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EDITORIAL

In January 2022, it was projected that the inflated prices for agricultural inputs and the demand for labour will be driving forces in 2022. Due to twin problems of low productivity and excess workforce employed in it, the per capita productivity of the workforce is very low which results in depressing the agriculture sector wages and ultimately the increased poverty. In our neighborhood, in Sri Lanka, fears of a hunger crisis are rising in, and rice production in the last harvest season had already plunged 40% to 50%. Due to the direst economic meltdown in Sri Lanka, seed and fertilizer scarcities could shrink crop yields by as much as 50%, whereas, on the other hand, Indian agricultural exports rose by about 20% to \$50.21 billion during 2021-22 despite logistical challenges posed by the COVID-19 pandemic. The rise in export of agricultural and processed food products has been largely due to the various initiatives taken by the Centre Government through organizing B2B exhibitions in different countries, exploring new potential markets through product-specific and general marketing campaigns by the active involvement of Indian Embassies. The agricultural extension system needs to respond against a slowdown in growth; degradation of natural resource base; uneven and slow dissemination of technology; inefficient use of available technology and inputs and other abiotic stresses.

The current issue (July-September 2022) contains 41 manuscripts dealing with issues of agriculture, dairy, fisheries, veterinary sciences, and community sciences. The various social and extension dimensions dealt with include; the role performance of agricultural input dealers including DAESI; poultry, *mithun* husbandry, dairy management practices, and scientific fish farming; *kisan* credit card; *kisan* mobile advisory service; soil health card; RKVY-RAFTAAR; farmer producer companies; marketing system effectiveness; migration behaviour; food adulteration; adaptation and consumption pattern during the pandemic; climate change vulnerability; social media; the impact of mobile app; attributes of innovation for adoption; training need; job satisfaction; water management under conservation agriculture and groundwater use efficiency in irrigation; minimization of yield gap in pulses and value chains analysis; entrepreneurship development; hybrid rice; integrated pest management practices; determinants for technology socialization; effect of nutrition interventions; information and communication technology and so on. The included manuscripts were submitted from 16 Indian states and UTs covering 26 Indian institutions (SAUs/CAUs/ ATARIs/ DUs/ SVUs/ KVKs). It is reiterated that to increase the citations and wider circulation of the manuscripts published in the Indian Journal of Extension Education we need to strive hard for quality submissions.

I extend my sincere thanks to all the authors for making valuable contributions. I also extend sincere thanks to all the expert members of the editorial board for their painstaking efforts. The support extended by Executive Council is duly acknowledged. 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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No. 3

CONTENTS

Research Articles

Knowledge Level of Smallholder Woman Farmers of Poultry Producer Company in Madhya Pradesh <i>Raj Kumar Patel, Mahesh Chander, Med Ram Verma and R. Hari</i>	..	1
Role Performance of Agricultural Input Dealers in Agro-advisory Services in West Bengal <i>Amitava Panja, N. S. Shivalinge Gowda, D. V. Kusumalatha and Debi Kalyan Jayasingh</i>	..	8
Information Sources, their Utilization Pattern vis-à-vis Mithun (<i>Bos frontalis</i>) Husbandry in Arunachal Pradesh <i>Kamni P. Biam, L. Sunitibala Devi, K. Khate, N. Uttam Singh, Pampi Paul and C. Gowda</i>	..	14
Impact of COVID-19 on Consumption Pattern of Vegetarians and Non-Vegetarians <i>M. B. Shanabhoga, Gurrappanaidu Govindaraj, G. S. Naveenkumar, H. M. Swamy, Mahantheshwara Bheemappa, M. Nagalingam, B. R. Shome and Habibar Rahman</i>	..	18
Perceived Marketing System Effectiveness by Pineapple Growers in Tripura <i>Priyanka Roy and Souvik Ghosh</i>	..	24
Knowledge and Association of Solar Pump Users Regarding Vegetable Production Technology in Jaipur Rajasthan <i>Pramod, Shobhana Gupta, K. C. Sharma, B. S. Badhala and R. N. Sharma</i>	..	29
Assessment on the Progress of KCC Scheme in India <i>Sonia, D. P. Malik and Joginder Singh Malik</i>	..	33
Factors Influencing the Utilization Pattern of Kisan Mobile Advisory Service <i>K.V. Patil and V.T. Patel</i>	..	38
Knowledge Level of DAESI and Non-DAESI Dealers for Paddy and Wheat Cultivation in Punjab <i>Amrit Banerjee, Vipin Kumar Rampal and Pranoy Ray</i>	..	42
Assessment of Farmer's Attitude and Social Vulnerability to Climate Change in the Semi-arid Region <i>D. C. Meena, R. K. Dubey, Rama Pal, S. K. Dubey and Rajesh Bishnoi</i>	..	46
Social Media Use Profile of Farmers in Haryana <i>Ayush Mishra, Jogender Singh, Joginder Singh Malik and Abhilash Singh Maurya</i>	..	51
Perception of the Jute Growers on Attributes of Innovation- CRIJAF SONA <i>Devayan Chatterjee and Sagar Mondal</i>	..	55
Socio-ecological Factors Influencing Farmers' Perceptions on Water Management under Conservation Agriculture <i>Anwesha Mandal, S. K. Acharya and Monirul Haque</i>	..	60
Pulses Yield Gap Minimization: Consequences of CFLD-Pulses in India <i>S. K. Dubey, U. S. Gautam and Atar Singh</i>	..	65
Leveraging Social Media Platforms for valuing Agri-Entrepreneurship in Punjab, India <i>Amanjit Kaur, Gurjeet Singh Walia and Ramandeep Singh</i>	..	70
What Motivates Rice Farmers to Adopt Hybrid Rice Technology in Assam, India? <i>Jeemoni Gogoi, Rinumoni Buragohain and Nivedita Deka</i>	..	74

Usage Pattern of Social Media among Higher Secondary School Students of Haryana <i>Sanyogita Dhanwal, Poonam Kundu, Joginder Singh Malik, Dangi Pooja Arun and Neelam Kumari</i>	..	78
Comparing the Nutrient Management Pattern in Soybean and Rice based Cropping Systems by Soil Health Card holders and Non-holders <i>Meenal Dubey, Kallely C. Shinogi, H. K. Awasthi and M. A. Khan</i>	..	83
Factors Affecting Perception of Extension Agents Towards Effective Social Media Utilization Behaviour <i>A. Shanmuka, V. Lenin, V. Sangeetha, L. Muralikrishnan, V. Ramasubramanian and Alka Arora</i>	..	88
Migration Behaviour of Rural Youth in Haryana <i>Abhilash Singh Maurya, Bhavesh, Ayush Mishra and Joginder Singh Malik</i>	..	93
Understanding Conservation Agriculture in terms of Knowledge, Perception and Application <i>Riti Chatterjee, S. K. Acharya, Amitava Biswas, Prabhat Kumar and Monirul Haque</i>	..	99
Consumers' Awareness and Opinion Towards Food Adulteration in Selected Areas of West Bengal <i>Madhurima Maiti and Tanushree Saha</i>	..	104
Socio-economic Transformation through RKVY-RAFTAAR in Uttar Pradesh and Karnataka <i>Bhagya Vijayan, Manjeet Singh Nain, Rashmi Singh, N. V. Kumbhare and Ravi K. N.</i>	..	108
Training Need Assessment of Board of Directors of Farmer Producer Companies: An Application of Borich's Model <i>Himadri Roy, Basavaprabhu Jirli and Saikat Maji</i>	..	113
Adoption of Sustainable Dairy Management Practices among Peri-urban Dairy Farmers in Odisha <i>Kamlesh Kumar Acharya, Ravinder Malhotra, R. Sendhil, T. K. Mohanty and Biswanath Sahoo</i>	..	120
Determinants of Adaptation during COVID-19 Pandemic by Rural Households in Cooch Behar District of West Bengal <i>Suman Roy and Souvik Ghosh</i>	..	126
Extent of Information Utilization Behaviour of Vegetable Growers Regarding Integrated Pest Management Practices <i>Narendra Kumar Choudhary, Rajendra Rathore, Manoj Kumar Sharma, Jitendra Kumar, Rajesh Kumar Serawat and Meenakshi Jakhar</i>	..	131
Farmers' Acuity on Climate Change in the Central Dry Zone of Karnataka <i>N. Ashoka, M. Harshavardhan, Shivanand Hongal, Shankar Meti, R. Raju, Ganeshgouda I. Patil and N. Shashidhara</i>	..	136
Impact of Meghdoot Mobile App - A Weather-based Agro-advisory Service in Cold arid Ladakh <i>Yogesh Kumar, Kaneez Fatima, Mahendra Singh Raghuvanshi, Manjeet Singh Nain and Mehrajuddin Sofi</i>	..	142
Effect of Personal Characteristics of Respondents on their Perception towards Over-exploitation of Water Resources <i>Shubham, Rati Mukteshwar, Anil Kumar Rohila, Joginder Singh Malik, Amit Kumar and Rohtash Kumar</i>	..	147
Job Satisfaction of Teachers of Orissa University of Agriculture and Technology, Bhubaneswar, Odisha <i>Debi Kalyan Jayasingh, N. S. Shivalinge Gowda, Amitava Panja and Maitreyee Tripathy</i>	..	151
Performance of Groundwater Irrigation System as Perceived by Farmers in West Bengal <i>Subhajit Mukherjee, Arijit Roy and Souvik Ghosh</i>	..	157
An Insight into Value Chains of Green Gram in Bundelkhand Region of India <i>Uma Sah, Vikrant Singh, Jitendra Ojha, Mohit Katiyar and S. K. Dubey</i>	..	163
Knowledge Level of Respondents Regarding Important Aspects Covered under DAESI Programme in Rajasthan <i>Rakesh Kumar, R. K. Verma, A. K. Jhaharia and Rohtash Kumar</i>	..	170

Research Notes

Socio-psychological Determinants for Technology Socialisation of Jute Production in West Bengal <i>Devayan Chatterjee, Sankar Kumar Acharya and Sagar Mondal</i>	..	175
Effect of Nutrition Interventions on Knowledge and Adoption Feasibility of Gluten Free Products by Celiac Disease Patients <i>Jyoti, Veenu Sangwan and Varsha Rani</i>	..	179
Accessibility of Information and Communication Technology Services by Faculty Members of a State Agricultural University <i>Ziaulhaq Haqyar, Anil Kumar Rohila, Rati Mukteshwar, Joginder Singh Malik and Ram Niwas Sheokand</i>	..	182
Determinants of ICT Tools Accessibility by Farmers in Bihar <i>Shreya Anand, Satya Prakash and A.K Singh</i>	..	186
Constraints in Adoption of Scientific Fish Farming in Nagaon District, Assam <i>Manas Pratim Dutta, Binod Kalita, Shah Mustahid Hussain and Kaustabh Bhagawati</i>	..	190

Research Tool

Test to Measure the Attitude of Horse Stakeholders Towards Horse Keeping <i>Ana Raj J., Gururaj Makarabbi, R. K. Dedar and Yash Pal</i>	..	193
Development of Scale to Measure Sunflower Farmers' Perception on Public and Private Extension Systems <i>Bhumireddy Chandhana, G. D. S. Kumar and R. S. Sengar</i>	..	197



Knowledge Level of Smallholder Woman Farmers of Poultry Producer Company in Madhya Pradesh

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ABSTRACT

The poultry producer companies provide trainings and extension services to their members. The present study was conducted in 2021-22 in Madhya Pradesh state to assess the impact of poultry Producer Company on knowledge level of smallholder women poultry farmers of company. Ex-post facto research design was used. Multistage sampling was done for the selection of respondents. Data was collected from randomly selected, 140 members and 140 non-members, through a structured interview schedule. Propensity score matching was applied at 0.2 tolerance level, to reduce extraneous variable effect and finally 96 members and 96 non-members respondents were selected for data analysis and interpretation of results. The majority of the members had medium to a high level of knowledge of poultry housing, brooding, litter management and feeding while medium to low level of knowledge of healthcare management, whereas, most non-members had a medium to low level of knowledge of poultry housing, litter management, feeding, and healthcare, and medium to high level of knowledge of brooding. There was a significant difference in knowledge of members and non-members at 0.1% level of significance regarding housing, litter management, and feeding and interpreted as poultry producer company had positive impact on knowledge of member poultry farmers.

INTRODUCTION

In India, Poultry industry had enormous potential, growing with CAGR of 10.5 per cent annually. Due to its potential to grow as industry it had attracted large commercial farmers leading to huge competition for traditional smallholder poultry farmers. It was reported that developing countries are experiencing paradigm shift from subsistence occupation to commercial farming (Mukherjee et al., 2012). Due to paradigm shift smallholder farmers became vulnerable due to high cost of production, lesser access of recent information, high cost of input procurement, lower scale of production, and poor linkages with market intermediaries. It has also been reported that smallholding poultry producers are vulnerable due to a lack of recent knowledge and skill on poultry

farming, marketing, and input procurement (Thapa & Gaiha, 2011). Small and marginal farmers face challenges of high input cost and inability to produce efficiently (Singh et al., 2022). Livelihood security of the farmers is associated with access to resources and technical information (Dagar & Upadhyay, 2022).

To overcome the drawbacks, smallholder poultry farmers for survival in the market collectivized their resources and worked in cooperative form but didn't progress well. Cooperatives membership had potential to improve linkages and productivity of animals (Mandi, et al., 2022). In 2002, the committee under chairmanship of Y.K. Alagh, the then economic advisor to the Government of India, an amendment was proposed in the Indian Companies Act 1956 by introducing a new section IXA in section

581 in the Company Act 1956, which allowed the cooperatives to register under the company act and perform all activities from input procurement, marketing and profit maximization for the shareholders (Alagh, 2007 & Mukherjee et al., 2019). As evidenced the FPOs are capable of reducing transactional cost (Sakthi et al., 2015), the smallholder poultry farmers made two tier company system. They established one input supplier company Madhya Pradesh Poultry Producer Company Limited (MPWPCL) at top and 12 poultry producer companies in the second tier. MPWPCL procures inputs in wholesale from open market and distributes to the second tier producer companies in retail at lower price to the open market reducing the input cost of production of goods. Companies provide training and extension services to their producer farmers regarding housing, brooding, litter management, feeding, and healthcare management to develop capacity building in the farmers and reduce input cost and production losses with the competitive selling price. Extension services have positive impact on knowledge of the poultry farmers (Singh et al., 2018). Training to the farmers can enhance utilization of technology efficiently and effectively (Gupta et al., 2013; Raju et al., 2022). Knowledge of the poultry farmers has a direct effect on their efficiency and plays important role in decision making (Jat et al., 2022). Present study on the knowledge level of smallholder woman poultry farmers of poultry producer company in Madhya Pradesh was taken up to compare the knowledge level of producer members and non-members poultry producers.

METHODOLOGY

The study was conducted among members of poultry producer companies functional in Madhya Pradesh and non-member poultry farmers in the same region. Multistage sampling was done for data collection. Madhya Pradesh was selected for the research purpose as it was the pioneer state in establishing and converting cooperatives to producer companies. MP women poultry producer company was selected purposively as it had completed five years of gestation period. Four poultry producer companies were selected randomly. Thirty-five members were chosen randomly from each of the four poultry producer companies, and 35 non-member poultry producers residing in the vicinity of each poultry producer company randomly. Total of 280 respondents were selected for data

collection. The respondent was the person who was rearing at least ten birds per flock which should not be higher than 1000 birds per flock. Landholding varied from landless to less than 2 hectares. Data collection was done through a structured interview schedule. Fifty-eight items were selected from texts and available resource material and sent to experts for relevancy opinion. 44 items were revealed as highly relevant with a weighted mean relevancy score of more than 0.75 which were used for data collection. The weighted mean relevancy score was calculated with following formula:

$$\text{Weighted mean relevancy score} = \frac{(\text{Highly relevant} \times 2) + (\text{Relevant} \times 1) + (\text{Irrelevant} \times 0)}{2 \times \text{Total number of expert opinion}}$$

Propensity score matching was applied to each poultry producer company member and non-members and found no exact matches, but 24, 22, 24, and 26 fuzzy matches were found at a 0.2 tolerance level. These pairs of 24 from Churhat, 22 from Singrauli, 24 from Maikal, and 26 from Kesla were used to analyze and interpret the results. For each correct response, '1' and the wrong response '0' were allotted. The arithmetic mean was calculated for each item in each group of individuals. Classification of respondents was done at low, medium, and high levels, by applying equal class interval method of classification of data (Gupta & Kapoor, 2002; Bharti, et al., 2019). The Chi-square test was applied among the producer's company members and non-members and in pooled data of members and non-members. The difference in the knowledge level was interpreted accordingly.

