies Adopted by Farmers and Forest Officials

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ABSTRACT

Human-wildlife conflict is unfavorable interactions between people and wild animals that hurt both people and their resources as well as wildlife and their habitats. The study was conducted in the year 2021-2022 in the surrounding villages of Ranthambore Tiger Reserve to understand the type of conflict and strategies adopted to prevent conflict. Garret ranking method was used to assess degree of vulnerability of crops and livestock towards wild animals and vice versa and strategies to prevent conflict. Farmers have grown 10 types of crops among them maize and among livestock goat was highly preferred by wild animals. Farmers mostly followed seven strategies to prevent conflict out of seven, fencing around the field and guarding crops and livestock by humans was found most effective strategies and eight practices were followed by forest officials to prevent conflict out of eight, boundary wall around the reserve area was most effective practice.

INTRODUCTION

Global conservation efforts face significant obstacles as a result of human-wildlife interactions that cause damage to property, loss of crops and livestock, injuries to people, and even death. Human activity has increased, fragmenting shared spaces, which has increased these conflicts between people and wildlife (Karanth et al., 2013). One of the most essential natural and renewable resources for human survival, particularly for people who live in or near forests, is the forest (Bhat, 2018). Programme like Joint Forest Management programme works for the development of forests but it's also not effective due to problems like lack of fund and delay in planting time (Iqbal et al., 2020). An estimated 200 million people reside in or near woods and are entirely dependent on these areas' natural resources for their survival (Iqbal et al., 2021). A large portion of this human-carnivore conflict happens within the boundaries of protected areas where people, livestock, and carnivores coexist (Nyhus & Tilson, 2004). There are numerous non-lethal methods available to help reduce livestock and livelihood losses, such as physical deterrents, and financial incentives for

communities (Shivik, 2006). And Organizations like Tripura Forest Development & Plantation Corporation Limited also work for uplifting the life of tribes in a state like Tripura (Uchoi & Singh, 2020). This paper aims to provide a brief and their ranking, about type of crops and livestock highly preferred by wild animals and vice versa and strategies adopted by farmers and forest officials to prevent human-wildlife conflict.

METHODOLOGY

The present study was carried out during December 2021 to May 2022 in the surrounding villages of Ranthambore Tiger Reserve, India. RTR was selected purposively due to the highest crop raiding by wild animals and the highest 304 villages with one million population in the vicinity of RTR. The Ranthambore Tiger Reserve is divided into two zones namely the Core also known as critical tiger habitat and Buffer zone, both zone were selected for the study. Out of 304 villages, 30 villages (18 villages from the core zone and 12 villages from the buffer zone) were selected randomly, from each village 12 farmers were selected randomly from each village, so total 360 farmers, Further 30 forest officials

belonging to RTR have been selected, so, the total sample size was 390 for the study. An exploratory research design was used to identify wildlife conflict and strategies adopted by the farmers and forest officials. Data were collected in two phases. In the first phase of data collection, a survey and focus group discussion was conducted to identify the type of wildlife conflict and strategies adopted by the farmers and forest officials to prevent conflict. Then, all the types of conflict were categorized into different heads like most vulnerable crop, and type of livestock, wild animals mostly dangerous for the crops, livestock, and humans, and strategies adopted by the farmers and forest officials to prevent Conflict. In the second phase, asked farmers and forest officials to put rank on the particular items then it was quantified by using the garret ranking as suggested by Garret (1981) which is as follows:

$$\text{Per cent position} = \frac{[100(R_{ij} - 0.50)]}{N_j}$$

Whereas, R_{ij} , Rank given for the i th service by j^{th} respondent; N_j , Number of services ranked by j th respondent.

RESULTS AND DISCUSSION

Crops and livestock's vulnerable to the wild animals

Since it was clear in the earlier focus group discussions with the farmers of the vicinity of the RTR that there is intense HWC in the village and their crops as well as livestock. HWC happened in crops in the form of destroying the standing crop, crop raided, eating, uproots whole plants, etc. by the wild animal. So, the farmers were then asked to list different crops they grow and rank them in terms of their vulnerability to damage by wild animals. The details of the crop type that farmers are cultivating and their rank is presented in Table 1. The study explored that farmers were mostly cultivating 10 types of agriculture crops and found that maize crop was highly vulnerable to raiding by the wild animal and most desirable crops of the wild animal like Nilgai, monkey, etc. so, farmers have kept rank

Table 1. Ranking of crops and livestock vulnerable towards the wild animal

S.No.	Crops	Garret mean score	Rank
Vulnerability of crops toward the wild animals			
1	Wheat	56.84	V
2	Mustard	46.08	VII
3	Gram	49.73	VI
4	Barley	36.23	VIII
5	Sorghum	34.28	IX
6	Pearl Millet	57.66	III
7	Maize	74.85	I
8	Black Gram	23.43	X
9	Vegetable	57.61	IV
10	Guava	62.31	II
Vulnerability of livestock to wild animals			
1	Buffalo	35.29	IV
2	Cow	30.88	V
3	Calves of Buffalo and Cow	49.42	III
4	Goat	68.83	I
5	Sheep	65.58	II

I of the maize crop. Chauhan, (2011) reported that nilgai is a major cause of crop-raiding and trampling of crops like wheat, gram, millet, etc. The majority of the farmers used to cultivate horticulture crops like guava and guava farming is very much prevalent in the study area and this crop is highly vulnerable to wild animals like wild boar, which used to destroy whole the plant of guava and entered in guava field despite having fencing around the field due to this reason farmers have kept it II rank.

Farmers surrounding the vicinity of RTR used to keep livestock like buffalo, sheep, goats, and cows for their livelihood but due to HWC, these animals were killed and injured by the wild animal in the reserve area. The data presented in the Table 1 revealed that goat was most vulnerable for the wild animals followed by sheep and calves of buffalo and cow.

Wild animals toward vulnerable crops and livestock

The result of the rank of wild animals destroying crops and livestock depredation has been given in detail in Table 2. Their study explored that wild boar (Garret mean score: 72.18) was a major cause of crop damage, wild boar destroyed all types of crops including horticulture crops such as guava, and uprooted whole the plant of guava due to this reason farmers have given rank first. Nilgai was used to destroy standing crops in form of crop-raiding and foraging the crop and given II rank by the farmers. Chhangani et al., (2008) also found a similar result in their study and reported that most crops were raided by the blue bull (nilgai) followed by wild boar. Wild animals like big cats leopards and tigers are used to harm livestock as well as human in form of lifting and killing livestock as well as making injured the livestock and humans.