RESULTS AND DISCUSSION

Knowledge of poultry housing

The distribution of the poultry producer-wise respondents according to their knowledge about poultry farming is presented in Table 1. Knowledge on poultry housing was assessed through 12 items viz. suitable site for poultry house, characteristics of land for poultry house, the requirement of drinking water, location of poultry house, power supply, dampness, type of flooring, the space requirement for different category birds and its importance was assessed. It was found that the majority of members had good knowledge about quality of land for shed construction, drawbacks of insufficient space, requirement of water, and quality of the site

Table 1. Poultry producer-wise members' and non-members' knowledge of poultry housing

S.No.	Knowledge of Poultry Housing	Pooled	
		Member (N=96)	Non Member (N=96)
1.	It is better to select a site where there was no poultry activity earlier	0.56 VII	0.33 XII
2.	Land should be even, elevated, and preferably east-west rectangularly	0.75 II	0.39 VII
3.	Site should be low lying and should have water lodging	0.49 IX	0.38 IX
4.	Site should provide scope for plenty of light, water, and aeration	0.67 III	0.53 II
5.	Requirement of drinking water/bird	0.66 IV	0.51 III
6.	Shed should locate either too near to the residence or too far from the residence	0.49 X	0.48 IV
7.	Power supply should be available to the shed for brooding and lighting	0.45 XII	0.40 VI
8.	Dampness is necessary for the poultry shed	0.48 XI	0.39 VII
9.	Floor of the shed should be at ground level	0.58 VI	0.42 V
10.	Space requirement for birds depends upon	0.59 V	0.35 XI
11.	Space requirement for the adult birds in a deep litter is	0.49 VIII	0.37 X
12.	Insufficient space results in	0.75 I	0.59 I

for shed building. Most of the poultry producer company members satisfactorily performed regarding site selection of poultry farming having no poultry activity, floor quality, and space requirement for birds. In the remaining parameters, performance was poor amongst members who were supposed to improve through training (Table 1). The non-members had replied satisfactorily about drawbacks of insufficient space, light, water; aeration in the poultry shed, and water requirements. In the remaining parameters, performance was poor amongst non-members who were supposed to improve through training (Table 1). The majority (50%) of the members belonged to a medium level of knowledge of poultry housing, followed by a high level (41.67%) and low level (8.33%), while most (45.83%) of the non-member respondents belonged to a low level of knowledge of poultry housing followed by medium level (40.63%) and high level (13.34%). The members of the poultry producers had knowledge mean score of poultry housing as 7.11 with a standard deviation of 2.45. In contrast, non-members' knowledge mean score of housing was relatively lower, i.e., 5.21, with a comparatively higher standard deviation of 2.91. It was interpreted that members were more consistent in replying correct response than non-members and had higher variation among non-members. Comparison between members and non-members was done by applying chi-square. It was found that the knowledge of member poultry producers had significantly higher knowledge of poultry housing than that of non-members at a 0.1% level of significance (Table 6). It was observed that members of the poultry producer company have specific poultry sheds for the rearing of birds while non-members were rearing birds in the part of their residence; hence it was concluded that members had practical exposure to the quality of poultry shed leading to better knowledge of poultry housing, thus having better poultry sheds. Similar findings were reported by Senthilkumar et al., (2009) & Kavithaa et al., (2020), who reported that the majority of respondents had a medium level of knowledge of housing. Findings are contrary to the findings of Mandavkar et al., (2020), who had reported that most respondents were having full knowledge of poultry housing.

Knowledge of brooding

Poultry producer company-wise distribution of the respondents regarding the knowledge about brooding is presented in Table 2. Knowledge of brooding was assessed through 9 items, i.e., use of chick guard, quality of litter for brooding, temperature regulation in brooding shed, signs of poor brooding, and brooding

environment. It was found that the majority of the members had good knowledge about the type of chick guards, quality of litter cover for brooding, heating arrangement in brooding house, signs of poor brooding; use and importance of chick guards. Most of the member respondents replied satisfactorily to humidity management in the shed. On the remaining parameters, performance was poor among members who were supposed to be improved through training (Table 2). It was also found that most non-members had good knowledge about the type of chick guards, quality of litter cover for brooding, and use of chick guard. Most of non-member respondents replied satisfactorily to importance of chick guard and sign of poor brooding. On the remaining parameters, performance was poor amongst non-members who were supposed to improve through training (Table 2). The majority of the members (60.42%) and non-members (53.13%) belonged to a medium level of knowledge of brooding, followed by a high level (26.04%) among members and 23.96 per cent among non-members. It was also found that few members (13.54%) and non-members (22.92%) had low knowledge of brooding. The members of the poultry producers had 5.54 mean score about knowledge of brooding with a standard deviation of 1.89. In contrast, non-members' mean score was relatively lower, i.e., 4.58, with a comparatively higher standard deviation of 2.56. It was interpreted that members were more consistent in replying correct response than non-members and had higher variation among non-members. Comparison between members and non-members was made by applying chi-square. It was found that knowledge of member poultry producers was non-significantly differing from knowledge of brooding of non-members (Table 6). It was observed that both members and non-members were practicing brooding in the initial stage of poultry farming and had good knowledge of brooding. Similar findings were reported by Senthilkumar et al., (2009); Raju et al., (2007) & Kavithaa et al., (2020), who reported that most respondents were having a medium knowledge of brooding. Findings are contrary to the findings of Mandavkar et al., (2020), who reported that most respondents had full knowledge of poultry brooding.

Knowledge of litter management

The distribution of the respondents according to their knowledge about litter management is presented in Table 3. Knowledge on litter management was assessed through 5 items viz. essential quality of litter, the thickness of litter material in different seasons, percentage of moisture in litter material, and frequency of

Table 2. Poultry producer-wise members' and non-members' knowledge of brooding

S.No.	Knowledge of Brooding	Pooled	
		Member (N=96)	Non Member (N=96)
1.	Chick guard should be placed	0.73 II	0.62 I
2.	For chick brooding, litter should be covered with	0.72 III	0.61 II
3.	Heating arrangement should be made by:	0.60 VI	0.49 VI
4.	Temperature of the brooding house should be	0.47 VIII	0.36 VIII
5.	Brooding temperature measured at height from floor	0.47 IX	0.35 IX
6.	Sign of poor brooding	0.61 V	0.57 IV
7.	Chick guard applied for	0.78 I	0.62 III
8.	Chick guard helps in	0.61 IV	0.56 V
9.	High humidity in the shed leads to	0.54 VII	0.39 VII

Table 3. Poultry producer-wise members' and non-members' knowledge of litter management

S.No.	Knowledge of Litter management	Pooled	
		Member (N=96)	Non Member (N=96)
1.	Basic qualities of the litter material	0.75 II	0.53 I
2.	Thickness of litter material spread at the time of starting in winter season	0.61 IV	0.45 IV
3.	Thickness of litter material spread at the time of starting in summer season	0.61 III	0.41 V
4.	Percentage of moisture to be maintained in the litter	0.60 V	0.45 III
5.	Stirring of litter should be done	0.77 I	0.49 II

stirring of litter material. It was found that the majority of members had good knowledge about all the parameters viz. frequency of stirring litter material, quality of litter material, thickness of litter material in different seasons and percentage of moisture in litter material. The majority of the non-members responded satisfactorily about the quality of litter material. On the remaining parameters, performance was poor amongst non-members which were supposed to improve through training (Table 4). Most (48.96%) of the members belonged to a medium level of knowledge of litter management, followed by a high level (47.92%) and low level (3.12%), while most (46.88%) of the non-member respondents belonged to a medium level of knowledge of litter management group followed by low level (36.45%) and high level (16.67%). The members of the poultry producers had a mean score of 3.34 with respect to knowledge of litter management with a standard deviation of 0.93. In contrast, non-members' mean score was lower, i.e., 2.32, with a comparatively higher standard deviation of 1.36. It was interpreted that members were more consistent in replying correct response than non-members and had higher variation among non-members. Comparison amongst members and non-members was made by applying chi-square. It was found that knowledge of member poultry producers was significantly higher than that of the knowledge of non-members at a 0.1% level of significance (Table 6). It was observed that members of the poultry producer company were using litter according to scientific standards and recommendations, while non-members were practicing according to the availability of litter material. Hence members had higher knowledge than that of the non-members. Similar findings were reported by Senthilkumar et al., (2009) & Kavithaa et al., (2020), who reported that the majority of respondents had a medium level of knowledge of litter management. Findings are contrary to the findings of Mandavkar et al., (2020), who revealed that most respondents had full knowledge of litter management.

Knowledge of poultry feeding

The distribution of the respondents according to their knowledge about feeding is presented in Table 4. Knowledge of

poultry feeding was assessed through 6 items viz. percentage of total expenditure on feed, percentage of protein in poultry feed, the energy requirement of poultry, source of protein, source of carbohydrate in feed, and source of mineral in feed. It was found that the majority of members had good knowledge about the percentage of total expenditure on feed, percentage of protein in poultry feed, source of protein, source of carbohydrate in feed, and source of the mineral in feed. Most of the poultry producer company members satisfactorily performed regarding energy requirements for the bird. The majority of the non-members had replied satisfactorily about the source of protein in feed and carbohydrates in feed. On the remaining parameters, performance was poor amongst non-members who were supposed to improve through training (Table 4). The majority (55.21%) of the members belonged to a group having high level of knowledge of poultry feeding, followed by medium level (37.50%) and low level (7.29%). In comparison, most (47.92%) of the non-member respondents belonged to a group having medium level of knowledge of poultry feeding, followed by low level (41.67%) and high level (10.41%). The members of the poultry producers had mean score 4.26 about knowledge of poultry feeding with a standard deviation of 1.17. In contrast, non-members' mean score was relatively lower, i.e. 2.84, with a comparatively higher standard deviation of 1.39. It was interpreted that members were more consistent in replying correct answers than non-members and had higher variation among non-members. Comparison amongst members and non-members was made by applying chi-square. It was found that knowledge of member poultry producers was significantly higher than the knowledge of non-members at a 0.1 % level of significance (Table 6). It was observed that the poultry producer company members were using poultry feed according to scientific standards and recommendations, while non-members were feeding according to poultry feed availability. Hence members had higher knowledge than non-members. Similar findings were reported by Senthilkumar et al., (2009); Paonam and Ram, (2016) & Kavithaa et al., (2020), who reported that the majority of respondents were having a medium level of knowledge of poultry feeding. Findings are contrary to the

Table 4. Poultry producer-wise members' and non-members' knowledge of Poultry feeding

S.No.	Knowledge of Poultry Feeding	Pooled	
		Member (N=96)	Non Member (N=96)
1.	Percentage of the total expenditure incurred on the cost of feed	0.76 II	0.46 IV
2.	Percentage of protein in poultry feed	0.73 III	0.46 V
3.	Energy requirement for broiler birds	0.57 VI	0.43 VI
4.	Source of protein in feed	0.80 I	0.50 II
5.	Source of carbohydrates in feed	0.72 IV	0.52 I
6.	Source of minerals in the feed	0.68 V	0.48 III

findings of Mandavkar et al., (2020), who reported that most respondents have full knowledge of poultry feeding.

Knowledge of healthcare management

Poultry producer company-wise distribution of the respondents regarding knowledge about healthcare management is presented in Table 5. Knowledge of healthcare management was

assessed through 12 items, i.e., poultry disease prevalent in the area, average mortality in batch, age of vaccination of Ranikhet disease, infectious bronchitis and infectious bursal disease., mode of administration of Ranikhet vaccine, rate of coccidiostat in feed, a sign of diarrhea, cause of mortality in the first week, second week, 3rd to 5th week and finishing weeks. The majority of the members had good knowledge about average mortality in batch, age of

Table 5. Poultry producer-wise members' and non-members' knowledge of poultry healthcare management

S.No.	Knowledge of Poultry Healthcare management	Pooled	
		Member (N=96)	Non Member (N=96)
1.	Poultry diseases prevalent in your area	0.57 V	0.47 III
2.	Average mortality in a batch	0.67 II	0.46 IV
3.	Age at which broiler vaccinated against Ranikhet	0.61 III	0.51 II
4.	Age at which broiler vaccinated against Infectious bursal disease	0.49 VI	0.40 VI
5.	Age at which broiler vaccinated against Infectious bronchitis	0.47 VII	0.38 VII
6.	Mode of administration of Ranikhet vaccine	0.59 IV	0.44 V
7.	Rate of coccidiostat for preventive measures	0.43 VIII	0.31 VIII
8.	Sign of diarrhea in poultry	0.68 I	0.55 I
9.	Mortality in the first week is due to:	0.40 IX	0.30 X
10.	Mortality in the second week is due to	0.40 X	0.31 IX
11.	Mortality in 3 rd - 5 th week is due to	0.33 XI	0.24 XI
12.	Mortality in finishing week is due to	0.31 XII	0.23 XII

Table 6. Distribution of women poultry farmers according to different category of knowledge of poultry farming

Knowledge of poultry farming		Pooled	
		Member (N=96)	Non Member (N=96)
A. Knowledge of poultry Housing	Low (0-4)	08 (8.33)	44 (45.83)
	Medium (5-8)	48 (50.00)	39 (40.63)
	High (9-12)	40 (41.67)	13 (13.54)
	Mean	7.11	5.21
	SD	2.45	2.91
	χ^2	39.609***	
B. Knowledge of Brooding	Low (0-3)	13 (13.54)	22 (22.92)
	Medium (4-6)	58 (60.42)	51 (53.13)
	High (7-9)	25 (26.04)	23 (23.96)
	Mean	5.54	4.58
	SD	1.89	2.56
	χ^2	2.847NS	
C. Knowledge of litter management	Low (0-1)	03 (3.12)	35 (36.45)
	Medium (2-3)	47 (48.96)	45 (46.88)
	High (4-5)	46 (47.92)	16 (16.67)
	Mean	3.34	2.32
	± SD	0.93	1.36
	χ^2	34.429***	
D. Knowledge of poultry feeding	Low (0-2)	07 (7.29)	40 (41.67)
	Medium (3-4)	36 (37.50)	46 (47.92)
	High (5-6)	53 (55.21)	10 (10.41)
	Mean	4.26	2.84
	± SD	1.17	1.39
	χ^2	53.739***	
E. Knowledge of healthcare	Low (0-4)	36 (37.50)	52 (54.17)
	Medium (5-8)	50 (52.08)	36 (37.50)
	High (9-12)	10 (10.42)	08 (8.33)
	Mean	5.95	4.59
	SD	2.13	2.25
	χ^2	5.410NS	

*=5% level of significance; **=1 % level of significance; ***=0.1% level of significance, NS=Non-Significant, In parenthesis= Percentage

vaccination of Ranikhet disease, and signs of diarrhea. Most of the members had satisfactory knowledge about poultry diseases prevalent in the study area and the mode of administration of the Ranikhet disease vaccine. In the remaining parameters, performance was poor amongst members who were supposed to be improved through training (Chaturvedani et al., 2017). Most of the non-members reported satisfactory performance in knowing signs of diarrhea and average mortality in a batch. In the remaining parameters, performance was poor amongst non-members, which is supposed to be improved through training (Table 5). The majority of the members (52.08%) belonged to a medium level of knowledge of healthcare management, followed by low level (37.50%) and high level (10.42%). In comparison, the majority (54.17%) of non-members belonged to the group having low-level knowledge of healthcare management, followed by medium level (37.50%) and high level (8.33%). The members of the poultry producers had mean score 5.95 about knowledge of healthcare management with a standard deviation of 2.13. In contrast, non-members' mean score was relatively lower, i.e., 4.59, with a comparatively higher standard deviation (2.25). It was interpreted that members were more consistent in replying correct response than non-members and had higher variation among non-members. Comparison amongst members and non-members was made by applying chi-square. It was found that knowledge of member poultry producers was non-significantly differing from knowledge of healthcare management of non-members (Table 6). It was observed that members were practicing healthcare management under the guidance of veterinarians and para-vets with minimal involvement in the diagnosis and took least efforts to learn healthcare management due to easy access to veterinary facilities, hence, low level of knowledge. At the same time, non-members didn't have access to healthcare management practices; hence non-members also had low level of knowledge of healthcare management. Similar findings were also reported by Senthilkumar et al., (2009) & Kavithaa et al., (2020), who found that most respondents had a low level of knowledge of healthcare management. These findings, however, are contrary to the findings of Mandavkar et al., (2020), who reported that most respondents had full knowledge of healthcare management.

CONCLUSION

Poultry producer company has achieved its objective of strengthening smallholder farmer by providing training and extension services. Members of poultry producer company were belonging to medium to high level of knowledge of housing, feeding and litter management which was significantly higher as compared to non-members belonging to medium to low level of knowledge and differing at 0.1% level of significance. It was found that mean knowledge score was maximum for space requirement, quality of land for poultry shed, sources of nutrients in feed and vaccination knowledge which was lacking in non-members. Members of poultry producer company have opportunity to improve their knowledge about healthcare practices as they have access to veterinarian and para-vets. Poultry producer company had positive impact on the knowledge level of the member poultry farmers which was comparatively lacking in non-member poultry farmers.

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Role Performance of Agricultural Input Dealers in Agro-advisory Services in West Bengal

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ABSTRACT

Agricultural input dealers, among many agencies in pluralistic extension systems, have the highest reach to farmers based on their location advantage, rapport building, and ease of accessibility. The study was conducted in two districts of West Bengal viz. Purba Bardhaman and Hooghly in 2020 to measure the role performance of agricultural input dealers in agro-advisory services. Eighty agricultural input dealers from these two districts were selected using random sampling procedure. Data was collected using personal interview method. Independent variables included personal and socio-economic, psychological, and communication variables. Majority of the variables were found to have a significant positive contribution to the role performance. In addition, variables such as cosmopolitanism, extension participation, credit orientation, information sharing behaviour, and types of inputs sold were found to have a significant positive contribution and explained about fifty-seven percent variation of the dependent variable. Path analysis showed that types of inputs sold had highest direct effect. Also, through this highest indirect effect of maximum variables had channelized.

INTRODUCTION

Agriculture is India's leading employment generating sector, catering to almost 69 per cent of India's population as their livelihood. The agricultural sector in India was able to have a record food grain production of 296.65 million tonnes in 2019-20 and 310.74 million tonnes in 2020-21. India is also estimated to reach the milestone of 316.06 million tonnes of food grain production in 2021-22 (PIB, 2022). Small and marginal farmers predominate the context of Indian agriculture. They often lack resources, advanced knowledge, and technologies. They, with less than two hectares of land, account for almost 86.08 percent of all farmers in India. However, their landholding is only 47.30 per cent of the total crop area (Agricultural Census, 2015-16). Thus, extension advisory services with information, technology, and services should meet the needs and interests of these small and marginal farmers timely and

efficiently. Lack of knowledge is also a serious constraint in adoption of improved technologies such as IPM (Gupta et al., 2020). Sustainable development of farmers depends on proper consumption of information (Sinha, 2018). However, the ratio of extension agents to farmers has reduced than the recommended rate of 1:750 (Ravi, 2019), creating a gap between the situation that should have been and the prevailing situation.

Pluralistic extension system is a solution to this serious problem. Support of multi-agency in input and service delivery can play a crucial role in enhancing the effectiveness of extension advisory services. It is successful in areas where farmers are resource-poor by providing appropriate technologies and integrated extension services, including marketing facilities (Mukherjee & Maity, 2015). Several studies have indicated that agricultural input dealers are one of the important nodes of the social network of farmers, from where they can get information and knowledge on

various agricultural aspects. In India, there is an extensive network of almost three lakhs input dealers and is one of the most important sources of agricultural information in India after progressive farmers. They have advantage of the location, strong understanding, and easy accessibility to the farmers. Adoption of scientific practices in a farming system relies highly on the knowledge of the farmers (Nain & Chandel, 2013), and for that credibility should be placed on localized information sources (Bhagat et al., 2004; Ravikumar et al., 2015; Nain et al., 2015; Panda et al., 2019). Agricultural input dealers are best of those localized sources of information. National Institute of Agricultural Extension and Management (MANAGE), has initiated the Diploma in Agricultural Extension Services for Input Dealers (DAESI) in 2003, for building their technical competency in agriculture and facilitating them to act as para-extension professionals (MANAGE, 2012). In this context, study was undertaken to measure the role performance of agricultural input dealers in West Bengal.

METHODOLOGY

The state of West Bengal was purposively selected for the study. Two districts viz. Purba Bardhaman and Hooghly were purposively selected. Both Purba Bardhaman and Hooghly districts were having four sub-divisions each. One block was selected randomly for the study from each subdivision, thus making eight blocks. Ten agricultural input dealers were randomly selected from each block as respondents. Thus, making a total sample size of eighty (80) agricultural input dealers. Criteria used for the selection of respondents included that agricultural input dealers must have undergone a Diploma in Agricultural Extension Services for Input Dealers (DAESI) programme, dealers should get their dealership license renewed regularly and the areas should have a large number of input dealers operating.

Role-performance was operationally defined as the manner in which the input dealers carry out or perform their perceived roles of agro-advisory services. A schedule developed by Ganiger (2012) with suitable modifications was used to measure the role-performance of agricultural input dealers in agro-advisory services. The schedule consisted of twenty-four items, which were validated with the help of experts and were measured on five-point continuum, i.e., most often (MO), often (O), sometimes (ST), Seldom (S), and never (N). The possible score for one respondent ranged between 24 to 140, which was then normalized. Cumulative square root frequency method was used to categorize the respondents into high, medium, and low levels of role performance. Data was collected from the respondents with the help of personal interview method. 'Exploratory' research design was employed for this study.

Appropriate variables were selected for this study after an extensive literature review and consultation with experts. Independent variables were selected under the category of personal and socio-economic variables, psychological variables and communication variables. Correlation analysis was used to measure the relationship between the selected independent variables and the role performance of agricultural input dealers in agro-advisory services, followed by multiple linear regression to find out the relative contribution of the selected independent variables and their

combined effect on role-performance. To find out the channelising effect of the independent variables on the role performance of agricultural input dealers, path coefficient analysis was used.

RESULTS AND DISCUSSIONS

Item wise analysis of role performance of agricultural input dealers

The result given in Table 1 reveals hundred percent of the respondents had agreed to items like 'Delivering relevant and appropriate agro-advisory services to the farmers', 'Sending report to the company agents/agriculture officer regarding any serious pest and diseases problems and natural calamities prevailing in the area', 'Visiting the farmers field on fixed day to observe field activities and conditions of crops', 'Actively participating in training sessions conducted by company/AOs to gain knowledge and skills on new technologies and agro-advisory services', 'Holding regular meetings with farmers and rural institutions to discuss location specific problems'. Items viz. 3,5,6,9,10, 12,16,17,20 &21 (Table 1) were agreed upon by a majority of the farmers. Input dealers in the locale of the study, after going through the DAESI programme, felt the need to emerge as para-extension professionals. They provided solutions to the farmers as and when needed by the clients. This emerged as a 'win-win' situation for them, with farmers getting more and more advisory services from them, the more trust and credibility they are building and ultimately positioning them as repeat customers for the input dealers. Besides, respondents were keen to learn new technology, package of practices, etc., and transfer it to the farmers for better use. They regularly monitored the prevailing agricultural scenario in the farmer's field and helped them diagnose any disease infestations in the field. Respondents held regular meetings, training sessions, and demonstrations with farmers and experts and helped line departments implement any agriculture and allied activities schemes. Getting feedback from the farmers regarding any agro-advisory services also helped them emerge out to the farmer as the 'closest aid in any farming problem'. Input dealers used various modes of advertisements for awareness generation, knowledge dissemination, and advertising about their business. Among various modes of advertisements, progressive farmers stood out to have the highest rank (Panja, 2020). However, it was found 1 that respondents had not commercialized providing agro-advisory services. Items such as 'Providing agro-advisory services to the farmers on credit basis', 'Maintaining a daily record on agro-advisory services discussed with farmers', 'Working out the credit requirements and expenditure on agro-advisory services provided to farmers annually' had received most minor agreements from a majority of the farmers. They were neither selling agro-advisory services to the farmers nor maintaining any daily records for providing agro-advisory services to the farmers. Instead, they considered an integral part of their business as an agricultural input dealer. As discussed earlier, providing appropriate agro-advisory services and emerging as para-extension professionals were helping them grow their primary business, with an increasing frequency of repeat customers. Singh et al., (2021) conducted a research on input dealers for assessing their training needs in Banda district of Uttar Pradesh and had specified the areas where the respondents should

Table 1. Item wise analysis of role performance of agricultural input dealers in agro-advisory services

S.No.	Items of role performance of input dealers in agro-advisory services	Mean score	Percent of score obtained
1	Delivering relevant and appropriate agro-advisory services to the farmers	5.00	100
2	Sending report to the company agents/agriculture officer regarding any serious pest and diseases problems and natural calamities prevailing in the area	5.00	100
3	Visiting the farmers field on fixed day		
	i. To observe field activities and conditions of crops	5.00	100
	ii. To probe about the problems and suggest suitable measures	4.51	90.25
	iii. To assess extent of adoption of recommended agro-advisory services and reasons for non-adoption	3.38	67.75
	iv. To detect the incidence of pests, diseases, and natural disorders	4.41	88.25
4	Providing agro-advisory services to the farmers on credit basis	1.13	22.50
5	Reporting to the company/department of agriculture special achievements of farmers by using agro-advisory services provided by them	4.89	97.75
6	Evaluate the feasibility of agro-advisory services in field conditions	4.67	93.50
7	Provide high quality agro-advisory services to the farmers at low-cost	1.13	22.50
8	Attending training season to learn how to convince the farmers regarding adoption of any agro-advisory services	3.81	76.25
9	Motivating the farmers to adopt new and additional recommended agro-advisory services	4.65	92.75
10	Conducting campaign / demonstrations / seminars etc. on productive technologies related to diverse income generating enterprises for farmers	4.53	90.75
11	Actively participating in training sessions conducted by company/AOs to gain knowledge and skills on new technologies and agro-advisory services	5.00	100
12	Arranging field visit for company agents for getting solutions to problems of farmers which he is unable to get satisfactory solutions	4.85	97.00
13	Maintaining a daily record on agro-advisory services discussed with farmers	1.16	23.25
14	Aware of the demand and availability of agro-advisory services on new technologies and products prevailing in the market	4.36	87.25
15	Holding regular meetings with farmers and rural institutions to discuss location specific problems	5.00	100.00
16	Proper utilisation of mass media to disseminate agro advisory services	4.58	91.75
17	Preparing training schedules based on training content required for farmers	4.80	96.00
18	Assessing type of agro-advisory services essential in the area	4.26	85.25
19	Implementing government / company sponsored agriculture related programme.	2.68	53.75
20	Supervising the development of adoption of agro-advisory services	4.76	95.25
21	Regularly receiving feedback from farmers regarding the agro-advisory services provided to them	4.67	93.50
22	Attend any other work assigned by company/government authorities that do not conflict with the essential duties	3.71	74.25
23	Attentive against occurrence of pest and diseases of different crops in the area	3.57	71.50
24	Working out the credit requirements and expenditure on agro-advisory services provided to farmers annually	1.5	30.00

be given training for improving their business as well as their role performance in agro-advisory services.

Relationship between independent variables and role performance

It was found in the correlation analysis (Table 2), that education, cosmopolitaness, types of input sold, self-confidence, extension contact, extension participation, deferred gratification, credit orientation, social participation, and information sharing behaviour had a significant positive relationship with role performance of agricultural input dealers in providing agro-advisory services to the farmers. Training received and mass media participation had a significant positive relationship with the dependent variable at a five percent significance level. The good education background of the input dealers had broadened their horizons in comprehending prevailing agricultural scenarios and providing the farmers with appropriate agro-advisory services needed for their farming activity and the right solution to the problem they are facing. More diverse types of inputs they were selling, more was their possession of the latest knowledge and information about various types of products. The result got a similarity to Ganiger (2012). Regular interaction with experts,

Table 2. Correlation coefficients between independent variables and role performance

S.No.	Profile characteristics	Role performance in agro-advisory services
1	Age	0.138
2	Education	0.372**
3	Annual income	0.059
4	Location of the enterprise	0.036
5	Cosmopolitaness	0.349**
6	Experience as input dealer	0.16
7	Types of agricultural inputs sold	0.512**
8	Self-confidence	0.437**
9	Training received	0.244*
10	Extension contact	0.424**
11	Extension participation	0.379**
12	Deferred gratification	0.316**
13	Competition orientation	0.176
14	Credit orientation	0.327**
15	Level of aspiration	0.067
16	Social participation	0.339**
17	Mass media participation	0.267*
18	Mode of advertisement	0.211
19	Empathy	0.111
20	Information sharing behaviour	0.378**

** p< 0.01(2 tailed), * p< 0.05(2 Tailed)

manufacturing companies, extension agents, KVKs, and other fellow input dealers, as well as participation in various activities such as training, demonstrations, etc., had helped them to learn about the latest information in agriculture, technology, modern agricultural skills, package of practices, etc. from various sources, resulting in having the significant positive effect of cosmopolitaness, social participation, mass media participation, training received, extension contact and extension participation were also having significant positive effect on role-performance of agricultural input dealers. The findings were in similar line with Anitha (2005); Ganiger (2011); Singh et al., (2016); Sharma (2017); Mamatha (2018).

Respondents also had good information sharing behaviour. Timely sharing of relevant information with farmers helped them build rapport with them and effectively play the role of a professional para-extension worker. Self-confidence was having a positive and significant relationship with the role performance of agricultural input dealers in agro-advisory services. Self-confidence in running the business motivated the agricultural input dealers to learn more about the latest technology and information and pass it on to the farmers. Self-confidence was having a significant positive

relationship with role performance of agricultural input dealers. The result found a similarity with Anitha (2005).

Table 4 shows the results of the multiple linear regression analysis carried out. The R^2 value in the regression model says that all the independent variables could explain 64.40 percent variation in the role performance of agricultural input dealers. Among all the independent variables, types of agricultural inputs sold and credit orientation were significant contributors at a one percent level of significance. Another independent variable, cosmopolitaness, was a significant contributor at a five percent level of significance. Considering a large number of non-significant independent variables, backward regression analysis was carried out to eliminate the least contributing variable at each step and simultaneously identify the highest significant contributing variables. The result of backward regression analysis shows that cosmopolitaness, extension participation, credit orientation, information sharing behaviour, types of agricultural inputs sold were having significant contributions and could explain about 57 per cent of the variation of the dependent variable. The credit orientation of an input dealer is significantly related to the growth of his business, which in turn

Table 3. Linear multiple regression analysis of independent variables with role performance

Independent variables	Unstandardized coefficients		Standardized coefficients	t	P-value
	B	Std. error	Beta		
(Constant)	-23.818	12.296		-1.937	.058
Age	.116	.097	.105	1.200	.235
Education	.134	.101	.140	1.322	.191
Location of the enterprise	-.029	.084	-.036	-.348	.729
Income	-.164	.102	-.161	-1.602	.114
Cosmopolitaness	.211	.098	.224	2.167*	.034
Experience as input dealer	.031	.075	.038	.414	.680
Types of agricultural inputs sold	.407	.095	.472	4.304**	.000
Self-confidence	.054	.128	.044	.422	.675
Training received	-.102	.114	-.096	-.889	.378
Extension contact	.032	.108	.033	.296	.768
Extension participation	.185	.115	.176	1.611	.113
Deferred gratification	.179	.108	.171	1.665	.101
Competition orientation	-.056	.089	-.060	-.632	.530
Credit orientation	.282	.090	.286	3.118**	.003
Level of aspiration	-.111	.079	-.124	-1.408	.164
Social participation	-.099	.083	-.118	-1.196	.236
Mass media participation	.105	.091	.122	1.153	.253
Mode of advertisement	-.014	.064	-.021	-.225	.823
Empathy	.027	.090	.027	.298	.767
Information sharing behaviour	.156	.085	.167	1.835	.072

$R^2 = 0.644$ $F = 5.333^{**}$, $^{**}p < 0.01$ level (2 tailed) *, $p < 0.05$ level (2 Tailed)

Table 4. Backward regression analysis of independent variables with role performance

Independent variables	Unstandardized coefficients		Standardized coefficients	t	P value
	B	Std. error	Beta		
(Constant)	-23.125	8.301		-2.786	.007
Cosmopolitaness	.274	.072	.291	3.792	.000
Extension participation	.189	.085	.180	2.223	.029
Credit orientation	.275	.076	.279	3.597	.001
Information sharing behaviour	.206	.074	.221	2.783	.007
Types of agricultural inputs sold	.382	.068	.443	5.586	.000

$R^2 = 0.570$ $F = 19.652^{**}$, $^{**}p < 0.01$ (2 tailed), * $p < 0.05$ (2 Tailed)

Table 5. Path analysis of independent variables on role performance

Variables		Direct effect	Indirect effect	Total effect	Variable through which highest substantial indirect effect got channelled
X1	Age	0.105	0.033	0.138	0.06935 (X7)
X2	Education	0.14	0.232 (6 th)	0.372 (6 th)	0.08667 (X7)
X3	Location of the enterprise	-0.036	0.072	0.036	0.02826 (X11)
X4	Annual income	-0.161	0.22	0.059	0.08099 (X7)
X5	Cosmopoliteness	0.224 (3 rd)	0.125	0.349	0.04775 (X12)
X6	Experience as input dealer	0.038	0.122	0.16	0.05042 (X11)
X7	Types of inputs sold	0.472 (1 st)	0.04	0.512 (1 st)	0.04488 (X11)
X8	Self-confidence	0.044	0.393 (2 nd)	0.437 (2 nd)	0.19418 (X7)
X9	Training received	-0.096	0.34 (4 th)	0.244	0.0814 (X5)
X10	Extension contact	0.033	0.391 (3 rd)	0.424 (3 rd)	0.14234 (X7)
X11	Extension participation	0.176 (4 th)	0.203	0.379 (4 th)	0.12028 (X7)
X12	Deferred gratification	0.171 (5 th)	0.145	0.316	0.0876 (X14)
X13	Competition orientation	-0.06	0.236 (5 th)	0.176	0.06091 (X7)
X14	Credit orientation	0.286 (2 nd)	0.041	0.327	0.05257 (X12)
X15	Level of aspiration	-0.124	0.191	0.067	0.06652 (X14)
X16	Social participation	-0.118	0.457 (1 st)	0.339	0.1094 (X7)
X17	Mass media participation	0.122	0.145	0.267	0.0875 (X5)
X18	Mode of advertisement	-0.021	0.232	0.211	0.06396 (X2)
X19	Empathy	0.027	0.084	0.111	0.03812 (X17)
X20	Information sharing behaviour	0.167 (6 th)	0.211	0.378 (5 th)	0.06054 (X7)

Residual value: 0.3563

is related to his role performance in agro-advisory services. With the growth of his business, he would diversify his sale into various types of inputs. His knowledge would also diversify and strengthen his presence as a para-extension worker. Participating in various extension activities such as field days, demonstrations, exhibitions, workshops, etc., helped the respondents develop their cognition of several technologies and services and developed their communication ability to convince their clients to adopt any technologies or services beneficial. Besides, good information sharing behaviour of the respondents in his strong network with progressive farmers, neighbours, other fellow input dealers, etc., had assisted them in building rapport with the farmers and traversing the last mile for improving their role performance in agro-advisory services.

Path analysis of independent variables on role performance

As presented in Table 5 the results of path analysis show the channelizing effect of the independent variables on the dependent variable, i.e., role performance of agricultural input dealers in agro-advisory services. Types of inputs sold had the highest total effect of 0.512, followed by self-confidence (0.437) and extension contact (0.424). With respect to the direct effect of independent variables, types of inputs sold had the highest direct effect of 0.472, followed by credit orientation (0.286) and cosmopoliteness (0.224). Social participation had the highest indirect effect of 0.457, followed by self-confidence (0.393) and extension contact (0.391). It is also clear from Figure 2 that through variable X7, i.e., types of inputs sold, the highest indirect effect had been channelized. Highest indirect effect of nine other independent variables had been channelized through this variable, followed by X11, i.e., extension participation, through which the highest indirect effect of three other variables had been channelized. Value of the residual effect in the path analysis reveals that despite splitting of the effect of independent variables into direct and indirect effect, 35.61 percent of the variation in the

role performance of agricultural input dealers in agro-advisory services could not be explained and required more variables to be incorporated to explain this variation.

Considering correlation analysis, regression analysis, and path analysis, it can be concluded that agricultural input dealers should be encouraged and trained about diverse types of inputs for selling. This would increase farmers' ease of accessibility of various inputs from a single input dealer and enhance the role performance of the agricultural input dealers in providing agro-advisory services to them. Input dealers should also be encouraged to increase their participation in any extension activity to gain practical knowledge about various agricultural scenarios and farmers' psychological components, decision-making abilities, and thought processes. Furthermore, input dealers should be encouraged to build a robust social network with the farmers and increase their information sharing behaviour for swift dissemination of information to them. Policy advocates should also consider improving the agricultural input dealers' financial knowledge and credit orientation. This would help them grow their business and diversify their sales, which strongly relates to their role performance in agro-advisory services.

CONCLUSION

Among many agencies of pluralistic extension system, agricultural input dealers had the best reach to the farmers in providing inputs and new technologies and other agro-advisory services. Majority of the respondents consider their role in providing agro-advisory services as an integrated part of their business. Majority of the profile characteristics of the respondents profile characteristics have a significant positive relationship with their role performance. Factors such as cosmopoliteness, extension participation, credit orientation, information sharing behaviour, and types of inputs sold had a vital contribution to the variation of the dependent variable and thus should be given due importance. The

results of this study would be helpful in policy advocations on agricultural input dealers for improving their ability and performance as para-extension workers. Further studies on the role-performance of agricultural input dealers in various agro-climatic zones are suggested to get a generalized view of the role performance of agricultural input dealers in agro-advisory services.