Strategies adopted by the farmers and forest officials

Farmers followed various strategies to prevent HWC and tried to reduce their losses as much as they can reduce losses by these practices. Details of the strategies have been given in Table 3. Fencing of wire with the help of poles (Pole made by stone or Cement) around the agriculture field was ranked first with a Garret mean score of 74.07. Similar findings also reported by Huygens and Hayashi (1999). And guarding the crops and livestock in the daytime as well as the night time by the human along with some of the farmers keeping dogs while they were guarding crops and livestock were ranked second. Karanth & Kudalkar (2017) reported

Table 2. Ranking of wild animals toward vulnerable crops and livestock

S.No.	Type of Wild animal	Garret mean score	Rank
Ranking of the wild animal towards destroying crops			
1	Nilgai (<i>Boselaphus tragocamelus</i>)	67.69	II
2	Wild Boar (<i>Sus scrofa</i>)	72.18	I
3	Chital (<i>Axis axis</i>)	46.40	IV
4	Sambar (<i>Rusa unicorn</i>)	52.64	III
5	Common langur (<i>Semnopithecus</i>)	30.44	VI
6	Rhesus monkey (<i>Macaca mulatta</i>)	31.60	V
Ranking of Wild animals towards depredation of livestock			
1	Tiger (<i>Panthera tigris</i>)	58.52	I
2	Leopard (<i>Panthera pardus</i>)	41.48	II

Table 3. Strategies and their rank towards effectiveness to prevent Human-Wildlife Conflict

S.No.	Strategies	Garret mean score	Ranking
Ranking of effectiveness of strategies adopted by the farmers to prevent Conflict			
1	Guarding the crops and livestock	69.22	II
2	Fencing around the agriculture field	74.07	I
3	Use of crackers	50.37	IV
4	Spreading hair around the border of the field	42.77	V
5	Using rope, bottle, banging tin to make sound	57.24	III
6	Temporal changing of cropping pattern	30.02	VI
7	Insurance	29.33	VII

Table 4. Ranking of effectiveness of strategies adopted by the forest officials to prevent Conflict

S.No.	Strategies	Garret mean score	Ranking
1	Boundary walls around the Tiger Reserve	74.58	I
2	Technical financial support to the farmers by the Forest officials	68.33	III
3	Guarding the Reserve area by the forest guard	70.75	II
4	Training program related to preventing attack by the wild animal	44.03	V
5	Awareness Programme	51.33	IV
6	Resettlement of the villages and farmers	36.42	VI
7	Transfer the more aggressive wild animal to the safe zone	32.72	VII
8	Eco-Development activities	28.00	VIII

that watching crops and livestock and using scare devices were good mitigation practices for wild animals.

Forest officials followed various strategies to prevent HWC and restricted entering humans and their livestock inside the premises of RTR by some strategies. So forest officials were asked to give a ranking based on effective strategies to prevent HWC. The result of strategies adopted by the forest official is presented in Table 4. A study revealed that Boundary walls around the Tiger Reserve were most effective and given rank first. Guarding the Reserve area by the forest guard to restrict the entry of humans and livestock were given ranked II. If any livestock and human has been countered by wild animals on the premises of human settlement area forest officials used to give Technical financial support to the farmers were ranked III with the garret means score of 68.33.

CONCLUSION

The primary finding of this study emphasizes the need for ongoing development of direct mitigation techniques to promote harmonious cohabitation between people and wildlife. Conflicts frequently result in local communities losing their main sources of income due to the destruction of crops and livestock losses which frequently causes hunger and poverty. Through preventive, mitigation, and indirect strategies, coping strategies aim to reduce human-wildlife conflicts and increase local community tolerance. They also promote more sustainable practices that will not only help decrease human-wildlife conflicts but also strengthen local communities' resilience. We found that some outdated tactics require revision to have a meaningful impact, but even more crucially, these techniques require revision to lessen habitat devastation. Therefore, in order to create more effective mitigation policies that will aid populations in better coexisting with wildlife, policymakers must give weight to these important elements.

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Utilization Pattern of ICT Tools by Paddy Growers in Uttar Pradesh

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ABSTRACT

Information and Communication Technology (ICT) in agriculture refers to the process of making available ICTs to assist, enhance, and optimise the dissemination of knowledge among the farmers. This study was conducted during 2018-19 in Sultanpur district of Uttar Pradesh. Due to the district's significant area under rice cultivation, Sultanpur in Uttar Pradesh was chosen as the location of the research. For the sampling a total of 120 farmers, from five villages were selected randomly by using proportionate random sampling technique. ICT utilization among the farmers was the maximum and 45.83 per cent respondents were using ICT tools to a medium extent, and the mobile was the most utilized ICT tool, ranking first with a mean score value of 6.99. In contrast to age, caste, family type, social involvement, and material ownership, this showed non-significant and negative correlations with the extent to which ICT tools were used. The variable 'education' had a very significant and positive correlation with the use of ICT tools that mainly effect the utilization of ICT tools 19. The utilization extent of ICT tools was satisfactory but still there was need of awareness and educational programmes to be introduced in study area.