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Information Sources, their Utilization Pattern vis-à-vis Mithun (*Bos frontalis*) Husbandry in Arunachal Pradesh

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ABSTRACT

The study was designed to assess the utilization pattern of mithun husbandry information sources by the mithun farmers in the state of Arunachal Pradesh during 2019-20. Using multi-stage stratified random sampling a total of 120 farmers who owned and reared mithuns was selected. The study compared the utilization pattern of different sources and channels used by the farmers. Overall, the major source of channel of the mithun for any information on mithun management and production was their fellow mithun friends, followed by television and internet. The indigenous knowledge played a prime source for mithun husbandry information. Multiple regression analysis was employed to find out the independent variables that simultaneously contributed the information utilization pattern. Age of the household head, years of formal education, annual income from mithun and annual income significantly contributed in influencing the information utilization pattern. The mithun farmers of Arunachal Pradesh used both the traditional as well as modern tools to access the mithun management and production information.

INTRODUCTION

Mithun (*Bos frontalis*) the unique and elegant bovine species of North East India, is being reared in four states only, viz. Arunachal Pradesh, Manipur, Mizoram and Nagaland with Arunachal Pradesh accounting for almost 90 per cent of the population (Biam et al., 2021). Mithuns are free ranging bovines inhabiting deeply within the community forests and jungles. In most case, the mithun owners are resource poor and have low purchasing power as a result they mostly use their locally acquired traditional knowledge and information on mithun management and production from their forefathers and fellow mithun which at times is not accurate and sufficient. Still the personal sources dominate the agricultural information system and the dearth of extension personnel and their poor linkages with farmers and amongst themselves have enough indication for the development planners (Bhagat et al., 2004; Nain et al., 2015). Information and Communication Technology (ICT) tools are mostly used to get

benefit of general communication and entertainment purpose and less for marketing and other productive purpose (Panda et al., 2019), although social media have the potential to promote the creation of social wealth in the form of discussion forums for learning exchange (Nain et al., 2019). The changing environment of the food and agricultural industry, particularly in the livestock-based high-value agriculture segment, has made information and knowledge become an increasingly crucial aspect in production for successful decision-making (Birkhaeuser et al., 1991; Cash, 2001; Galloway & Mochrie, 2005; Adhiguru et al., 2009). In developing countries, centralized extension services rarely prioritize the dissemination of livestock production knowledge (Morton & Matthewman, 1996). Though the government of India provides veterinary services, funding constraints have made it impossible for most state governments to expand livestock services and improve service quality (Ahuja et al., 2003; Bardhan, 2010). Farmers, as food producers, must have access to know-how and do-how in order to realize the full

potential of contemporary agricultural and its allied sectors technology, and they must be empowered to take initiatives and make decisions that will only help shape the future of the farmer's economy (Madhuri et al., 2021).

To mobilize the convergence of up to date information on mithun husbandry through different sources and channels, there is a need to investigate various researchable issues to delineate the pre-requisites of a sound strategy so that quality and effective information reaches the farmers. Agriculture is becoming less remunerative due to the lack of a proper information and communication network infrastructure, a need-based information dissemination center, and increased technical distribution to farmers (Jena et al., 2019). Hence, it becomes important to know the information utilization pattern of farmers with regard to the different information sources and channel for overcoming the challenges faced by the farmers. The utilization of relevant, accurate and up-to-date information on mithun husbandry by the key stakeholders would ensure increased productivity. With this in mind, the present study was conducted with the following objectives to study the sources of information and information utilization pattern of the mithun farmers' vis-à-vis mithun husbandry and to analyze the association and relationship of identified variables towards the information utilization pattern.

METHODOLOGY

The study was conducted in the state of Arunachal Pradesh located in the extreme northeastern part of India during 2019-2020. Using a multi-stage stratified random method the state's districts were divided into three quartiles depending on the mithun population. The districts with the highest mithun population in each quartile, namely Papum Pare (44,286), Upper Siang (20,463) and East Siang (9,758) (19th Quinquennial Livestock Census, 2012) were then purposely selected. A total of four villages from each of the districts were selected at random with ten respondents from each village. Thus a total of 120 mithun household heads was surveyed for the study. A pre-tested interview schedule that contained both closed-ended and open-ended questions was used to collect the primary data.

The information utilization pattern of the mithun farmers was operationalized as the dependent variable and was conceptualized as the process through which the mithun farmers gather information related to mithun husbandry and further utilize the same from different sources viz. impersonal cosmopolite, personal cosmopolite and personal localite. It was assessed with the help of respondents' responses to Likert-type scale (Mukherjee et al., 2018; Kumar & Meena, 2021) with slight modifications on 3 point continuum employing an ordinal level of measurement i.e. Frequently (F), Sometimes (S), and Never (N) with corresponding weightage scores of 2, 1, and 0. The weighted mean score (WMS) with respect to the frequency of the sources of information used was calculated to assess the information utilization pattern of the mithun farmers. Independent variables likely to influence the information utilization pattern of the farmers like age, years of formal education, family size, land holding, operational land, farming as primary occupation, number of mithun owned, years of mithun rearing experience, annual income from mithun and annual income were selected.

Multiple regression analysis was employed to find out the number of independent variables that simultaneously contribute or influence the information utilization pattern of the mithun farmers (Ray & Mondal, 2016). Statistical Package for the Social Sciences v22.0 (SPSS) of IBM was used for analyzing the data.

RESULTS AND DISCUSSIONS

Information utilization pattern of the mithun farmers

Information is an integral part of any change and development. For the extension functionaries, the communication gap is an alarming challenge (Kundal et al., 2018). The mithun farmers due to their location in far flung village use various types of sources for obtaining information on mithun husbandry. The findings revealed that out of all the different impersonal cosmopolite sources, television was ranked first as their main source of information about mithun husbandry, with a WMS of 1.51 and 82.50 per cent of the farmers reporting frequent usage, followed by internet (WMS 1.51) and radio (WMS 0.74). Similar findings were reported by Banmeke and Ajayi (2007). This could be because the mithun villages' remote location makes internet connection impossible, thus they rely heavily on the television and sometimes the radio. Radio being a cheap source of dissemination of information was widely used by the farmers when they visit the jungles to feed the mithun salt every fortnightly. Further perusal of Table 1, divulges that the National Research Centre on Mithun, Medziphema, Nagaland, was the most widely used personal cosmopolite sources (WMS 0.97). This can be attributed to the fact that the center being the only research organization in the world working exclusively for the conservation and preservation of mithun is a ready to access information repository on mithun husbandry for the farmers. This is followed by the specialist from the line department viz. state veterinary officers (WMS 0.86). Overall 99.17 per cent of the respondents were contacting fellow mithun/livestock farmers frequently (WMS 1.65) followed by bank personnel (WMS 0.08). Similar findings were reported by Kundal et al., (2018). This could be because most farmers have an average of 32.99 years of mithun rearing experience, making them more knowledgeable about numerous indigenous mithun husbandry techniques. Overall, the major source of any information on mithun management and production was their fellow mithun friends as is evident from the highest WMS of 1.65. They would first consult their fellow mithun/livestock farmers or else use the television, contact the National Research on Mithun or search the internet for any information pertaining to mithun husbandry. It is important to use ICT in combination with the more traditional extension methods such as mass media, group meetings, field days, demonstrations and exchange visits with the objective to make the information available to all the stakeholders very effectively, efficiently and quickly (Raina et al., 2011; Chander & Rathod, 2020).

Relationship between the information utilization pattern and the independent variables

The mithun farmers because of their low purchasing power and inaccessibility to quick information use different types of sources for acquiring information on mithun husbandry. A perusal

Table 1. Mithun farmers sources of information and their utilization pattern vis-à-vis mithun husbandry

Source of information	Utilization Pattern (%)			WMS	Rank
	Frequently	Sometimes	Never		
Impersonal cosmopolite					
Radio	25.83	37.50	36.67	0.74	III
Television	82.50	15.83	1.67	1.51	I
Internet	50.12	25.13	24.75	1.04	II
Newspaper	16.67	18.33	65.00	0.43	V
Educational Films	10.83	12.50	76.67	0.28	VI
Printed Farm publications	4.17	9.17	86.67	0.15	VII
Agri-fair/Exhibitions	4.17	22.50	73.33	0.26	VI
Kisan Melas/Mithun Melas	2.50	69.17	28.33	0.62	IV
Agriculture magazines	5.00	8.33	86.67	0.15	VII
Personal cosmopolites					
Training/Demonstrations	3.33	15.83	80.83	0.19	III
ICAR-NRC on Mithun	40.83	34.17	25.00	0.97	I
Specialist from State Veterinary Department	32.50	38.33	29.17	0.86	II
Personal localite					
Bank Personnel	0.83	7.50	91.67	0.08	II
Agricultural/veterinary input dealers	0.00	0.83	99.17	0.01	III
Mithun/livestock farmers	99.17	0.83	0.00	1.65	I

WMS: Weighted mean score

of the Table 2, reveals that age ($r = -0.181$) and annual income from mithun ($r = 0.430$) had a negative and significant correlation with the information utilization pattern of the mithun farmers. However, there was a positive and significant relationship between farmers'

Table 2. Relationship between information utility pattern (y) and selected independent variables

Independent variables	r value	Remarks
Age of household head (x_1)	-0.181	*
Formal years of education (x_2)	0.353	**
Family size (x_3)	-0.173	
Land holding (acre) (x_4)	-0.078	
Operational land holding (acre) (x_5)	0.068	
Farming as primary occupation (x_6)	-0.020	
Number of mithun owned (x_7)	0.126	
Years of mithun rearing experience (x_8)	0.195	*
Annual income from mithun (x_9)	-0.181	*
Annual income (x_{10})	0.237	**

*Correlation is significant at the 0.05 level

**Correlation is significant at the 0.01 level

information utilization pattern and their years of formal education ($r = 0.353$), annual income ($r = 0.237$) at 0.01 level of probability and years of mithun rearing experience ($r = 0.195$) at 0.05 level of probability. The findings are in line with Anbarasan & Bhardwaj (2017), wherein they reported that age, formal years of education and farming experience had a significant relationship with the information utilization pattern.

The regression analysis of the information utilization pattern with ten independent variables is presented in Table 3 by B-values (un-standardized partial regression coefficients), standard errors of unstandardized partial regression coefficients, β values (standardized partial regression coefficients), the coefficients of multiple regression determination (R^2) and the corresponding p -values. The farmers information utilization pattern was strongly influenced by the variables; formal years of education ($p < 0.05$), annual income from mithun ($p < 0.05$) and annual income ($p < 0.01$). These three variables' standard coefficient beta values explain why one unit changes in these variables contribute 0.200, -0.224, and 0.270 unit changes in information utilization pattern of the mithun

Table 3. Regression analysis in predicting information utility pattern using selected independent variables

Variables	Unstandardized Coefficients		Standardized Coefficients	t value	Sig.
	Reg. Coeff. B	S.E. B	Beta		
(Constant)	8.274	2.273		3.641	0.000
Age of household head (x_1)	-0.050	0.030	-0.143	-1.697	0.093
Formal years of education (x_2)	0.103	0.047	0.200	2.178	0.032
Family size (x_3)	-0.068	0.073	-0.085	-0.932	0.354
Land holding (acre) (x_4)	-0.047	0.034	-0.148	-1.392	0.167
Operational land holding (acre) (x_5)	0.015	0.011	0.133	1.409	0.162
Farming as primary occupation (x_6)	0.129	1.251	0.009	0.103	0.918
Number of mithun owned (x_7)	0.027	0.048	0.052	0.564	0.574
Years of mithun rearing experience (x_8)	0.067	0.045	0.129	1.503	0.136
Annual income from mithun (x_9)	0.000	0.000	-0.224	-2.613	0.010
Annual income (x_{10})	0.000	0.000	0.270	2.800	0.006

R Square = 0.609 & Adjusted R Square = 0.521, Standard error of the estimate = 2.426

farmers. The fitted regression model with ten independent variables could explain 60 per cent of the variability in comprehending the dependent variable (R square = 0.609).

On the basis of this regression analysis the linear relationship of the information utilization pattern with the independent variables is as per the following model:

$$Y = 8.274 - 0.143X_1 + 0.200X_2 - 0.085X_3 - 0.148X_4 + 0.133X_5 + 0.009X_6 + 0.052X_7 + 0.129X_8 - 0.224X_9 + 0.270X_{10}$$

Where, $X_1, X_2, X_3, \dots, X_{10}$ (independent variables) and Y (dependent variable)

CONCLUSION

Despite the revolution in information technology, the mithun farmers in the study areas have not taken use of its benefits. Due to limited internet connectivity, television and radio, which are both inexpensive and popular ways of gathering information, are commonly used. The ICAR-NRC on Mithun and the relevant State Veterinary Department should work together to develop need-based and time-based mithun husbandry programmes so that farmers can maximize the benefits of television. Mithun being a rare and unique bovine species requires that the farmers must be able to have information supplied to them at their convenience, so that they can benefit from increased output as a result of the adoption of new scientific rearing practices, actions to mitigate any losses and their conservation.

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Impact of COVID-19 on Consumption Pattern of Vegetarians and Non-Vegetarians

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ABSTRACT

The aim of this study was to investigate the impacts of COVID-19 on the consumption patterns of vegetarians and non-vegetarian populations, mainly on animal-based products. A cross-sectional, questionnaire-based survey was conducted among the urban and peri-urban populations of Bengaluru, Karnataka during October to November of 2020 through electronic mode. The data was collected from 837 (54.2% non-vegetarian and 54.2% vegetarians) participants. Significant change in the number of family members before and during the COVID lockdown was observed. The egg and chicken consumption had drastically increased among the non-vegetarians whereas, among the majority of the vegetarians, no change in milk consumption but a considerable increase in curd and buttermilk, paneer/cheese, and ghee/butter consumption was observed. Both non-vegetarian and vegetarian consumers had shifted to online delivery apps for purchasing products during the pandemic. 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. 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.

INTRODUCTION

Every country in the world is facing unprecedented socio-economic challenges due to the spread of the novel SARS-Cov-2 or COVID-19 (Mulvaney et al., 2020; Pu et al., 2020). This pandemic crisis the concern for the food and nutritional security of millions of people in low- and middle-income countries (LMICs) (Shankar et al., 2021) including India. To contain the virus spread, Government of India (GoI) initiated a nation-wide lockdown for 21 days effective from the 25th March 2020 which later extended until May 2020 (Ministry of Home Affairs, GoI, 2020a; 2020b). It suppressed all the economic activities, including transportation of goods, except the essentials like food and medical supplies (Kanika & Shekar, 2020). Majority followed inappropriate practices and

had few personal/familial/school related issues which needed immediate attention and help (Singh et al., 2021). Even the education system felt unaffordability of lockdown (Bhati et al., 2020). Stringent lockdowns or an extended epidemic affected food supply in many ways (Torero, 2020). Initially, it was food transportation and availability of packaged goods from food processing industries as manufacturing activity slowed down due to social distancing guidelines and labour shortages (Sharma, 2020). These concerns in a developing country are conspicuous, where food supply chains are long and fragile (Reardon et al., 2020).

India consists highest number of vegetarians in the world, with more than 400 million. Different surveys over a period of time showed that the estimated percentage of the vegetarian population is between 23 to 37 per cent (Roshni, 2021) with only 70 per cent

of the Indian population aged over 15 consumed non-vegetarian diets in 2014. The vegetarian diets in India are mainly due to strong cultural and religious traditions. The meat consumption in India is very low (4.5 kg per capita) and it has grown by only 1 kg per capita in the last 20 years, but the per capita milk consumption in India is relatively better and stands at 58.70 litres in 2020. During the pandemic, the consumption of non-vegetarian products was affected as there were supply chain disruptions. The stakeholders in meat industries came across difficulty in production during the lockdown, affected by restricted movement of animals within and across the country. These conditions adversely affected meat production, processing, and distribution adversely (Ijaz et al., 2021).

The COVID-19 pandemic has already affected the human lifestyle, including our consumption patterns, especially during the lockdown period (Attwood & Hajat, 2020; Mayasari et al., 2020). Although, several factors have contributed to the changes in our dietary pattern during the COVID-19 lockdown, the most important reason which can be attributed to the restriction imposed on the movement of people during the lockdown (Attwood & Hajat, 2020). The food supply chain was hampered by the restrictions placed on movement during the lockdown, and the purchasing power of low-income households in urban areas decreased. Although, there are few studies on the impact of COVID-19 on consumption pattern of people in India, the quantification of socio-economic aspects on the consumption pattern of animal-based products among the vegetarian and non-vegetarian population is lacking.

METHODOLOGY

A cross-sectional, questionnaire based survey was conducted among urban and peri-urban population of Bengaluru, Karnataka. The survey was conducted during October 2020 to November 2020 through electronic mode. A *Google form* questionnaire link was circulated through WhatsApp and Email. The survey was voluntary, confidential and anonymous. Consent was obtained before proceeding in the survey. A total of, 1028 participants responded to the survey questionnaire, of which, 191 were discarded due to incomplete information and stopping non-vegetarians' consumption during the lockdown (as it is not fit for comparison). For final analysis the data collected from 837 participants were considered of which 454 (54.24%) were Non-vegetarians and 383 (45.76%) were Vegetarians. In the beginning of the survey, respondents need to choose whether they belong to non-vegetarian or vegetarian category and thereafter it will be directed to different set of questions for each of the category. Hence, in this study, non-vegetarians (NV) were defined as "the person who consumes meat (Chicken, Mutton, Pork), sea products (Fish/prawns) and eggs",

whereas Vegetarians (V) as "the person who consumes Milk and associated milk products (Butter/Ghee, Curd, Cheese and Ice-cream)". A structured questionnaire was developed by consulting the academicians in the local settings. The questions were grouped into demographic characteristics, consumption frequency of the identified products, quantity consumed, expenditure on foods, source of purchase and problems faced in purchase during the COVID-19 lockdown. The data were coded and analysed with descriptive statistics viz., frequencies, percentages, means, standard deviations, etc. using Microsoft Excel 2019, and t test was performed using R version 4.0.3.