INTRODUCTION

Information and Communication Technology (ICTs) in agriculture is an emerging field that emphasizes on the enhancement of agriculture and other development in India. The agriculture sector is preparing itself to make optimum use of new information and communication technologies. Agriculture extension is a service that educates farming communities by introducing them to new information and technological advancements so they can raise their yield, income, and living standards. Despite having a significant, educated, skilled, and organised agricultural extension workforce, about 60 per cent of farmers in the nation are still unreached (NSSO, 2005), means they are not being helped by any extension organisation or functionary. Radio and television are the main sources of agricultural information for the 40 per cent of people who have some access to it. Although there are several ICT facilities, the majority of extension agents owned, accessed, and

used radios, televisions, and phones that they had personally purchased from the open market (Ezeh, 2013). ICT improvements can be used to provide farmers with accurate, timely, and relevant information and services, facilitating an environment in which the agriculture occupation is also financially rewarding. However, there are differences between regions in the quantity and quality of telecommunications, information, and the effort of individuals, public and private organisations, as well as a differentiated nature of farmer demand in various areas. This means that not all ICT initiatives are created equal. The rapid growth of ICTs has enormous potential for expanding farmers' information access and, thus, yields and profitability through the adoption of productivity-enhancing technology; yet, the lack of ICT-based technical knowledge is the most significant barrier to the widespread adoption of ICTs (Mahalakshmi et al., 2015). Illiteracy, the availability of relevant and specialized content in their own language, the easy and affordable access of ICT tools,

and other issues such as understanding and willingness to adopt new technologies are all common issues in the utilization of ICT. Farmers with larger land holdings were using ICT more effectively than farmers with smaller holdings. However, it is important to understand how farmers use ICT (Lokeswari, 2016). It was very important to know the extent of utilization, and problems faced during the use of ICT tools by the farmers.

METHODOLOGY

The study was conducted in the state of Uttar Pradesh, and Sultanpur district was purposefully chosen for the study because of its predominant rice-wheat cropping pattern. Thus, paddy growers from the Sultanpur district constituted respondents for the study. Out of the district's 14 community blocks, Motigarpur block was purposefully chosen for this study because it had the most area under the rice-wheat cropping pattern. Five of the 79 villages in the Motigarpur block were identified through a simple random sampling technique. At the end of the sampling process, a separate list of respondents was prepared for each sample village, and thus a total of 120 paddy grower farmers from the five sample villages were selected using a proportionate random sampling technique based on the farmers' categories, namely marginal farmers (less than 1 ha), small farmers (between 1 and 2 ha), medium farmers (between 3 and 4 ha) and large farmers (from 4 ha and above). A pretested and structured interview schedule was prepared. Thus, the data were collected from the respondents using the personal interview method, according to a predetermined interview schedule for data collection. The extent to which paddy grower farmers used ICT tools was measured on a 7-point continuum, with 1, 2, 3, 4, 5, 6, and 7 assigned, respectively, for yearly, half-yearly, quarterly, monthly, fortnightly, weekly, and daily use. The mean and standard deviation were used to divide the respondents into low, medium, and high utilization extent categories based on the total feasible score. Based on the total attainable score, the respondents were classified into three categories, namely low, medium, and high utilization extent, by using the mean and standard deviation. The following formula was used to figure out the overall mean score value for using information sources:

$$MSV = \frac{\sum_{i=1}^n \text{Total Score}}{K}$$

Where, MSV = Mean Score Value, K= total number of respondents

The mean score value was determined by the total score of an individual ICT tool divided by the total number of respondents. To determine the extent of utilization of each ICT tool by respondents, the mean score value (MSV) was worked out and ranked accordingly. The coefficient of correlation (r) was used to measure the mutual relationship between independent variables and utilization extent of ICT tools.

RESULTS AND DISCUSSION

The levels of utilization of ICT tools by paddy growers were calculated using the method as Mean $\pm$ S.D. and the data and the maximum number of paddy growers (45.83%) was using selected ICT tools to a medium extent. As a result, it was concluded that the majority of respondents used ICT tools at a medium level.

Similar results were also reported by Panda et al., (2022), as the majority of livestock and poultry farmers had medium level information source utilization. It is also in agreement with the results of Kumar et al., (2019).

Utilization extent of ICT tools

The data in Table 1 indicated that there were twelve different ICT tools used for this study. Among the different selected ICT tools, paddy growers had the highest utilization of mobile phones, with a mean score value of 6.99, which was assigned first rank. This indicates that paddy growers were mostly using mobile phones as ICT tools. A similar result was reported by Anastasios et al., (2011). Television came in second with a mean score value of 6.94, followed by the internet and radio, which came in third and fourth with a mean score value of 4.85 and 4.81, respectively. The paddy-growing farmers had the lowest utilization of the e-Agricultural Magazine, with a mean score of 0.81, which was awarded last rank among the selected ICT tools, i.e., twelfth rank. They were the ones who were least likely to use the e-Agricultural magazine.

In terms of ICT use, the findings supported Sharma et al., (2012), who reported that most of the farmers receive information through cell phones because they are dissatisfied with print media and prefer two-way mobile phone communication. The study's findings were consistent with those of Adamides & Stylianou (2013), who reported that nearly 98 per cent of the farmers in Cyprus used their mobile phones as a source of agriculture information. It was also in line with Roy et al., (2018), who reported that the majority of farmers often used mobile phones (98%) as a main source of communication tools, followed by television (97%), telephones (60%), radio (57%) and the internet (49%) as ICT tools. It was also somewhat in agreement with the results of Olaniyi (2013) & Ani et al., (2015), which showed that radio (M = 2.38), television (M = 2.10), and mobile phones (M = 2.20) were the most utilized ICT tools in their study area.

Correlation between different independent variables and utilization extent of ICT tools

Table 2 shows that, of the 14 variables investigated, the variable "education" had a highly significant and positive correlation

Table 1. Distribution of the respondents on the basis of utilization extent of ICT tools

S.No.	Categories of information sources	Total Score	Mean Score Value	Rank order
1.	Radio	578	4.81	IV
2.	Television	833	6.94	II
3.	Mobile	839	6.99	I
4.	Internet	582	4.85	III
5.	Kisan call center	411	3.42	VII
6.	e-Kisan	377	3.14	VIII
7.	e-news paper	267	2.22	X
8.	e-Agricultural magazine	98	0.81	XII
9.	Email	229	1.90	XI
10.	YouTube	455	3.79	VI
11.	Whatsapp	565	4.70	V
12.	Face book	352	2.93	IX

Total score: 5586, Average Mean Score Value: 3.87

Table 2. Correlation between independent variables and utilization extent of ICT tools

S.No.	Independent variable	Correlation coefficient
1.	Age	-0.1786
2.	Education	0.5632**
3.	Caste	-0.1958
4.	Type of family	-0.0904
5.	Size of family	0.0370
6.	Housing pattern	0.1526
7.	Land holding	0.0079
8.	Occupation	0.2507*
9.	Annual income	0.0622
10.	Social participation	-0.0593
11.	Material possession	-0.0174
12.	Economic motivation	0.2186*
13.	Scientific orientation	0.0476
14.	Knowledge extent about paddy cultivation	0.0782