RESULTS AND DISCUSSION

The socio-demographic details of the respondents are quantified. Among the non-vegetarians, majority (59.3%) were male, belonged to 18-30-year age category (67.6%), postgraduates (74.2%), equally poised with 35, 33 and 32 per cent in private/business or self-employed and government sector, urban (73.5%) and having less than Rs. 50,000 monthly income (57.3%). Similarly, majority (56.9%) of the vegetarians were males belonged to 18-30 age category (64.75%), having post-graduation (66.84%) working in private (30.8%)/ business or self-employed (37.6%) and government sector (31.6%) and living in urban area (76.76%) earning less than Rs. 50,000 monthly income (53%).

The number of family members are the key determinant factor for measuring the changes in consumption pattern during the lockdown. Among non-vegetarians and vegetarians there was a significant change in the number of family members before and during the COVID lockdown (Table 1). The family size of both the vegetarian and non-vegetarian respondents had increased considerably during the pandemic (Table 1). Globally, the COVID-19 pandemic has affected purchase and eating habits of food (UN, 2020 and FAO, 2020). Further, it is evident from the present study that the pandemic had an immediate impact on animal-based food products consumption among the vegetarian and non-vegetarian population. A significant increase in the family members during lockdown due to shutdown of various activities and resultant movement of people to their native places to stay with their families. This increase in number of family members directly contributed to the increase in food consumption and associated expenditure of the family during the pandemic. Further, the change in frequency of consumption of meat and milk products was observed non-vegetarians and vegetarians, respectively.

The change in quantity of consumption among the vegetarians and non-vegetarians during the lockdown is depicted in Table 2. A considerable increase in eggs (48.69%) and chicken (37%) and decline in fish/prawns (37.95%) was observed among the non-

Table 1. Change in number of family members

Change in number family members	Family Size							
	Vegetarians				Non-Vegetarians			
	Before COVID (%)	During COVID (%)	Changes (%)	Paired t test	Before COVID (%)	During COVID (%)	Changes (%)	Paired t test
≤ 5	43.87	18.28	-58.33	7.95**	57.49	43.61	-24.13	8.88**
≥ 6	56.13	81.72	45.58		42.51	56.38	32.64	

Note: The figures in the parenthesis indicates the percentage change; **Significant at 1% level

Table 2. Consumption quantity of consumers during COVID19 pandemic lockdown

Items	Non-Vegetarians			
	No of Consumers (No)	Increased (%)	Decreased (%)	No Change (%)
Chicken	399	37.09	34.09	28.82
Mutton	285	36.14	32.28	31.58
Fish/Prawns	195	23.08	37.95	13.33
Pork	43	48.84	51.16	23.26
Eggs	419	48.69	16.71	34.61
Vegetarians				
Milk	381	25.72	12.34	61.94
Curd/Buttermilk	362	40.88	23.20	35.91
Paneer/Cheese	305	18.03	45.90	36.07
Ghee/Butter	290	20.69	44.83	34.48
Ice-Cream	323	3.10	61.61	35.29

vegetarian respondents. Interestingly almost similar percentage of pork consumers increased (48.84%) and decreased (51.16%) their quantity consumption during quantity. Among the vegetarians, majority of the respondents didn't change the milk (61.94%) consumption levels but ice cream (61.61%), paneer/cheese (45.9%) and ghee/butter (44.83%) consumption had decreased and curd/buttermilk (40.88%) consumption had increased during the pandemic (Table 2). The quantity of meat purchased had increased due to the higher consumption during the lockdown period (Rahman et al., 2020) and demand for staples and basic dairy products remained relatively steady, as milk consumption in India is relatively high (Sangeetha et al., 2018). However, the consumption of high-end dairy products dropped due to the collapse of the hospitality sector under lockdown. These changes consumption pattern can be attributed to the closures of schools, restricted socializing and lack of outdoor activities (Singh, 2021). Although the restrictions were lifted in the later phases of lockdown, likelihood of a household being food insecure is higher for households with fewer resources (Kumar et al., 2022).

The consumption frequency of vegetarians and non-vegetarians before and during COVID pandemic was quantified and presented in the Table 3. It was observed that, majority of the non-vegetarian

respondents were consuming eggs (92.49%) followed by chicken (87.88%) and mutton (62.77%). The number of once in a week non-vegetarian products consuming respondent increased for all the five non-vegetarian products whereas fifteen-days- once non-vegetarian products consuming group declined for all products. Among the daily non-vegetarian products consuming households, no difference was observed across the products except chicken and mutton. Among vegetarians, majority (88.5%) consumed milk regularly before and during COVID-19 lockdown. And number of once-in-a-week paneer/cheese consuming respondents increased from 25.90 per cent to 29.18 per cent during lockdown. The curd/butter milk consumption among the vegetarians had increased during the lockdown in all the classified consumption frequencies.

The monthly expenditure pattern of vegetarians and non-vegetarians on food products before and during pandemic is presented in Table 4. Among the vegetarians, the number of respondents among the low expenditure group had declined after the pandemic, whereas it increased among the medium and high expenditure group, though not significantly. Similar pattern was observed among the non-vegetarian respondents. Uncertainty in the first phase of lockdown drove people to panic buying and stockpiling and to some extent due to increased family members during lockdown had resulted in demand-supply gap and price rise. The supply could not match with the sudden increase in demand left the price of meat skyrocketing in the market (DHNS, 2020) and caused burden on the planned food expenditure budget of the consumers. Furthermore, the increased demand for protein rich nutritious food like meat mainly among the high-income consumers, particularly in big cities have preferred nutritious food, caused a rise in demand for dairy-based products during the pandemic (Bhosale, 2020 & Knowland, 2020). The disruptions in transport, shutting down the animal markets reduced the availability of live animals resulted in the scarcity of meat and meat products in India (Rahman et al., 2020). Further, fake news on spreading of COVID through meat lead the non-vegetarians to depend on dairy products for their nutrition and it causes increased sale and consumption of dairy products during the lockdown period (Singh et al., 2021) by households.

Table 3. Consumption Frequency of the Vegetarians and Non-Vegetarians before and during lockdown

Products	Number of Consumers (No)	Consumption frequency of Non-vegetarians							
		Daily		Once in Week		Twice in a Week		Once in 15 Days	
		Before COVID (%)	During COVID (%)	Before COVID (%)	During COVID (%)	Before COVID (%)	During COVID (%)	Before COVID (%)	During COVID (%)
Chicken	339	6.51	2.75	34.58	45.11	38.10	35.09	20.80	17.04
Mutton	285	4.21	4.56	37.19	45.26	29.12	24.91	29.47	25.26
Fish/Prawns	195	10.77	8.72	23.08	26.67	22.56	23.59	43.59	41.03
Pork	43	0.00	0.00	32.56	39.53	32.56	34.88	34.88	25.58
Eggs	419	26.97	28.88	24.11	26.25	38.19	37.23	10.74	7.64
Consumption frequency of Vegetarians									
Milk	381	88.45	89.76	7.61	7.09	3.94	2.89	0.00	0.26
Curd/Buttermilk	362	65.75	67.96	6.08	7.73	24.86	22.93	0.55	1.38
Paneer/Cheese	305	3.93	4.26	25.90	29.18	22.62	22.95	47.54	43.61
Ghee/Butter	290	28.97	32.41	31.03	29.66	25.52	23.45	15.17	14.48
Ice-cream	323	9.60	7.43	31.89	19.50	34.67	28.17	23.84	44.89

Table 4. Monthly Expenditure Pattern of the Vegetarians and Non-vegetarians before and during lockdown (INR)

Monthly Expenditure of vegetarians and non-vegetarians (INR)	Vegetarians				Non-Vegetarians			
	Before COVID (%)	During COVID (%)	Changes (%)	Paired t test	Before COVID (%)	During COVID (%)	Changes (%)	Paired t test
≤1000	36.55	32.37	-11.42	1.35 ^{NS}	26.87	20.26	-9.80	1.67 ^{NS}
1001-2000	50.39	52.21	3.62		30.62	35.02	14.38	
≥ 2001	13.05	15.40	18.00		42.51	44.71	5.18	

Note: NS: Non-significant; INR: Indian Rupees

The respondents were asked about the purchasing sources of products before and after the start of COVID. Most of the non-vegetarians purchased the meat products from local retail shops before (64.54%) and during (54.85%) the pandemic, though frequency declined during the pandemic. Further, the meat purchase from super markets (5.29%) and online delivery apps (7.71%) had increased (Table 5). Before pandemic, vegetarians were purchasing the milk and milk products from various sources, of which, local provision stores (50.39%) were most preferred but it was decreased during the pandemic (46.78%). However, the increased purchase from local milk parlours (10.18%) and online apps (11.23%) was observed during the pandemic (Table 5). The barrier gestures, social distancing, as well as general hesitation to visit local retail shops, as a precautionary measure to prevent contracting the virus, this pandemic has transformed the consumers to depend on online delivery apps and super markets to get their food as they practice COVID appropriate behaviours. Further, consumers seem to be environment consciousness and were concerned about their consumption behaviour which may have a detrimental effect on the

environment (Vivek & Sahana, 2021). To cater to the increasing number of daily online orders, most of the supermarkets and other stores in study area increased their delivery capacity with more delivery vehicles and crew to improve their service.

The respondents faced several challenges in purchasing the animal-based food products during the pandemic. Majority of the non-vegetarians (80.8%) opined that meat products price had increased whereas, 55.1% vegetarians reported increase in price of the milk and milk products. It is interesting to note that non-vegetarians (68.06%) faced much difficulty in purchasing the food products than vegetarians (39.68%). Furthermore, both vegetarians and non-vegetarians faced time shortage for purchasing the food products followed by too much crowd at the shops. The other important factors in the ascending order for the non-vegetarians was the increase in prices, non-availability and transportation to access the items whereas it was non-availability, transportation and price hike for the vegetarians. Majority of the non-vegetarians (80%) opined that increase in the meat price was observed during lockdown and corroborates with the study by Akter (2020). Similarly, Falsu Rahman et al., (2020) reported an average 20-30 per cent increase in the price for meat throughout the country due to scarcity of stock. Further, the study by Sanjeev et al., (2021) reported that, increased price affected the consumption of meat and sea foods. The vegetarian consumers expressed that increase in the milk and milk products price due to disruption in supply (Harris et al., 2020), panic buying in the initial days and high input cost during the lockdown period (Khairnar, 2020).

Many challenges were faced by the consumers to get their food products during the initial lockdown period. The non-vegetarians were affected more compared to vegetarians, mainly due to steep hike in prices but both vegetarians and non-vegetarians opined that the less time allowed to purchase the products and crowd in shops. As a general observation, the threat of the pandemic and social distancing measures has transformed consumer demand and

Table 5. Preferred source of purchase for consumers during lockdown

Sources	Non-vegetarians (n=454)		
	Before COVID (%)	During COVID (%)	Change (%)
Slaughter House	18.28	14.98	-3.30
Local Retail Shop	64.54	54.85	-9.69
Super Market	5.95	11.23	5.29
Online Delivery Apps	11.23	18.94	7.71
Vegetarians (n=383)			
Local Provision Stores	50.39	3.66	-46.74
Super Market	18.02	10.44	-7.57
Milk Parlours	27.15	37.34	10.18
Online Delivery Apps	4.44	15.67	11.23

Table 6. Challenges faced by the consumers during lockdown

S.No.	Questions	Non-Vegetarians		Vegetarians	
		Yes (%)	No (%)	Yes (%)	No (%)
1	Price increase during the COVID lockdown?	80.84	19.16	55.09	44.90
2	Challenges while purchase during the COVID lockdown?	68.06	31.94	39.68	60.31
	If Yes, Reasons*		Rank		Rank
a	Non-Availability	8.28	IV	10.99	III
b	Timing of the purchase was not sufficient	38.62	I	26.61	I
c	Hiked Price	9.52	III	1.90	V
d	Transportation	5.10	V	2.54	IV
e	Too much crowd at the shop	18.48	II	13.95	II

*Multiple Responses

business-customer interactions in urban areas and accelerated an ongoing process of digitalization. As more and more businesses are coping with the COVID-19 challenges, India has witnessed a growing use of digital technologies in various sectors such as health, finance, education, and retail. There are few limitations in the study that need to be noted. Since, the study is cross-sectional in nature and, thus, the findings are intermittent, subjective, and do not reflect the changes during the study period of partial and full lockdown in study area. Furthermore, the cross-sectional nature of this study does not allow us to confer causation.

CONCLUSION

In light of the growing uncertainty due to pandemic, the outcome of this study demonstrated a change in consumption and expenditure behaviour of the vegetarian and non-vegetarian consumers. However, the non-vegetarians were mostly affected than vegetarians and some were forced to change their diet due to non-availability of certain commodities. The sudden imposition of lockdown leads to panic buying and scarcity of the commodities which affect the change in price resulting more expenditure on the food products by consumers. This can be tackled with increasing the accessibility of essential produce through deliveries or pick-up points. With partial lockdown and many adults are still working from home it is imperative to circulate more accurate information on appropriate consumption behaviour. Further, longitudinal studies may provide greater insight on the long-term influence of the pandemic on consumer's food dynamics, and whether they will return to how they were before the pandemic.

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Perceived Marketing System Effectiveness by Pineapple Growers in Tripura

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ABSTRACT

Pineapple, an important cash crop of Tripura providing the major source of farm livelihood, has been facing marketing challenges. Present study was conducted during January-June 2020 to assess farmers' perceptions towards marketing system effectiveness of pineapple that included a random sample of 80 farmers. Marketing system effectiveness was measured on different aspects of pineapple marketing based on farmers' perceptions on 5-point continuum. Higher mean perception scores (≥ 4.0) were obtained for two aspects viz., grading & quality checking, and direct selling of produce. Contrastingly, lower perception scores (≤ 2.0) were found for many aspects like inadequate transportation system, profit and price determination by middleman, fluctuating marketing price, non-availability of up-to-date market information, excessive time to disposing produce, government marketing channel & auction, and inability of small-scale farmers to bringing produce to market. Overall marketing system effectiveness was found 47 per cent. Attributes of farmers were having significant correlation with it; out of which family size, use of personal cosmopolite information sources, mass media use and knowledge level showed significant relationship in multiple regression model. Therefore, to improve pineapple marketing system effectiveness, extension and advisory services need to undertake capacity building measures of the pineapple growers.

INTRODUCTION

Pineapple is one of the most important fruit crops of India being fifth largest producers in the world with about 116 thousand ha area, 1984 thousand tonnes production and 17.1 t/ha productivity (National Horticulture Board, 2015-16). Due to compatible agro-ecosystems, it is largely grown in north eastern states of India, out of which the state of Tripura's economy is highly influenced by it being a major source of farmers' livelihood and economic security. Tripura is 4th largest producer of pineapple in India after Kerala, West Bengal and Assam, accounting for approximately 9 per cent of country's total production from 8768 ha area with about 127 thousand tonnes production and 14 t/ha productivity (National Horticulture Board, 2015-16 & Directorate of Horticulture and Soil Conservation, Government of Tripura, r

2015-16 & 2016-17). Tripura's 'Queen', or Queen pineapple, declared 'State Fruit' in 2018, has a GI tag and regarded as the best quality of pineapple in the world. Pineapple crop has shown a decline in area and productivity due to which growers have been facing an income slump in India. According to Mission for Integrated Development of Horticulture, MoA & FW, Govt. of India (2018), area under pineapple in Tripura has decreased from about 12000 ha in 2014-15 to 8850 ha in 2016-17 due to loss incurred by the farmers in absence of processing infrastructure, reduction of price and high perishability nature of pineapple. According to pineapple growers, business is at all-time low and the fruit is sold at less than half of market rate in the months of June-July due to glut in the market (Deb, 2019). Pineapple farmers of Tripura have complained of huge losses due to absence of storage and lack of procurement facilities by the government (Panday, 2019).

The pineapple marketing sector has high capacity to reduce unemployment (Das et al., 2016) though the pineapple growers incur losses due to the perishable nature of product (Roy et al., 2022). Because of perishable nature and bulkiness, marketing of pineapple is complex and risky as well, and it requires a well-functioning marketing system to transfer the product from the point of production to the point of consumption within a specified time keeping the produce fresh (Okal, 2018). The government aims to regulate the trade practices, increase marketing efficiency by reducing marketing charges, eliminate intermediaries, and protect the interests of the producer/seller. Though regulated markets have always helped to reduce multiple charges to the producer/seller, the system has failed to check trade malpractices, making such markets highly restrictive, inefficient and dominated by traders (Dastagiri et al., 2012). So, it is very crucial for the pineapple growers to know the appropriate channel to market their yield, as this will prevent them from suffering high losses and obtaining higher income (Apandi et al., 2017). Existing marketing system determines the return on investment of the farmers from pineapple cultivation and thereby the growth and sustenance of pineapple farming. On this backdrop, present study was conducted to assess the perceived marketing system effectiveness by pineapple growers and its determinants.

METHODOLOGY

Present study was undertaken in the purposively selected state of Tripura that being one of the major pineapple growing states in India. Sepahijala district was selected occupying 750 ha area producing about 11 thousand tonnes of pineapple with productivity of 14.66 t/ha (Directorate of Horticulture and Soil Conservation, Government of Tripura, 2017-18). Out of three subdivisions, one subdivision i.e., Sonamura and two blocks from Sonamura namely Boxonagar and Mohanbhog were chosen randomly. Subsequently Kuluibari, Aralia and Kalapania, Diptali villages were selected with random sampling technique. A probability proportionate simple random sampling was done for selection of respondents; accordingly, 25 farmers (31%) from Kuluibari, 13 farmers (16%) from Aralia, 26 farmers (33%) from Kalapania and 16 farmers (20%) from Diptali were selected making a total of 80 pineapple growers.