*Significant at 0.05% probability level 0.197, ** Significant at 0.01% probability level 0.257

with the extent to which ICT tools were used. The variables, namely occupation and economic motivations, were discovered to have a significant and positive correlation with the extent to which ICT tools were used. This signifies that as education, occupation, and economic motivations increase, information source utilization also increases, resulting in a highly educated and economically motivated group utilizing more information sources. Other variables, i.e., size of family, housing pattern, land holding, annual income, scientific orientation, and knowledge extent about paddy cultivation, have a non-significant but positive correlation with the utilization extent of ICT tools, while age, caste, type of family, social participation, and material possession have a non-significant and negative correlation with the utilization extent of ICT tools. This signifies that as it increases; information source utilization decreases, resulting in younger age groups and nuclear families utilizing more information and communication sources.

The outcomes of the study are in line with Kafura et al., (2016) & Panda et al., (2019) who reported that level of education had a positive and significant relationship with the extent of use of different ICT tools by the farmers, while age showed a negative relationship. The findings are consistent with the reports of Chakraborty et al., (2000) about ICT utilization who found a strong and positive correlation between the variables education and economic motive.

CONCLUSION

The study indicated that nearly half of the paddy grower farmers were using ICT tool at medium level. Among the different ICT tools paddy grower were having highest utilization of mobile phone. They were using social media such as YouTube, WhatsApp, and Facebook to a moderate extent, but they preferred WhatsApp, YouTube and Facebook. Education had a highly significant and positive correlation with the extent to which ICT tools were used. The variables, namely occupation and economic motivations, were discovered to have a significant and positive correlation with the extent to which ICT tools were used. It is necessary to enhance

the capacity of paddy farmers and extension workers to use modern ICT technologies effectively to increase agricultural productivity. They should be trained and also know the importance of ICT tools in agriculture and how to make it easy to connect agriculture with information and communication technology.

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Analyzing the Feedback from Women Dairy Farmers in the East District of Sikkim

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ABSTRACT

The dairy sector is a women-centric endeavor. It is an instrument for elevating the vulnerable section of society, particularly the farm women. Farm women contribute diligently towards dairy activities. The study was conducted in the East district of Sikkim in the year 2021. A simple random technique was used for selecting four blocks, five villages from each block, and ten respondents from each village were randomly selected. A personal interview schedule was used for the collection of data. Data were collected from 200 dairy farm women owning at least one dairy cattle. The study analyzes the feedback of dairy farm women based on five aspects, i.e., economical, technical, administrative, information networking, and independent decision-making. The result revealed that the high cost of concentrate, feed, and fodder, delayed service of animal health officials, lack of financial support from the government, irregular information on government schemes on dairy, and non-availability of financial support to women farmers were some of the major feedbacks given by the respondents.

INTRODUCTION

India is bestowed with abundant of resources. In term of human resources, women labors are a significant asset of the nation. The contribution made by women in development of nation is remarkable. Especially, the farm women are the foundation for upliftment of country. In India, majority of the population depends on agriculture and allied sector for their livelihood. The livestock sector provides the farm families with additional income for sustaining their living. Around 15-40 per cent of the total farm income is generated from livestock sector (Ahuja et al., 2003). Dairy farming is one of the sub sectors under the livestock sector, which is proved to be a profitable enterprise. It has evidenced to be an advantage for the women farmers, as dairy production employs around 95 per cent of women (World Bank, 1991). In India participation of women engaged in dairying is about 75

million compared to 15 million men (Thakur & Chander, 2006). Dairy farming has become a female-based enterprise as farm women are having more control over this enterprise (Jadav et al., 2014). They are playing major roles in decision making on “labour management” and “retaining milk and its products for family consumptions” (Yadav et al., 2021). Community leadership and time allocation dimensions empowered the farm women (Raj et al., 2022). The women in the farm are spending more time on collection of fodder (254.68 hrs/year) and transporting of the fodder (132.07 hrs/year) (Kishtwaria et al., 2009). Farm women are seen as a covert worker. Their contribution to the dairy related activities is often scanty acknowledged as these activities are not determined in profit- making term. Farm women have low support from the family in participation in culture and social activities. Diversified workload, lack of interest in handling technical gadgets was some problem faced by the farm women (Niketha et al., 2018).

Introduction of women friendly technologies can impart drastic change in the present scenario of the farm women (Shamna et al., 2022). Migration of labour during different seasons, low literacy rate of the tribal women, poor economic condition and their shy nature were some limitations faced by women dairy farmers (Dhayal & Metha, 2020). In Sikkim, dairy farming is a traditional practice of sustaining the livelihood of people living in hilly region. The farm women are the functional mechanism behind the dairy sector in the state. East district of Sikkim act as milk pocket in the state due to its active functioning of milk cooperative society, leading to involvement of many dairy farm women. There is a need to acknowledge the contribution made by the dairy farm women in the state. Thus, the study was conducted in this regard with the objectives to analyse feedback from women dairy farmers in East district of Sikkim.

METHODOLOGY

The research was conducted in East district of Sikkim. It covers an area of 964 km sq. It lies between 27 °19' N and 88 °36' E. It is situated in the south-east corner of the state. Four blocks namely, Ranka, Nandok, Rakdong Tintek and Khamdong were selected randomly. Under the selected block, five villages were selected through random sampling and ten respondents were

selected randomly from each village. Thus, the total sample size was 200 in number. The criteria for selection of the respondents were according to possession of at least one dairy cattle. The study was conducted during the month of January to February 2021. Personal interview technique was used for data collection. For analyzing the feedback from the women dairy farmers, five aspects were selected related to dairy activities and Garret ranking technique had been applied, where the obtained values were transformed into scores by using the following formula.

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

Where, R_{ij} = Rank given for i^{th} factor by j^{th} individual, N_j = Number of factors ranked by j^{th} individual

The percent position was altered in to score as per table given by Garret and Woodworth (1969). Then for each statement the scores of the individual respondent were added together and divided by the total number of respondents.