Socio-personal (age, education, family size, earning members in the family), socio-economic (average annual income, average annual expenditure, cultivable land, farm implements holding), and communicational characteristics (mass media exposure, use of personal cosmopolite information sources, use of personal localite information sources) of the pineapple farmers as well as their overall knowledge and adoption level of scientific recommended pineapple cultivation techniques were considered as independent variables. While farmers' perception on marketing system effectiveness of pineapple was considered as dependent variable. A total of 16 items pertaining to different aspect of pineapple marketing were rated by the respondents on five-point continuum: 'strongly agree'-5, 'agree'-4, 'Undecided'-3, 'disagree'-2, and 'strongly disagree'-1 for favourable items and scoring was reversed for unfavourable items. Data were collected from the sampled respondents with the help of interview schedule developed for the purpose and pretested before administration to sampled respondents. Collected data were

subjected to frequency, percentage, mean, standard deviation and range as well as relational statistics like correlation and multiple regression coefficients.

RESULTS AND DISCUSSION

It is evident from the Table 1 that pineapple farmers realized the cost efficiency on an average with farmer's receipt of Rs. 9.53 per unit, marketing cost of Rs. 4.27 per unit, labour wages of Rs. 3.85 per unit, auction price of Rs. 23.24 per unit and open market price of Rs. 27.95 per unit. In Tripura, under Mission for Integrated Development of Horticulture MoA & FW, Govt. of India (2018), an average weight of 750 gm per pineapple and selling price of Rs 5 per piece at farmer level was found. They also mentioned the transportation cost ranged Rs 7 to 10 per kg of produce. In addition, the average labour cost was Rs 100 per 1000 pieces. According to Chand et al., (2020), marketing cost of the product depends on many things like, the kind of product they produce, distance from farmer's field to market, packaging materials they used in transportation. It was observed that all the respondents used to sell their produce directly to the nearby markets without any intermediaries. Almost every one used jeep on hired basis and transport the produce directly by themselves to the nearby market. Similarly, under the Mission for Integrated Development of Horticulture MoA & FW, Govt. of India (2018), it was observed that the farmers in Tripura used jeep for transporting the produce when in smaller quantities and used mini trucks when in large quantity.

It is evident from Table 2 that the higher (≥ 4.0) mean score of perceptions of farmers towards pineapple marketing system effectiveness, were obtained for certain aspects like grading, quality checking and receiving higher price by farmers through direct selling of their produce to nearby market. The mean perception scores were found to be at lower level (≤ 2.0) for many of the aspects like inadequate transportation system for the produce, earning more profit by middleman, determining the price by middleman, the ways to ensure better price for farmer production, fluctuating marketing price and market information for facilitating smooth and efficient operation, non-availability of up-to-date market information, taking more time during disposing of the produce, marketing channel by government to help in auction to increase the return, and some small-scale farmers who have neither the time nor the money to bring their produce to market. An above average perception level (> 3.0 to 4.0) of respondents is found with respect to available storage facilities, fair and accurate weighing system, marketing standards followed by market functionaries, and mandatory involvement of middlemen to sell the produce in market. Overall marketing system effectiveness (MSE) was calculated as 47.13 per cent.

Table 1. Cost efficiency realized by pineapple growers

Category	Mean (SD)
Farmer's receipt (Rs.)	9.53 (4.03)
Marketing cost (Rs.)	4.27 (1.95)
Transportation cost (Rs.)	0.41 (0.05)
Labour wages (Rs.)	3.85 (1.95)
Auction market price (Rs.)	23.24 (4.20)
Open market price (Rs.)	27.95 (3.69)

Table 2. Perceptions of farmers towards pineapple marketing system effectiveness

S.No.	Statements on different aspects of marketing system	Mean (SD)(n=80)
1	Available transportation system is not adequate according to quantity of produce	1.78 (0.45)
2	Storage facilities availability are adequate	3.36 (1.29)
3	Weighing system of produce is having fairness and accuracy	3.41 (0.94)
4	Marketing standards are followed by market functionaries	3.93 (0.82)
5	Methods of grading and quality checking are practiced in market	4.18 (0.47)
6	Middlemen (Local dealers) earn more profit than the farmers	1.35 (0.48)
7	Middlemen determine the price of produce	1.45 (0.50)
8	Farmers get higher price by directly selling their produce to nearby auction market	4.55 (0.57)
9	Limited ways to ensure better price for the farmer's production	1.36 (0.48)
10	Marketing price fluctuation every year	1.24 (0.43)
11	Market information facilitating smooth and efficient operation	1.80 (0.40)
12	Non availability of up-to-date market information	1.95 (0.22)
13	Without middleman, it is impossible to sell the produce in the market	3.10 (0.95)
14	Disposing of produce by the farmer in market takes more time	1.46 (0.50)
15	Marketing channel developed by the Government, whereby auctions are held at a nearby market town increase the return to farmers.	1.51 (0.50)
16	There are some small-scale farmers, who have neither the time nor the money to bring their produce to market.	1.28 (0.45)
MSE (%)		47.13 (2.99)

Sharma et al., (2016) highlighted the marketing problems faced by the pineapple growers in Nagaland, which were inadequate transport facilities, non-availability of market in the locality, low marketable surplus, absence of market information, lack of organization among producers, and problems of storage, which are in conformity of the findings of present study. Reema et al., (2020) in their study in Kannauj (Uttar Pradesh) reported that 56% of the farmers faced loss due to storage, marketing constraints and fluctuation of farm produce. Under the Mission for Integrated Development of Horticulture MoA & FW, Govt. of India (2018), it is reported that there are no regulated market and storage infrastructure for pineapple in Tripura. Hossain & Islam (2017) mentioned that every year large amount of pineapple damaged for lack of storage and transportation facilities in Bangladesh. Das et al., (2016) opined that pineapple cultivation is highly remunerative provided marketing of raw fruits is done properly, pricing system of pineapple is developed. They indicated that poor processing facilities restricted the expansion of pineapple cultivation in West Bengal. During the present study, pineapple growers have mentioned that they are compelled to sell the pineapples at a low price in peak season due to lack of proper marketing facilities. Similar findings were also reported by Gupta et al., (2020). This calls for an urgent attention and marketing policy reforms to sustain the area and production of pineapple cultivation and remunerative income of the pineapple growers.

It is important to find out the factors influencing the perception level of farmers towards effectiveness of marketing system of pineapple. Therefore, the factors affecting the perceived marketing system effectiveness was identified through the correlation and multiple regression analyses considering socio personal, socio-economic, and communication attributes of the farmers along with their overall knowledge and adoption level of recommended pineapple cultivation practices as independent variables and perceived marketing system effectiveness by the pineapple farmers as dependent variable.

The perception level of the farmer was having significant associations with the farmer's attributes like family size, education,

earning members of the family, available farm implement, annual income, annual expenditure, cultivable land, use of personal cosmopolite information sources, use of mass media sources, knowledge level and adoption level as evident from the significant correlation coefficient values (Table 3). However, attribute of the farmers like age was not significantly associated with perception level. While, use of personal localite information sources has showed negative significant relationship with the farmers' perception level on marketing system effectiveness.

Correlation analyses do not indicate the functional relationship among those independent variables with the dependent variable. Therefore, to reveal functional relationship, multiple regression analysis was done considering the selected attributes of the pineapple growers as independent variables and perceived marketing system effectiveness as dependent variable.

Results given in Table 4 reveal that all of the selected variables together determined 56.3 per cent variation in perceived marketing system effectiveness. Out of 13 attributes, regression coefficients of four attributes were found to be positively significant, which

Table 3. Correlational analysis

S.No.	Attributes	Correlation coefficient (r)
		Perceived MSE
1.	Age	.114
2.	Family size	.559**
3.	Education	.236*
4.	Earning members	.376**
5.	Annual Income (Rs.)	.423**
6.	Farm implement	.516**
7.	Cultivable land (acre)	.552**
8.	Annual Expenditure (Rs.)	.401**
9.	Use of Personal localite information sources	-.334**
10.	Use of Personal cosmopolite information sources	.289**
11.	Mass media use	.296**
12.	Knowledge level	.557**
13.	Adoption level	.346**

**significant at 1% level of significance *significant at 5% level of significance

Table 4. Multiple regression analysis

S.No.	Attributes	Std. Error	Beta Coefficient	t	Sig.
	(Constant)	19.850	64.369 (B value)	3.243	.002
1.	Age	.031	-.092	-.882	.381
2.	Family size	.858	.250	1.937	.057
3.	Education	.316	.020	-.204	.839
4.	Earning members	.555	.149	1.488	.142
5.	Annual Income (Rs.)	.000	.206	.920	.361
6.	Farm implement	.576	.167	1.455	.150
7.	Cultivable land (acre)	.584	.158	1.053	.296
8.	Annual Expenditure (Rs.)	.000	-.010	-.049	.961
9.	Use of Personal localite information sources	.982	-.168	-1.629	.108
10.	Use of Personal cosmopolite information sources	.505	.198	2.081	.041
11.	Mass media use	1.887	.278	-1.767	.082
12.	Knowledge level	.108	.226	1.917	.060
13.	Adoption level	.085	-.092	-.774	.442
R value:		0.750			
R Square:		0.563			
Adjusted R Square:		0.494			
F value:		6.535**			

** significant at 1% level of significance

are family size, use of personal cosmopolite information sources, use of mass media source and knowledge level. Hassan et al., (2011) reported that education, farm size, annual income, knowledge and attitude towards Pineapple cultivation were positively correlated with increased income from Pineapple cultivation in Bangladesh. Okal (2018) mentioned that the growers having more education realized better marketing efficiency, as educated growers were more innovative and likely to adopt better marketing strategies. Therefore, to improve marketing system effectiveness of pineapple, extension and advisory services need to undertake market led extension approach and develop the capacities of pineapple growers for improving their knowledge level, use of mass media and cosmopolite information sources. Institutional innovations to developing required marketing infrastructure, which were lowly perceived by the pineapple growers, need to focus on transportation system for the produce, eradicating middleman and their interferences in price fixation, better pricing system tackling fluctuating marketing price and up-to-date market information for facilitating smooth and efficient operation, government regulated marketing channel helping farmers to participate in auction to increase their return, and cooperative marketing for small-scale farmers lacking resources to bring their produce to market. Similar observations were highlighted by Das et al., (2014); Das et al., (2015). Farmer led extension approach in terms of promotion of farmer producers' organization may be a potential option to improve pineapple cultivation and marketing scenario.

CONCLUSION

Pineapple growers have expressed their concerns on prevailing marketing system effectiveness and showed satisfaction towards a few marking aspects like grading, quality checking direct selling their produce to nearby market, fair and accurate weighing system, marketing standards followed by market functionaries. However, the involvement of middlemen and their interferences in different aspect of marketing including price fixation have raised concerns. The inadequate transportation system for the produce, fluctuating

marketing price due to non-existence of price fixation systems, non-availability of up-to-date market information, lack of government-controlled marketing channel ensuring farmers participation in auction, and market inaccessibility of resource poor farmers warrant urgent attention of the planners, policy makers and line department officials. Market led extension approach and organization of pineapple growers may be considered as way forward to sustain pineapple cultivation-based farm livelihoods in Tripura as well as other pineapple growing regions of the country facing market related constraints.

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Knowledge and Association of Solar Pump Users Regarding Vegetable Production Technology in Jaipur Rajasthan

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ABSTRACT

Rajasthan has outstanding solar radiation in India and a solar water pump is a great investment that makes money in the long run. The present study was conducted in Jaipur district with 120 beneficiary and non-beneficiary farmers regarding knowledge about the improved practices of vegetable production possessed by solar pump users during 2020. The practices namely- selection of improved seed variety, time of sowing, seed treatment, organic and chemical manure application of irrigation at the right time, intercultural operations, weed management, insect and disease management etc. were found as popular practices. The results of the study revealed that majority (95%) of beneficiary fall into the category of medium to high level of knowledge against 80 per cent of the non-beneficiary were falling under low to medium knowledge level. It can be summarized that the variables viz., education, occupation, annual family income, size of land holding, farm mechanization, utilization of information, contact with extension agents etc. were found significant with their knowledge of vegetable production technology. The results also depicted that age was found in non-significant relationship with knowledge of vegetable production technology. There was a significant association between knowledge of vegetable production technology of non-beneficiaries with their occupation, size of land holding and contact with extension agents. In case of age no association was found between age and knowledge of vegetable production technology for both the beneficiary and non-beneficiary farmers.

INTRODUCTION

A solar energy-powered water pump is operated on the electricity that is generated by solar photovoltaic modules. It is equivalent to the input and output energy of the solar-pump panels and in addition available voltage security. As per the farmers who set up any of the micro irrigation systems (Drip irrigation, Mini sprinkler or Sprinkler) on their fields are only eligible under the solar-pump subsidy scheme. India's irrigation is mostly groundwater well based and India has the world's largest groundwater well equipped irrigation system (about 39 million hectares, or 67 per

cent of its total irrigated). Around 84 per cent of the total available water is consumed for irrigation in the country and it is crucial to provide timely and adequate water supply to ensure improved agricultural productivity (NITI Aayog, 2015; Dhawan, 2017). Since energy is coming from the sun, your utility bill will be drastically reduced. Solar pump systems do not have a large operating cost, since they are powered naturally by the sun. You don't need to pay a ton of money every time you turn your pump on. A solar water pump is a great investment that will make you money in the long run. Solar water pumps are also easier to maintain than other pump power sources. These pump systems can run for years

without needing any maintenance. There are not many mechanical components, making them less likely to break down and require new parts or repairs. Many of the Advanced Power customers have run their solar pump systems for more than 10 years without needing any maintenance. One of the biggest benefits of solar water pumps is the fact that you can use them anywhere. Even if you have a well on your property, miles from any source of power, you will still be able to pump water from your well by using solar energy. This means that you don't have to spend thousands trying to get a source of power out to your well location or find an alternative source of power. Solar is a reliable way to power your water pumps in remote areas.

In India, irrigation is majorly dependent on diesel and electric pumps with nearly 21 million agricultural electricity connected pumps (70%) and more than 8 million diesel irrigation pump sets (30%) (IEEFA, 2018). At present, only 0.4 per cent (around 2 lakh) of solar water pumps has been installed in the country (MNRE, 2018 and IEEFA, 2018). For agriculture in India grid electricity is given at tremendously short tariffs. In most cases, flat rates are paid depending on the pump classification (Tanwar, 2016). There is a small market for non-subsidized pumps that witnesses demand from Non- Government Organizations and Institutions. Rajasthan has outstanding solar radiation in India and is one of the world's best. A solar pump along with a micro-irrigation system scheme is ongoing in Rajasthan from the year 2010-11. The Government of Rajasthan launched the scheme in the year 2011 with a sum of Rs. 515 crore to provide subsidized solar irrigation system to the state's 10,000 farmers within three years. Presently, this scheme in Rajasthan was initiated to provide financial support to horticulture farmers who utilised drip irrigation and farm ponds

METHODOLOGY

The research was conducted purposively in Jaipur district of Rajasthan, during the year 2020 because this district stands first in number of beneficiaries under solar pump set as well as in the area under vegetable production. In total there are 13 blocks in Jaipur district, out of which, two blocks i.e., Govindgarh with an area of 269.8 acre and Jalsu with an area 210.8 acre, were selected. From each selected block, 30 beneficiary farmers and 30 non- beneficiary farmers (60 farmers from both blocks) of solar pump set were chosen randomly with the help of data gathered from the office of Deputy Director of Horticulture, Govt. of Rajasthan, Jaipur. The information was collected by personal interview method with the help of structured schedule.

The knowledge for the purpose of present study was operationalized as the amount of understood information about improved vegetable production practices possessed by the farmers. The questionnaire for improved vegetable production practices was prepared. As per the responses of respondent regarding knowledge of each component of technology was given 3 for high, 2 for medium and 1 for low or no knowledge of each practice. The total score obtained by the respondents from all the practices was used to calculate the knowledge index of each respondent. The Knowledge Index calculated from the following formula:

$$\text{Knowledge Index} = \frac{\text{Obtained knowledge score}}{\text{Obtainable knowledge score}} \times 100$$

RESULTS AND DISCUSSION

Knowledge about vegetable production technology

Individual aspect-wise extent of knowledge of vegetable growers was worked out. For this mean per cent score were calculated. The results of the same have been presented in Table 1.

As observed regarding selection of improved seed variety, maximum number of the respondents had medium knowledge. In relation to time of sowing, 65.00 per cent of the respondents had high knowledge. Regarding rate of seed treatment, medium knowledge of 43.34 per cent, while high knowledge (46.66%) and low knowledge (10.00%) was found. Regarding recommended dose of organic and chemical manures, maximum number of the respondents (46.66%) was in medium knowledge. Medium knowledge of application of irrigation of 38.34 per cent of the respondents was observed whereas for intercultural operations, medium knowledge of 51.66 per cent of the respondents, for weed management medium knowledge of 60.00 per cent, for insect and disease management medium knowledge of 55.00 per cent and for harvesting, medium knowledge of 53.33 per cent was observed. Similar findings were obtained by Harishankar et al., (2014); Ghintala & Singh (2013); Jethi et al., (2019); Kaur & Singh (2019).

Table 2 shows that medium knowledge level of 41.66 per cent respondents, followed by high knowledge level (33.34%) and low knowledge level of 25.00 per cent respondents. In case of beneficiaries of scheme, maximum number of the respondents, i.e., 48.34 per cent belonged to the medium level of knowledge, followed by 46.66 per cent of the respondents had high level of knowledge and 5.00 per cent had low level of knowledge. On the other hand, in case of non-beneficiaries, maximum number of the respondents,

Table 1. Practices wise knowledge of vegetables production technology under solar pump set scheme

Improved agricultural practices	Beneficiaries Knowledge			Non-beneficiaries Knowledge		
	High	Medium	Low	High	Medium	Low
Selection of improved seed variety	24 (40.00)	31 (51.66)	05 (08.34)	11 (18.34)	21 (35.00)	28 (46.66)
Time of sowing	39 (65.00)	21 (35.00)	00 (00.00)	15 (25.00)	14 (23.34)	31 (51.66)
Seed treatment	28 (46.66)	26 (43.34)	06 (10.00)	13 (21.66)	17 (28.34)	30 (50.00)
Organic and chemical manures	27 (45.00)	28 (46.66)	05 (08.34)	12 (20.00)	20 (33.34)	28 (46.66)
Application of irrigation	34 (56.66)	23 (38.34)	03 (05.00)	14 (23.34)	14 (23.33)	32 (53.33)
Intercultural operations	27(45.00)	31 (51.66)	02(03.34)	10 (16.66)	26 (43.34)	24 (40.00)
Weed management	23 (38.34)	36 (60.00)	01 (01.66)	10 (16.66)	27 (45.00)	23 (38.34)
Insect and disease management	24 (40.00)	33 (55.00)	03 (05.00)	11 (18.34)	25 (41.66)	24 (40.00)
Harvesting	26 (43.30)	32 (53.33)	02(03.34)	12 (20.00)	25 (41.66)	23 (38.34)

Table 2. Categorization of respondents according to their level of knowledge

Category	Beneficiary (n=60)	Non-beneficiary (n=60)	Total (n=120)
Low (Upto 14)	03 (05.00)	27 (45.00)	30 (25.00)
Medium (Between 15-22)	29 (48.34)	21 (35.00)	50 (41.66)
High (Above 22)	28 (46.66)	12 (20.00)	40 (33.34)

i.e., 45 per cent belonged to the low level of knowledge category, followed by 35.00 per cent of the respondents with medium level of knowledge and 20.00 per cent of the respondents fell into high level of knowledge category.