RESULTS AND DISCUSSION

The Table 1 showed, the ranking of feedback given by the respondents regarding different aspects. According to economical

Table 1. Feedback from women dairy farmer according to different aspects

S.No.	Feedbacks	Total score	Garrett mean score	Mean Rank
A.	Economical aspect			
1.	High cost of crossbred animal	9978	49.89	VI
2.	High cost of concentrate, feed and fodder	13743	68.72	I
3.	Difficulty in getting loans from bank	11087	55.44	III
4.	Lack of schemes for purchasing milch cattle	9059	45.30	V
5.	High cost of medicine for cattle	7453	37.27	VI
6.	Low productivity of local breed	11569	57.85	II
7.	Lack of transport facility for milk and animal.	7232	36.16	VIII
B.	Technical aspects			
1.	Lack of bulk milk cooler in the milk centre	8390	41.95	V
2.	Lack of machine milking system	11007	55.04	III
3.	Lack of training on scientific cattle management.	11719	58.60	II
4.	Lack of awareness on disease management	10668	53.34	IV
5.	Delayed service of animal health officials	12173	60.87	I
6.	Problem in heat detection	6032	30.16	VI
C.	Administrative aspects			
1.	Lack of financial support from govt.	13215	66.08	I
2.	Lack of veterinarian service in the village	9400	47.00	III
3.	Lack of schemes promoting dairy farming	10255	51.28	II
4.	Lack of training availability on new technology to the farmers	8860	44.30	IV
5.	Lack of extension contacts in the village	8275	41.38	V
D.	Information networking aspects			
1.	Irregular information on govt. schemes on dairy	13325	66.63	I
2.	Lack of information on new technology	10035	50.18	III
3.	Lack of information on training of dairy practices	11105	55.53	II
4.	Lack of information on disease and pest management	9370	46.85	IV
5.	Irregular information on AI	6165	30.83	V
E.	Independence decision making aspect			
1.	Non availability of financial support to women farmers	12572	62.86	I
2.	Lack of knowledge on dairy activities	7657	38.29	IV
3.	Poor managerial skills	9808	49.04	III
4.	Lack of self-confidence	9963	49.82	II

aspect, it can be seen that; “high cost of concentrates, feed and fodder” was given first rank with mean score (68.72). The reason behind this might be due to the fact that, the area for fodder cultivation is very limited and there is lack of availability of good fodder variety to the cultivators. The feeds are usually bought from outside the state making it costly for the respondents to purchase. Similar results were seen in study of Shankar et al., (2017) & Patel et al., (2016). Availability of concentrates, feed and fodder should be provided to the respondents at a subsidized rate by the government. Followed by second rank given to “low productivity of local breed” with mean score (57.85). The reason behind this can be due to the fact that local breeds of the area were producing milk on an average 5 kg/day resulting in low productivity. Comparable results were found in the study of Adhikari et al., (2020). Suitable training on feed management can be conducted in the area to improve the productivity of breeds in the area. Third rank was given to “difficulty in getting loans from bank” with mean score (55.44). Similar results were reported by Patel et al., (2015) & Das et al., (2015). As majority of the respondents were marginal land holder and less educated to apply for loans in the bank. According to feedback with respect to technical aspect, it was observed that, first rank was given to “delayed service of animal health officials” with mean score (60.87). Second rank was given to “lack of training on scientific cattle management” with mean score (58.60) and third rank was given to “lack of machine milking system” with mean score (55.04). The reason behind this is due to, lack of availability of veterinary clinics at each village and lesser number of veterinarians. The state being an organic state, focuses more on agricultural activities, thus there is limited emphasis on scientific training on dairy management. Apart from that, the majority of the respondent possesses small herd size and belongs to low income category therefore, availability of machine milk in their household is not possible. Similar results were reported by Singh et al., (2016); Shankar et al., (2017) & Singh et al., (2019). The feedback with respect to administrative aspect, showed that, the first rank was assigned to “lack of financial support from government” with mean score (66.08). Followed by second rank assigned to “lack of schemes promoting dairy farming” with mean score (51.28) and third rank assigned to “lack of veterinarian service” in the village with mean score (47.00). Similar findings were reported by Patel et al., (2015) & Hundal et al., (2015). The reason for this might be that, the administrative setup in the study area has no proper plan and programmes for implementing dairy related schemes and developmental activities. Regarding feedback with respect to information networking aspect, the first rank was given to “irregular information on government schemes on dairy” having mean score (66.63). Second rank was assigned to “lack of information on training of dairy practices” having mean score (55.53). Similar findings were reported by Patel et al., (2015) & Adhikari et al., (2020). The third rank was allotted to “lack of information on new technology” having mean score (50.18). The reason for this can be due to weak functioning of extension workers in the area, inappropriate communication technique and method followed by the officials and communication gap between the farmers and government officials. The feedback with respect to independence decision making aspect, the first rank was given to “non-availability of financial support to dairy farmer” having

mean score (62.86). Similar result was in line with research of Fatima and Gupta et al., (2013); Akhtar (2014) & Hundal et al., (2015) who found that financial empowerment was lacking in dairy women farmers. Second rank was given to “lack of self-confidence” with mean score (49.82). Similar result was observed by Singh et al., (2017); Dhayal & Mehta (2020) reported that farm women were shy in nature and lacked self-confidence and third rank was allotted to “poor managerial skills” with mean score (49.04). The reason behind this may be the fact that, majority of the respondent practiced agriculture and dairy farming as their occupation. They had no other source of income thus making them financially unstable. Majority of the respondent possessed only primary education leading to lack of self-confidence and poor managerial skills.

CONCLUSION

High cost of concentrate, feed and fodders, delayed service of animal health officials, lack of financial support from government, irregular information on government schemes on dairy and non-availability of financial support to women farmers were some of the major feedbacks given by the women dairy farmers. In depth study needs to be conducted in other region of the state to gain intense knowledge about the dairy farm women, so to predict future roles. The study suggests, availability of high yielding fodder variety to the dairy farm women, provision of concentrates, feed and fodder at a subsidized rate, accessibility of credit facility to the target women groups to overcome the financial constraints and recruitment of animal health care officials in the village centers for providing timely service and information regarding the dairy activities.