Association between profile and knowledge of vegetable production technology

Association of beneficiaries and non-beneficiaries' vegetable growers of solar pump set scheme with their knowledge of vegetable production technology were worked out and presented in Table 3. In case of non-beneficiaries profile viz., education, annual family income, farm mechanization, utilization of information, economic motivation and scientific orientation were found significant at 0.01 level of probability while occupation, size of land holding and contact with extension agent were found significant at 0.05 level of probability with their knowledge of vegetable production technology, whereas age was found in non-significant association.

In case of beneficiaries also the profile viz., education, annual family income, farm mechanization, utilization of information, economic motivation and scientific orientation were found significant at 0.01 level of probability while occupation, size of land holding and contact with extension agent were found significant at 0.05 level of probability with their knowledge of vegetable production technology, whereas age were found not significant association. In case of age the calculated chi-square value was less than its corresponding tabulated value at 4 degree of freedom. Thus, the null hypothesis "there is no association between age of beneficiaries & non-beneficiaries and knowledge of vegetable production technology" was accepted and hence, it was calculated that the knowledge of vegetable production technology did not depend upon the age of the beneficiaries & non-beneficiaries farmers. The results are in accordance with the results obtained by Nasrin et al., (2017); Ojha et al., (2020); Suman (2013); Gupta et al., (2020).

Table 3. Association of knowledge of beneficiaries and non-beneficiaries with profile

Variables	Beneficiaries		Non beneficiaries	
	χ^2 value	d.f.	χ^2 value	d.f.
Age (X_1)	5.28 ^{NS}	4	6.37 ^{NS}	4
Education (X_2)	23.56**	8	24.28**	8
Occupation (X_3)	13.67*	6	14.56*	6
Annual family income (X_4)	15.32**	4	14.78**	4
Size of landholding (X_5)	14.48*	6	15.26*	6
Farm mechanization (X_6)	19.58**	4	18.68**	4
Utilization of information (X_7)	16.72**	4	15.42**	4
Contact with extension agent (X_8)	10.28*	4	11.58*	4
Economic motivation (X_9)	12.56**	4	11.82**	4
Scientific orientation (X_{10})	14.56**	4	13.24**	4

^{NS} Non significant **Significant at 0.01 level of probability *Significant at 0.05 level of probability

CONCLUSION

Among the beneficiary respondents knowledge about the improved practices of vegetable production namely selection of improved seed variety, time of sowing, seed treatment, organic and chemical manure, application of irrigation at the right time, intercultural operations, weed management, insect and disease management and harvesting were found to be popular. It can be summarized that the variables viz., education, occupation, annual family income, size of landholding, farm mechanization, utilization of information, contact with extension agent, economic motivation and scientific orientation were found significant with their knowledge of vegetable production technology. The age was having non-significant relationship with their knowledge of vegetable production technology. It could, therefore be suggested that trainings be organized as well as promotion of the ongoing schemes should be conducted on the foregoing aspects coupled with method demonstration, in combination with other extension methods. Good governance activities have to be undertaken to promote the knowledge of the scheme.

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Assessment on the Progress of KCC Scheme in India

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ABSTRACT

Financial assistance to agriculture sector is very important as India is an agriculture dominant economy. Government has launched various plans and programmes to boost credit to rural society for supplying requisite quantity of credit to the farmers. Kisan Credit Card scheme was launched in 1998 on recommendations of R.V. Gupta committee. This research paper insights the KCC scheme performance in India since its inception. The main objective was to evaluate the year-wise, agency-wise and region-wise KCCs progress in the country. The period of study was from 1999-00 to 2018-19. The study concludes the growth of Kisan Credit Card scheme both with respect to KCCs issued and sanctioned amount under the scheme during the period 1999-2019. It was also recorded that the performance of Commercial banks was better than the both RRBs and Co-operative banks in implementation of KCC scheme. The study also revealed that inter-region variation in the performance of KCC scheme across the country during 1999-2019.

INTRODUCTION

Agricultural sector's functioning has a prominent out-turn on the development of an economy. The agriculture and allied sector provided 19.90 percent to the GDP in 2020-21. About 50 per cent of population of India depends upon agriculture. At present net cultivated area and gross sown area in India is 140.13 million ha and 198.36 million ha, respectively. India is an agricultural economy, the farmers need credit to enhance productivity and efficiency in agriculture. Credit in agriculture impacts production increment through two main channels. First, increase in formal credit result in greater availability of working capital and more investment in fixed capital. Second, credit also enables consumption smoothing for cultivators (Chavan et al., 2016). Most of the institutions are catching hold of fairly successful farmers and brand them as entrepreneurs and take credit as their own but Central Sector Scheme of financing facility under the Agriculture Infrastructure Fund supports farmers, PACS, FPOs, Agri-entrepreneurs, etc. in building community farming assets and post-harvest agriculture infrastructure (Kademani et al., 2020). The access to subsidy reflected the availability of external capital support as one of the

determining factors for adoption of technology (There is a requirement to include farmers in financial framework to empower rural people as well as women (Kumari & Malik, 2019; Kumari et al., 2020).

Kisan Credit Card scheme was first time proposed in the budget 1998-99 by then Indian finance minister Yaswant Sinha. Kisan Credit Card scheme was introduced in the country on the recommendations of Shri R.V. Gupta committee to extend credit facility to the farming community. Credit under the scheme is available for crop production, as well as for auxiliary and non-farm activities and also for consumption needs. All farmers (individual/joint cultivator, owner, tenant farmer, oral lessee and sharecropper, SHGs, etc.) are eligible within the age group of 18 to 75 years. In the 2018-19 financial year, the government has issued KCC facilities to livestock farmers and fishers to support them in managing their working capital requirements.

The KCC scheme picked up momentum soon after its foundation and have become one of the important instruments to enhance the flow of institutional agricultural credit. As per the RBI, about 7.03 crores operative KCCs have already been issued up to December 10, 2019. This approach has greatly eased the timely

availability of funds and greatly simplified the process for obtaining a loan from a bank. The progress in the execution of KCC scheme has depicted a significant inter-region variation in the country (Kumar et al., 2011). Present paper has insights on the performance of Kisan Credit Card scheme in India.

METHODOLOGY

This research is based on secondary information on Kisan Credit Card scheme. The secondary data for number of Kisan Credit Card issued and sanctioned credit amount under Kisan Credit Card scheme by various institutions in country was collected from different published reports of RBI, NABARD, Govt. of Haryana, Govt. of India, State level bankers' committees and other published sources based on Kisan Credit Card scheme. The data was collected for the financial year 1999-00 to 2018-19. The progress of Kisan Credit Card scheme was assessed year-wise, agency-wise and region-wise with respect to number of Kisan Credit Cards issued and amount sanctioned under the scheme during the period 1999-2019. Agency-wise progress was evaluated by assessing the performance of different institutions with respect to KCC scheme namely commercial banks, co-operative banks and Regional Rural Banks. Region-wise progress of Kisan Credit Card scheme was estimated by evaluating the performance of different financial institution in all five regions of India (Eastern, Western, Northern, Southern and North-eastern regions). The progress of Kisan Credit Card scheme in India has been assessed by using various statistical techniques like mean, coefficient of variation and compound growth rate and presented in the form of tables. The average value of number of Kisan Credit Cards indicated the average performance of Kisan Credit Card scheme per year. Coefficient of variation studied the consistency in the performance of Kisan Credit Card scheme during the study period and expressed in percentage. The higher the value of coefficient of variation, lesser will be the consistency in performance of KCC scheme means more variation during the study period. Compound growth rate indicates the performance of Kisan Credit Card scheme annually and computed by using MS Excel and Statistical Package for Social Sciences (SPSS).

RESULTS AND DISCUSSION

Period-wise progress of kisan credit card scheme in India

The average value of cards issued from all banks in the country was 103.64 lakh and the mean value of amount sanctioned was Rs. 69,868 crores for the year 1999-00 to 2018-19. The period-wise advancement of KCC scheme in India for the year 1999-00 to 2018-19 is given in Table 1.

KCC picked up the momentum since its inception, between 1999 and 2019, the total of KCCs issued increased at a growth rate of 4.01 per cent per annum. The tremendous increase in amount sanctioned was reported in recent decade (Rs. 100957 crores) was nearly double in 2018-19 over 2008-09 with 13.58 per cent growth rate per annum during 1999-2019.

Coefficient of variation was 25.00 per cent with respect to total number of cards issued and 63.00 per cent for amount sanctioned under the KCC programme. With respect to total number of cards issued and the amount advanced under the Kisan Credit

Table 1. Progress of Kisan Credit Card scheme in India: 1999-2019

Year	No. of Cards Issued (No. of cards in Lakh)	Amount sanctioned (Rs. in Crore)
1999-00	51.34	7248
2000-01	86.52	16427
2001-02	93.41	25858
2002-03	82.43	26277
2003-04	92.45	21785
2004-05	96.80	34186
2005-06	80.12	47601
2006-07	85.14	46729
2007-08	84.70	49987
2008-09	85.92	46669
2009-10	90.05	57678
2010-11	101.69	72625
2011-12	117.60	91670
2012-13	129.82	126270
2013-14	139.04	135751
2014-15	129.34	126276
2015-16	121.85	141981
2016-17	135.79	114562
2017-18	133.63	106831
2018-19	135.12	100957
Mean	103.64	69868.40
C.V. (%)	25.00	63.00
CGR (%)	4.01	13.58
Total cultivators (Lakh)	1464.50	1464.50
Per thousand cultivators	1415	7.54

Source: RBI (various issues) and NABARD (various issues)

Card scheme, the scheme exhibited immense growth from 1999 to 2019. In India, 1415 KCCs were given per 1000 cultivators, and the total credit sanctioned under the KCC programme was Rs. 7.54 crores per 1000 growers. The reason for higher growth rate per annum was that the credit amount permitted under Kisan Credit Card scheme per unit of land increased during the period 1999-2019 which further helped to fulfill the financial requirements of farmers. The findings are supported by Bista et al., (2012) in their study on Progress and Performance of Kisan Credit Card Scheme with a Case Study of Bihar divulged that the growth rate was 13.7 per cent annually during 2000-11. Similarly, Gupta et al., (2018) in their study on An Economic Evaluation of Kisan Credit Card observed that the growth for the period 2001-12 was 10.30 per cent per annum.

Progress of KCC scheme with respect to number of cards issued in India

The progress of all the financial institutions i.e., RRBs, commercial banks and co-operative banks throughout the country in regard to Kisan Credit Card scheme with respect to number of cards issued for 1999-2019 is given in Table 2. During the period 1999-2019, the average value of total number of Kisan Credit Cards issued was highest by commercial banks i.e. 56.70 lakh. The average value of total of KCCs issued by cooperative banks (31.80 lakh) was more than RRBs (15.05 lakh). The annual rate of growth was found highest in case of commercial banks (8.83%), followed by RRBs (6.78%) and negative in case of co-operative banks (-1.78%).

Table 2. Numbers of cards issued by different financial institutions in India: 1999-2019

Year	No. of Kisan Credit Card Issued (in lakh)						Total
	Commercial Banks	Proportion in total (%)	RRBs	Proportion in total (%)	Co-operative Banks	Proportion in total (%)	
1999-00	13.66	26.61	1.73	3.37	35.95	70.02	51.34
2000-01	23.90	27.62	6.48	7.49	56.14	64.89	86.52
2001-02	30.71	32.88	8.34	8.93	54.36	58.20	93.41
2002-03	27.00	32.76	9.64	11.69	45.79	55.55	82.43
2003-04	30.94	33.46	12.73	13.77	48.78	52.75	92.47
2004-05	43.96	45.41	17.29	17.86	35.56	36.74	96.80
2005-06	41.65	51.98	12.49	15.59	25.98	32.43	80.12
2006-07	48.08	56.49	14.09	16.56	22.97	27.00	85.11
2007-08	46.06	54.38	17.73	20.93	20.91	24.69	84.70
2008-09	58.34	67.90	14.14	16.46	13.44	15.64	85.92
2009-10	53.13	59.00	19.49	21.64	17.43	19.36	90.05
2010-11	55.83	54.90	17.74	17.45	28.12	27.65	101.69
2011-12	68.04	57.86	19.95	16.96	29.61	25.18	117.60
2012-13	82.43	63.50	20.48	15.78	26.91	20.73	129.82
2013-14	85.49	61.49	21.79	15.67	31.76	22.84	139.04
2014-15	83.24	61.96	15.49	11.53	30.61	22.78	129.34
2015-16	84.29	69.17	22.37	18.36	15.19	12.47	121.85
2016-17	87.20	64.22	17.71	13.04	30.88	22.74	135.79
2017-18	85.21	63.76	14.93	11.18	33.49	25.06	133.63
2018-19	86.32	63.88	16.53	12.23	32.27	23.89	135.12
Mean	56.77	-	15.06	-	31.81	-	103.64
C.V. (%)	44	-	35	-	34	-	25
CGR (%)	8.83	-	6.78	-	-1.78	-	4.01

Source: RBI (various issues) and NABARD (various issues)

However, the coefficient of variation for KCCs issued was 44 per cent in commercial banks which was highest followed by RRBs with variation 35 per cent and co-operative banks with variation 34 per cent over the period 1999-2019. Commercial banks showed largest variation in case of KCCs issued as higher target fixed over years owing vast network of branches in the country and to cover large number of farm holdings within short span of time.

Kaur & Dahliwal (2018) in their study on Progress of Kisan Credit Card Scheme in India also reported significant growth rate with respect to total cards issued in India by commercial banks (14.27%), regional rural banks (22.84%) and co-operative banks (-2.67%) during time period 1998-2013. Parkash and Kumar (2016) in their research on Performance of Kisan Credit Card Scheme in Tamil Nadu reported negative growth rate for co-operative banks (-1.50%) and high growth rate for commercial banks (22.40%) during 2000-11. Mehta et al., (2016) in their study on Indian Kisan Credit Card Scheme found similar results about compound growth rates in their study during 2004-14. Prakash et al., (2022) also found similar results.

Progress of KCC scheme with respect to amount sanctioned in India

The sanctioned amount under KCC programme by different financial institutions during study period is presented in Table 3. Average sanctioned amount under KCC scheme was highest in commercial banks (Rs. 48294 crores) followed by co-operative banks (Rs. 13244 crores) and RRBs (Rs. 8329 crores) over the period 1999-2019. The growth of commercial banks was found highest i.e. 19.75 per cent per annum during 1999-2019.

However, RRBs was exhibiting growth rate of 14.27 per cent

annually during 1999-2019. The fraction of co-operative banks in total amount sanctioned by various institutions under KCC was 47.77 per cent in 1999-00 came down to 12.62 per cent in 2018-19 divulging steep decline over the years with growth rate 2.06 per cent during whole study period. It indicates financial health of co-operative banks in the country is worsening over the years. The coefficient of variation was highest in commercial banks i.e. 82.00 per cent with respect to amount sanctioned followed by RRBs and co-operative banks i.e. 54.00 and 32.00 per cent, respectively during time period 1999-2019. The results were supported by research work done by Sajane et al., (2011) Economic evaluation of Kisan Credit Card scheme reported compound growth rates for co-operative banks, RRBs and commercial banks 2.78, 43.25 and 14.53 per cent per annum during time period 1998-2009. Similarly Rajmohan and Subha (2014) on Kisan Credit Card Scheme in India revealed similar rate of growth for the sanctioned credit amount under the scheme during 2009-13.

Region-wise progress of kisan credit card scheme in India

The progress of different regions throughout the country in regard to KCC scheme with respect to total of KCCs issued and credit amount sanctioned for the year 1999-2019 is presented in Table 4. Total Kisan credit cards issued in India recorded a growth rate of 4.00 per cent per annum while amount sanctioned had a rate of growth of 13.50 per cent per annum over the time period 1999-2019. The performance of Kisan Credit Card scheme varied from region to region.

With respect to number of cards issued, North-eastern region comprising states namely Assam, Arunachal Pradesh, Meghalaya, Mizoram, Manipur, Nagaland, Tripura and Sikkim showed highest

Table 3. Progress of KCC scheme in terms of amount sanctioned in India: 1999-2019

Year	Amount sanctioned (Rs. in crore)						Total
	Commercial Banks	Proportion in total (%)	RRBs	Proportion in total (%)	Co-operative Banks	Proportion in total (%)	
1999-00	3537	46.86	405	5.37	3306	47.77	7268
2000-01	5615	34.18	1400	8.52	9412	57.30	16427
2001-02	7524	29.10	2382	9.21	15952	61.69	25858
2002-03	7481	28.47	2955	11.25	15841	60.28	26277
2003-04	9331	42.83	2599	11.93	9855	45.24	21785
2004-05	14756	43.16	3833	11.21	15597	45.62	34186
2005-06	18779	39.45	8483	17.82	20339	42.78	47601
2006-07	26215	56.10	7373	15.78	13141	28.12	46729
2007-08	20421	40.85	9074	18.15	20492	40.99	49987
2008-09	25865	55.42	7632	16.35	13172	28.22	46669
2009-10	39940	69.25	10132	17.57	7606	13.19	57678
2010-11	50438	69.45	11468	15.79	10719	14.76	72625
2011-12	69510	75.82	11520	12.57	10640	11.61	91680
2012-13	101090	80.05	13260	10.50	11920	9.44	126280
2013-14	103710	76.40	15846	11.67	16195	11.93	135751
2014-15	104496	82.75	10812	8.56	10968	8.69	126276
2015-16	111528	78.55	12128	8.54	18325	12.91	141981
2016-17	88100	76.90	11242	9.81	15220	13.29	114562
2017-18	82047	76.80	11336	10.61	13448	12.59	106831
2018-19	75507	74.79	12707	12.59	12743	12.62	100957
Mean	48294.5	-	8329.4	-	13244.55	-	69868
C.V. (%)	82	-	54	-	32	-	63
CGR (%)	19.75	-	14.27	-	2.06	-	13.58

Source: RBI (various issues) and NABARD (various issues)

Table 4. Total of KCCs issued, sanctioned amount under KCC scheme by various institutions in different regions of India
(Number in lakh and amount in billion Rs.)