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Constraints Faced by Tomato Growers at Production and Marketing Level in Haryana

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ABSTRACT

The tomato is the most consumed vegetable in raw or processed form in every house and its demand is throughout the year. The present study was carried out in the Kurukshetra, Karnal, and Yamunanagar Districts of Haryana in 2022-23. The data was collected from a sample of 210 farmers with the help of a well-structured interview schedule with the objective to study the constraints faced at the production and marketing levels. The analysis of data was done with the Garrett ranking technique. The study concluded that the major problem at the production level was climate vagaries (79.01), high labor cost (74.60), high incidence of insect, pest, and disease (70.52), high cost of tomato seed (62.75) and lack of skilled labor during peak time (59.79). At the marketing level, frequent price fluctuation (82.90), lack of cold storage and warehouse facilities (72.38), high transportation cost (68.83), and quality deterioration during transportation (61.07) were found to be major constraints. Extension programs focused on creating awareness among farmers on prevailing schemes, subsidies and hi-tech farming methods such as controlled climate production can be helpful in overcoming the constraints.

INTRODUCTION

India is blessed with the varied resources of production and diversified cropping systems which gives boost to vegetable cultivation. On an average, the vegetable farming gives five to ten times more yield than cereals (Prakash, 2014). Many farmers are diverting their farm resources toward vegetable cultivation by realizing its importance. Tomato (*Solanum lycopersicum*) is one of the most consumed vegetables in world as it forms the basic ingredient in raw, cooked or processed foods. India is the second largest producer of tomato in the world after China. Tomato is very important due to its nutritional value as it is a good source of vitamins, minerals and low amounts of proteins and fats and some carbohydrates (Kumari et al., 2022). The tomato is perishable in nature and faces many uncertainties regarding climatic conditions and input use efficiency. The marketing of tomato crop is very complex and risky due to its perishable nature, seasonal production

and bulkiness results into quick selling of crop on prevailing prices (Kumari et al., 2022). The realization of prices is also very unique from producer to consumer due demand and supply transactions among various involved intermediaries at different level of marketing (Dastagiri et al., 2013). The major constraints faced by vegetable growers were input constraints i.e., high price of hybrid seeds, fertilizers and chemicals, followed by unavailability of quality protection chemicals, technical constraints like poor confidence in recommended technology, risky application of plant protection measure due to lack of knowledge, lack of knowledge about balanced use of fertilizers (Kumar et al., 2020). The farmers need information on credit/loan procurement, marketing channels, processing and proper harvesting of tomatoes, weather and health nutrition whereas training need were on safe use of agro-chemicals, storage of seeds and fruits, nursery management techniques, weather and weed management (Adebisi et al., 2020). The processing capacity and the varieties suitable for processing should be developed to improve

the efficiency of vegetable sector. The focus should be on efficient post-harvest management to reduce wastage of the produce (Kumari et al., 2022). The vegetable cultivation in recent years have shown encouraging signs of changing from traditional food grains farming to diversified farming including vegetables (Akila et al., 2020). In view of this, the present study was conducted with the objective to study the constraints faced by tomato growers at production and marketing level in Haryana.

METHODOLOGY

The present study was conducted purposively in selected three districts i.e., Kurukshetra, Karnal and Yamunanagar of Haryana based on large area under tomato production. The Ladwa block from district Kurukshetra, Indri from Karnal and the block Radaur from Yamunanagar were selected purposively for the present study as these three blocks collectively makes a big pocket area for tomato cultivation. From each block five villages were select randomly and fourteen farmers cultivating tomato were further selected randomly from each village. Therefore, the total sample size for this study was 210. The primary data were collected using well-structured interview schedule to find out the major problems faced by tomato growers at production and marketing level. Garrett's ranking technique was used to identify major constraints at production and marketing level. The scores of individual respondents were summed up and divided by the total number of respondents for each factor and then according to average mean scores the final rank was given to constraints. The constraint with highest average mean score got rank one and so on.

RESULTS AND DISCUSSION

The tomato is perishable in nature due to which tomato farmers have to face problems right from sowing to the marketing

of crop to its final consumption and it was observed during data collection that the major problems faced by tomato growers were at production and marketing level. The constraints at production level involves problems faced by the farmers in growing tomato at farm level and the constraints at marketing level involves problems faced by farmers after harvesting of crop i.e., in taking crop to market to sell crop to different customer groups and other activities like transportation and storage. The tomato is mainly disposed through intermediaries i.e., wholesaler-cum-commission agents and the retailers. The constraints faced by these were also analyzed.

Constraints at production level

The major constraints faced by tomato growers at production level are presented in Table 1. The data in table revealed that climate vagaries were the biggest problem faced by tomato growers with mean score of 79.01. High labor cost was the second most faced problem with mean score of 74.60 followed by high incidence of insect, pest and diseases with mean score of 70.52, high cost of tomato seed with mean score 62.75, lack of skilled labor during peak time with mean score 59.79, yield risk, instability in tomato production, use of conventional methods of farming and lack of technical know-how among farmers and so on. Input supply Centre is far away with mean score of 20.48 was found out to be least important constraint faced by tomato growers followed by erratic supply of electricity, etc. The results were backed by the findings of Shende & Meshram (2015) and Roy & Ghosh (2022) who found that high labor cost, changing climate and high losses due to insects and pests were the major constraints faced by farmers at production level. It was suggested from the results that the farmers should adopt protected cultivation and follow recommended farm management practices in order to reduce crop damages from insect, pests and diseases.

Table 1. Constraints at Production and Marketing Level

S.No.	Constraints at Production Level	Haryana Mean Score (Rank)	Constraints at Marketing Level	Haryana Mean Score (Rank)
1	High incidence of insect, pest and diseases	70.52 (3)	Frequent price fluctuation	82.90 (1)
2	Climate vagaries	79.01 (1)	Quality deterioration during storage and transportation	61.07 (4)
3	Lack of skilled labor during peak time	59.79 (5)	Lack of awareness of new technologies	48.39 (8)
4	High labor cost	74.60 (2)	Lack of cold storage and warehouse facilities	72.38 (2)
5	Yield risk	57.68 (6)	Cumbersome process of BBY/ government procurement (NAFED)	59.89 (5)
6	High cost of tomato seed	62.75 (4)	Distant market	37.08 (11)
7	Instability in tomato productivity	49.87 (7)	Collusion among traders/ trade malpractices	41.75 (10)
8	Use of conventional methods of farming and lack of technical know-how among farmers	47.85 (8)	Delay in sale and payment	19.69 (14)
9	Timely unavailability of quality seeds and other recommended inputs like pesticides	40.00 (10)	High transportation cost	68.83 (3)
10	High cost of fertilizers and plant protection chemicals	44.74 (9)	Poor market infrastructure	31.35 (12)
11	Inadequate credit supply by financial institution and high interest rate	39.89 (11)	Lack of information about government schemes and subsidies	49.28 (7)
12	Input supply Centre is far away	20.48 (14)	Poor road network for transportation	23.20 (13)
13	Poor quality and insufficient underground water	29.52 (12)	Lack of availability of market information	59.25 (6)
14	Erratic supply of electricity	21.93 (13)	Labor problems for grading and packing	43.22 (9)

Figures in the parenthesis indicate ranks

Table 2. Constraints at Intermediaries' Level

S.No.	Particulars	Wholesaler-cum-commission agents	Retailers
		Mean Score (Rank)	Mean Score (Rank)
1	Dispersed nature of source of supply	72.00 (2)	59.53 (5)
2	Frequent price fluctuation	69.67 (3)	73.13 (2)
3	Lack of cold storage facilities	64.07 (4)	69.87 (3)
4	Perishable nature of tomato	85.00 (1)	85.00 (1)
5	High transportation cost and lack of vehicles facilitated with cold storage	47.47 (8)	46.80 (8)
6	Competitors in market	58.73 (5)	61.13 (4)
7	Delay in sale and payment	17.00 (14)	24.20 (13)
8	Poor market infrastructure	23.47 (13)	20.40 (14)
9	Quality deterioration during storage and transportation	54.67 (6)	51.87 (7)
10	High spoilage losses	52.60 (7)	55.93 (6)
11	Lack of grading and packaging facilities	38.80 (10)	35.13 (11)
12	Lack of access to credit and high interest rates	34.60 (12)	40.73 (10)
13	High market fee	45.80 (9)	30.53 (12)
14	Lack of availability of market information	34.87 (11)	45.40 (9)

Figures in the parenthesis indicates ranks

Constraints at marketing level

The major constraints faced by the tomato growers at marketing level were presented in the Table 1. The table revealed that at overall level i.e. when total sample of three districts taken together that frequent price fluctuation was the major problem faced by tomato growers with mean score of 82.90, lack of cold storage and warehouse facilities ranked second with mean score of 72.38, high transportation cost with mean score of 68.83 followed by quality deterioration during storage and transportation with mean score of 61.07, cumbersome process of BBY/ government procurement (NAFED), lack of poor availability of market information, lacking of information about government schemes and subsidies, lack of awareness about new technologies etc. The delay in sale and payment was found to be the least important by the sample farmers with mean score of 19.69 followed by poor road network for transportation with mean score of 20.63 etc. Similar results were found by Bharadwaj et al., (2011) & Prakash (2014) who revealed that lack of cold storage facilities and high transport costs were the major constraints in the cultivation of highly perishable vegetable crops. Further, Mishra *et al.* (2021) too stated that erratic power supply is no longer a major constraint faced by farmers in rural areas. The results emphasize the need for setting up of cold storage and warehouses at village level so that farmers can avoid postharvest losses. Also, the price fixed under BBY scheme should be done by keeping in the actual cost of cultivation of tomato. Kumar & Nain (2012), Gupta et al., (2013); Das et al., (2014); Yadav et al., (2018) & Gireesh et al., (2019) also reported similar nature of constraints in different setting.

Constraints at the intermediaries' level

The constraints at intermediary's level are presented in table 2. The tomato is mainly disposed through wholesaler-cum-commission agents and the retailers. The table revealed that the major problems faced by the wholesaler-cum-commission agents were perishable nature of tomato with mean score of 85.00, dispersed nature of source of supply with mean score of 72.00 followed by frequent price fluctuation with 69.67 mean score, lack

of cold storage facilities with mean score of 64.07, competitors in market with mean score of 54.67 and so on whereas the major problems faced by the retailers were found to be perishable nature of tomato ranked one with mean score of 85.00, frequent price fluctuation ranked two with mean score 73.13 followed by the lack of cold storage facilities, competitors in market, dispersed nature of source of supply and high spoilage losses. The problem of delay in sale and payment ranked fourteen and poor market infrastructure ranked thirteen were found to be least important at both wholesaler-cum-commission agents and retailers. The similar results were found by Haruna (2012).

CONCLUSION

The area under vegetable cultivation was increasing due to short life period and adaptability to different climatic conditions and cropping systems. It is recognized that, if progress has to be achieved in tomato growers, they are to be modernized in knowledge, adoption and other personal, social and economic characteristics. The farmers should be trained with scientific tomato farming through different government and other agencies on latest technical know-how. The farmers should made aware about various schemes and subsidies and the provision of cold storage facilities at village level and refrigerated transport facilities for efficient movement of tomato from farms to different consumption points without wastage will help in improving efficiency.

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Editorial Report on International Extension Education Conference, “IEEC BHU 2023” on “*Innovative Applications of Agricultural Extension for Sustainable Food & Environmental Security*” held at Banaras Hindu University, Varanasi (U. P.) India during 27-30 January, 2023.

Extension is a key pillar of agricultural development in the world. While large investments have been made during the last few decades to strengthen agricultural research, extension, and advisory services, the extension and outreach systems in most developing countries remain weak and are often broken, under-funded, and disconnected from research and education. The synergism between extension and research is well recognized, but in practice, often a lack of cooperation exists between them. Greater integration, cooperation, and effective communication are needed, and appropriate mechanisms to foster joint programs linking research and extension are critical. Additionally, extension programs should go beyond farm advisory support and encompass larger sphere of community development in both rural and urban areas. The 3rd International Extension Education Conference (IEEC BHU-2023) aimed to connect together the extension educators and practitioners round the globe for sharing their diverse experiences, innovations and good practices for proposing suitable alternatives for SDGs, climate and environmental security. The Indian Society of Extension Education (ISEE) New Delhi collaborated the event. The major themes were; Innovations in Agricultural Extension Management, Innovations in Extension Service and Future perspectives of Agricultural Extension. The following sub themes were presented viz, Institutional Pluralism: Mapping and Convergence, Entrepreneurial Extension, Incubation and Startups, Capacity Building & Training Management in Extension, Digital Initiatives, Disruptive Technologies and Knowledge Management, Technology Development Assessment and Transfer, Structural & Functional Imperatives of Communication Process, System Paradigm and Sustainable Models of Communication, Farm Journalism & Social Media Extension, Communication, Diffusion and Behavioural Research in Extension, Doubling Farmers Income: Innovations and Experiences, Value Chain and Market Led Extension, Family

farming & nutrition sensitive extension, Gender & Youth in agriculture, Extension approaches in climate smart agriculture, Rethinking Agricultural extension: Policies and reforms, Extension in social context: Vocal for local, Emerging pedagogy in teaching and learning, Worldwide education policies and NEP 2020 and Sustainable Food Production Addressing SDGs Grass root innovation, Adaptation Strategies and IPR rules.

The conference formally inaugurated on 27th January 2023, brought together 348 scientists and delegates round the globe along with 50 farmers for three-day deliberations spread over 15 oral & 6 poster sessions – pertaining to four seminar themes and 21 sub themes where 7 key note addresses, 14 lead papers were presented by delegates from 25 states. Around 493 abstracts were submitted by extension professionals, published in the form of Compendium of Abstracts containing 435 pages. The prestigious Extension Leadership Awards were conferred on Dr. U.S. Gautam, DDG (Agricultural Extension), ICAR, New Delhi and Dr. P. Chandra Shekara, DG, MANAGE, Hyderabad. The event was graced by the august presence of many stalwarts and doyens in the field of Agriculture from India and abroad including; Dr. V.V. Sadamate, Former Advisor (Agriculture), Planning Commission, Government of India, Prof. P.K. Roul, Vice Chancellor, OUAT, Odisha, Dr. P. Chandra Shekara, DG, MANAGE, Hyderabad, Prof. Janaki Alavalapati, Professor and Dean, Auburn University, USA, Prof. Venkatramana Sridhar Professor, BSE, Virginia Tech & Diplomate, D.WRE, USA, Prof. K. Narayana Gowda, Former Vice Chancellor, UAS, Bangalore, Sudhanshu Singh, Director, IRRI (ISARC), Dr. U.S. Gautam, DDG (Agricultural Extension), ICAR, New Delhi. Other stalwart of Agricultural Extension like; Dr. G. Trivedi, Former Vice Chancellor, RAU, Pusa, Dr. M. M. Adhikari, Former Vice Chancellor, BCKV, West Bengal, Prof. Chakradhar Satapathy, Former Director, Extension, OUAT, Former Vice Chancellor and Director AMITY University, Dr.

T.K. Behera, Director, IIVR, Varanasi, U.P. and Prof. Saket Kushwaha, Honorable Vice Chancellor, RGPU, Arunachal Pradesh. Prof. B. Jirli, Department of Agricultural Extension and Communication, I.Ag.Sc., BHU & convener of the event deliberated on various facets of themes of conference the recommendations of the conference.

The theme wise recommendations aroused from presentations and discussions were as follows:

- Institutional pluralism and convergence platforms need to be achieved for collaborative technology delivery system.
- FPOs are the institutions which can play key role in real time technology delivery.
- Exploiting youth power in agriculture by empowering them and developing entrepreneurial competencies.
- Overhauling agricultural education curriculum to suit the needs of the day and making provision for constant updating and revision on continuous basis.
- Providing blended learning opportunities not only to students but also practitioners of agriculture and allied sciences.

- Focusing more on demand driven approach rather than supply driven approach of extension.
- Extension education and extension services effort should focus more on blending traditional agricultural practices with modern practices.
- Open educational resources as weapon of mass education and education is the panacea of all problems of stakeholders.
- Agri -tourism combined with health and religious tourism can be the game changer in enhancing income of stakeholders of agriculture and allied sciences.
- There is immediate need for providing legal framework for extension service delivery mechanism to make extension more accountable.

On last day 930th January, 2023) a Scientist-farmer interaction with the active participation of around 50 farmers was organized.

Courtesy: Editorial Board, Indian Journal of Extension Education, ISEE, New Delhi

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- The **TITLE** should not exceed 14 words and must be representative of the content.
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- The **KEYWORDS** best describes the nature of the research after the abstract. Provide a list of 5 to 8 keywords (indexing terms). The first letter of each keyword should be in upper case or capital letter. As major words in the title are not used in the subject index, appropriate words from the title (or synonyms) should be listed as keywords.
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The tabular matter should not exceed 20% of the text. Any abbreviation used in a table must be defined in that table. All tables should be cited in the text. If an explanation is necessary, use an abbreviation in the body of the table (e.g. ND) and explain clearly in footnotes what the abbreviation means. References to footnotes in a table are specified by superscript numbers, independently for each table. Superscript letters are used to designate statistical significance. Use a lower case p to indicate probability values (i.e. $p < 0.05$). In general, use numerals, when two numbers appear adjacent to each other, spell out the first (i.e. three districts were selected rather than 3 districts were selected). In a series using some numbers less than 10 and some more than 10 use numerals for all (i.e. 2 splits, 6 plants were selected). Do not begin a sentence with a numeral. Spell it out or rearrange the sentence. Abbreviate the terms hour (h), minute (min) and second (sec) when used with a number in the text but spell them out when they are used alone. Do not use a hyphen to indicate inclusiveness (e.g. use 12 to 14 year or wk 3 and 4 not 12-14 mg or wk 3-4). Use Arabic numerals with abbreviated units of measure: 2 g, 5 d, \$4.00, 3% and numerical designations in the text: exp 1, group 3, etc.

- The **‘CONCLUSION’** summarizes principal findings and should not be of more than one paragraph (100-150 words) after the discussion and explain in general terms the implications of the findings of this research. It has to be written in present tense and the emphasis must be on what should now be accepted as established knowledge. Conclusion should relate back to introduction and hypothesis. Implication, the significance of your results or any practical application must find place in conclusion. Abbreviations, acronyms, or citations should not be used here. It should not be a repetition of the abstract.
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