Region	1999-00		2018-19		CAGR (1999-00 to 2018-19)	
	No. of cards	Amount sanctioned	No. of cards	Amount sanctioned	No. of cards	Amount sanctioned
Commercial Banks						
East	1.5	2.4	11.2	64.2	12.4	17.8
West	1.8	8.1	23.4	216.8	14.8	12.5
North	4.5	13.8	18.3	196.4	18.2	24.7
South	5.5	10.8	22.7	246.6	23.1	33.0
North-East	0.3	0.3	11.7	31.1	29.0	45.2
India	13.6	35.4	86.3	755.1	8.8	19.7
Regional Rural Banks						
East	0.0	0.0	4.8	28.4	24.3	41.0
West	0.2	0.2	2.2	30.7	14.5	27.7
North	1.2	2.9	4.3	38.8	4.1	34.5
South	0.3	1.0	4.7	24.9	3.6	33.8
North-East	0.0	0.0	0.6	4.3	18.2	5.3
India	1.7	4.1	16.5	127.1	6.8	14.3
Co-operative Banks						
East	5.0	4.6	4.8	13.5	-3.7	4.0
West	11.0	14.1	10.3	65.3	-4.7	-1.8
North	12.3	11.2	5.2	16.9	-18.5	-23.2
South	7.6	3.2	10.4	30.2	-2.8	-3.2
North-East	0.0	0.0	1.5	1.5	2.1	2.1
India	35.9	33.1	32.2	127.4	-1.78	2.1
All Banks						
East	6.5	7.0	20.8	106.1	16.9	12.8
West	13.0	22.4	35.9	312.8	3.9	3.6
North	18.0	27.9	24.7	252.1	8.4	31.2
South	13.4	15	37.8	301.7	3.0	35.5
North-East	0.3	0.3	13.8	36.9	17.7	45.8
India	51.3	72.6	135.1	1009.5	4.0	13.5

Source: Various issues of RBI and NABARD

annual growth rate *i.e.* 17.70 per cent followed by Eastern region (16.90%) states including Odisha, West Bengal, Andaman and Nicobar island, Bihar, Jharkhand, Chattisgarh and Madhya Pradesh, Northern region (8.40%) having states Haryana, Himachal Pradesh, Jammu and Kashmir, New Delhi, Punjab, Rajasthan, Chandigarh, Uttarakhand and Uttar Pradesh, Western region (3.90%) comprising Gujarat, Maharashtra, Goa, Daman and Diu, Dadar and Nagar Haveli and Southern region showed lowest growth rate (3.00%) including Karnataka, Kerala, Andhra Pradesh, Tamil Nadu, Telangana, Lakshadweep and Pondicherry for the study period 1999-2019.

With respect to sanctioned credit amount under KCC scheme, the annual rate of growth found highest in North-eastern region (45.80%) followed by Southern region (35.50%), Northern region (31.20%), Eastern region (12.80%) and Western region (3.6%) during 1999-2019. The annual rate of growth was found more in Eastern region because of more numbers of branches and increasing awareness in the recent years. Bista et al., (2012) also reported positive rate of growth for KCC scheme in all the regions of India and North-Eastern region had highest growing rate during time period 2000-2011 in their study on progress and performance of Kisan Credit Card scheme with a case study of Bihar. Kamble (2009) in his research Role of Kisan Credit Cards in the benefit of small farmers also observed that the performance KCC in Southern states found poor and in Northern region was quite good.

CONCLUSION

The number of KCCs and amount sanctioned showed growth during 1999-2019 in India. At all India level, the growth rates with respect to total cards issued and sanctioned credit amount were found positive for time period 1999-2019. The compound growth rates with respect to total number of cards issued and sanctioned credit amount under KCC scheme were 4.01 and 13.58 per cent per annum. Among various agencies, at all India level, commercial banks revealed maximum progress while co-operative banks indicated least for KCC scheme during 1999-2019. The compound growth rate of commercial banks, RRBs and co-operative banks for number of cards issued were 8.83, 6.78, -1.78 per cent per annum, respectively. The compound growth rate for sanctioned credit amount under KCC scheme by commercial banks, RRBs and co-operative banks were 19.75, 14.27 and 2.06 per cent per annum, respectively. Among the regions, North-Eastern region (17.7%) showed the highest rate of growth with respect to total number of Kisan Credit Cards issued and sanctioned credit amount under KCC scheme during the study period. Commercial banks showed maximum progress in all regions of India over the study period. More number of bank branches should be opened for uniform growth of KCC scheme in different

regions of India to cover large number of households under KCC scheme. Co-operative banks must be strengthened in the states across the country to participate actively and to cover large number of villages for extending KCC scheme.

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Factors Influencing the Utilization Pattern of Kisan Mobile Advisory Service

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ABSTRACT

The research was undertaken on 123 respondents of Banaskantha district of Gujarat state selected through multistage sampling method with the target to establish the relationship between farmer-subscribers' profile characteristics and their Kisan Mobile Advisory Service (KMAS) utilization pattern. The data was collected using a structured schedule and the respondents were interviewed personally. The information was analysed with mean, standard deviation, frequency, percentage, multiple regression and stepwise regression for a meaningful interpretation. The multiple regression analysis indicated that the 'Z' values of age, education, scientific orientation, extension participation and attitude had essentially accorded in disclosing the variety to the utilization pattern of KMAS. The stepwise regression investigation showed that extension participation was the most (69.80%) impacting attribute for usage of KMAS. As such, these factors ought to be considered while determination of the farmers for execution of extension programmes.

INTRODUCTION

Notwithstanding previous periods of great economic expansion, India's agriculture sector has had modest productivity growth. For productivity growth to be faster, there are many challenges to be addressed, including inadequate infrastructure, supply chain inefficiencies, along with access to and diffusion of information. Regaining agricultural dynamism is the key challenge for government and policy makers. Developing the next generation of technology and infrastructure in India is crucial for achieving a greater agricultural growth rate during the second green revolution. Small and marginal farmers, who make up the bulk of farmers in India, frequently lack access to correct information targeted at raising yields and pushing up crop prices (Mittal et al., 2010; Panda et al., 2019; Panda et al., 2020).

The availability of adequate information is critical for increasing agricultural productivity (Sharma et al., 2012; Nain et al., 2015). Information and Communication Technology (ICT) could make the greatest contribution by telescoping distances and reducing the cost of interaction between stakeholders. ICT has the potential

to help farmers in the entire cycle of production, i.e., from production to sales. Both detectable and undetectable exchange costs are impacted by ICT as suggested by Bhatnagar (2008). Most efforts to make ICT available to rural farmers have sought to improve the availability and quality of information either indirectly through producer associations, extension workers and the like, or directly through broadcast radio information, telecentres, and mobile short messaging services (SMS) (Bertolini, 2004). An investigation carried out by De Silva & Ratnadiwakara (2008) likewise, discovered that gherkin farmers belonging to Sri Lanka had the option to work on their livelihoods through straightforward cell phone applications that diminished waste through a criticism framework. Most of the farmers applied the advisories given by KVK on day to day farming activities and they were satisfied with the use of information sharing app (Patel et al., 2020). The execution of the Kisan Mobile Advisory Service (KMAS) scheme in Krishi Vigyan Kendra's front-line extension system is another ICT drive pointed toward meeting farmers' data needs and assumptions. KMAS was made by the Indian Council of Agricultural Research (ICAR) determined to give free agricultural information to however

many farmers as would be prudent in their local language by means of SMS. It is managed by KVKs all throughout India. Agronomy, plant protection, horticulture, animal science, home science, dairy, and other topics are covered in KMAS. Farmers benefit greatly from KMAS because it gives free information, delivers location-specific information, provides information in local languages, and is cost-effective. KMAS has been implemented in 192 KVKs across India, one of which being KVK Deesa. The Kisan Portal of the Ministry of Agriculture, Government of India, is utilized by KVK to send SMS to farmers. As its crucial to understand the elements that influence the utilization of KMAS by farmer-subscriber for its improvisation. So keeping this in view the study was mainly focused to reveal the relationship between the profile characteristics of the farmers of Banaskantha district and utilization pattern of KMAS.

METHODOLOGY

The multistage sampling technique was used for drawing the sample. The research was conducted in Banaskantha district, in the state of Gujarat. Agricultural technological information is being provided through KMAS by Krishi Vigyan Kendra (KVK) in that area. ICAR has selected KVK Deesa for mobile consulting services since the year 2009 from the 192 KVKs that were chosen in the first phase. Since KVK Deesa's work area is the Banaskantha district, it was purposefully chosen. Banaskantha district is divided into 14 talukas, out of which, six talukas namely Tharad, Deesa, Dhanera, Lakhani, Deodar and Amirgadh talukas were selected according to the highest number of KMAS farmer subscribers. Three villages in each taluka were purposefully chosen based on the number of subscribers of KMAS. Random sampling method was used in selection of respondents in proportion to 30 per cent of the subscribers from each selected village. Altogether, a sample comprising of 123 farmers was chosen. Keeping in view the objectives of the study, relevant variables for the study were selected on the basis of reviewed literature and by consulting the experts. The data was gathered using a structured schedule through one-on-one interviews with respondents.

Multiple regression analysis was carried to find out the combined effect of independent variables in explaining variation of the dependent variables. The stepwise regression analysis was done to know the significant factors with their prescient capacity in clarifying the variety in the reliant variable (Snedecor & Cochran, 1967).

RESULTS AND DISCUSSION

All the independent variables listed in Table 1 together explained as much as (83.20%) of total variation in utilization pattern of KMAS among the respondents. The unexplained variation (16.80%) could be attributed to factors beyond the present study.

Table 1 further shows that 'Z' values of five variables i.e., age (-2.481), education (4.335), extension participation (2.649), scientific orientation (2.498) and attitude (2.359) were significant either at 1% or at 5% level. Thus, these five variables greatly aided in analyzing the differences in KMAS usage patterns. At the 5% level, age had a negative and significant impact on KMAS utilization

Table 1. Multiple regression analysis of the selected independent variables with utilization pattern of KMAS

S.No.	Independent variables	Regression Coefficient (b)	S.E. of 'b'	'Z' value
1.	Age	-0.133	0.053	-2.481*
2.	Education	1.198	0.276	4.335**
3.	Farming experience	-0.006	0.058	-0.099 ^{NS}
4.	Farming system	0.176	0.341	0.516 ^{NS}
5.	Land holding	0.033	0.229	-0.144 ^{NS}
6.	Annual income	-0.229	0.204	-1.126 ^{NS}
7.	Sources of information	-0.102	0.089	-1.147 ^{NS}
8.	Extension participation	0.481	0.182	2.649**
9.	Scientific Orientation	0.337	0.135	2.498*
10.	Attitude	0.170	0.072	2.359*

Constant = 26.726, $R^2 = 0.832$, Multiple 'R' = 0.912, * Significant at 5% level, ** Significant at 1% level, NS Not significant

pattern. The most likely explanation is that young farmers are more enthusiastic than older farmers. As a result, younger farmers used KMAS more than older farmers. Farmers in their golden years had more farming experience, as a result, may be aware of certain elements. This could be behind the lesser usage of the KMAS by older farmers. The results are contrary with Hinduja et al., (2017) and similar with Patil & Patel (2021).

It's possible that the above patterns are related to the fact that education benefits people by acquiring them knowledge, broadening their horizons and motivating higher outcomes. Education turns outwards and opens up new opportunities in life. Literacy farmers may be able to locate, comprehend, interpret, evaluate, and apply information obtained through KMAS. The results related to education are in line with Joshi & Dhaliwal (2019).

Participation in agricultural extension commits to the agrarian society's full and equal engagement in technology transfer. In addition, the involvement of farmers in various extension programs offers many opportunities to obtain detailed information that can help farmers selected by KVK as KMAS subscribers.

Science-oriented farmers tend to cultivate using scientific methods. Another cause could be that better incomes and active participation in various extension programmes have helped in the development of a progressive and scientific mindset, which may lead to farmers using more KMAS services (Singh & Verma, 2021; Malik et al., 2021). A positive attitude towards new innovation is the first condition for its acceptance. A positive attitude always makes it easier and faster to accept technology. Therefore, the positive attitude of farmers can help them to use KMAS more as found by Patil & Patel (2017).

It is apparent from the Table 1, that variables viz., farming experience, farming system, land holding, annual income and source of information were not significant. Thus these variables failed to contribute significantly to utilization pattern of KMAS. The results are in accordance with Shinde et al., (2019); Joshi & Dhaliwal (2019). Farming is, in general, a hereditary profession, and most farmers begin farming at an early age. As a result, the older the farmer is, the greater farming experience he has. As a result, it's possible that they may be unaware of the significance of some of the messages. As age was found to be negatively related with

Table 2. Stepwise regression analysis of the independent variables with utilization pattern of KMAS

S.No.	Independent variables	Partial Regression Coefficient (b _j)	S.E. of b _j	'Z' value	Std. Partial Regression Coefficient (b' _j)	Rank
1.	Extension participation	0.587	0.169	3.476**	0.274	III
2.	Education	1.326	0.246	5.338**	0.293	II
3.	Age	-0.156	0.028	-5.585**	-0.312	I
4.	Scientific orientation	0.346	0.134	2.586*	0.175	IV

Constant = 30.493; R² = 0.820; Multiple 'R' = 0.906; * = Significant at 5% level; ** = Significant at 1% level

KMAS utilization pattern, a negative relationship between farm experience and KMAS utilization pattern seems plausible. Because most of the farmers used agriculture + animal husbandry farming system, which turned out to be widespread across the entire research area's farmers, the utilization pattern may not have been influenced. A farmer's land holdings are largely inherited from his parents and have no bearing on his education, extension activities, scientific approach, or attitude. Because the farmers who utilized KMAS had a variety of land holdings ranging from small to large, the results looked to be accurate. Farmers' annual income may not have had an impact on KMAS usage patterns because KMAS transmits information to them at no cost.

Stepwise regression analysis

The stepwise regression analysis was carried out for explaining the variation in the dependent variable. All the 10 selected independent variables were taken into account in the stepwise regression analysis as described in Table 2.

Four variables viz., extension participation, education, age and scientific orientation all together explained as much as 82.0 per cent of total variation in the respondents' utilization pattern of KMAS (Table 2). The unexplained variation of (18.0%) could be attributed to factors other than the ones listed above. Table 2 shows the 'z' values for extension participation, education, age and scientific orientation variables were found significant either at 5% or at 1% level indicating significant contribution of these four variables in utilization pattern of KMAS. The partial regression coefficient indicates a change of one unit in extension participation, education, age and scientific orientation would change (0.587), (1.326), (-0.156) and (0.346) units in respondents utilization pattern, respectively. Based on the results of stepwise regression analysis, following regression model was obtained.

$$Y = a + b_8X_8 + b_2X_2 + b_1X_1 + b_9X_9$$

Where, Y= Predicted dependent variable, a= The intercept i.e., 30.493, b₈= Partial regression coefficient of Y on X₈ (Extension participation), b₂= Partial regression coefficient of Y on X₂ (Education), b₁= Partial regression coefficient of Y on X₁ (Age), b₉= Partial regression coefficient of Y on X₉ (Scientific orientation)

By substituting the value of 'a' and 'bi' the model take place as under:

$$Y = (30.493) + (0.587) X_8 + (1.326) X_2 + (-0.156) X_1 + (0.346) X_9$$

Because each independent variable has its own unit of measurement, the partial regression coefficient value could not be compared. The partial regression values were translated into standard partial values, which were free of measurement units, to

make comparisons easier. Following that, the independent variables were sorted using standard partial regression coefficient values (b'_i), as shown in Table 3. From highest to lowest, the order of these four factors was (i) age (-0.312), (ii) education (0.293), (iii) extension participation (0.274), (iv) scientific orientation (0.175). From the preceding results of stepwise regression analysis, it can be determined that (82.00%) of the variation was accounted for by extension participation (X₈), education (X₂), age (X₁) and scientific orientation (X₉) put together on utilization pattern of KMAS.

Table 3 further shows that the variable, extended participation alone, accounted for a significant 69.80% variation in utilization pattern of KMAS, followed by extension participation + education (06.00%), extension participation + education + age (05.20%) and extension participation + education + age + scientific orientation (01.00%). Finally the stepwise regression analysis clearly indicated that extension participation emerged as an important attribute and highly influenced the utilization pattern of KMAS by the farmers. Further higher education, younger age and scientific outlook of the farmers also affected the utilization pattern as per order of importance.

Table 3. Stepwise variation accounted by selected independent variables towards utilization pattern of KMAS

S.No.	Independent variables	Multiple 'R'	Total variation accounted (R ²)	Variation between step
1.	X ₈	0.835	0.698 (69.80 %)	69.80
2.	X ₈ +X ₂	0.871	0.758 (75.80 %)	06.00
3.	X ₈ +X ₂ +X ₁	0.900	0.810 (81.00 %)	05.20
4.	X ₈ +X ₂ +X ₁ +X ₉	0.906	0.820 (82.00 %)	01.00
Total				82.00

Note: X₈= Extension participation, X₂=Education, X₁=Age, X₉= Scientific orientation

CONCLUSION

From the above discussion, it could be concluded that practically all farmers had a positive view about KMAS. As a result, KMAS has a broad scope in delivering information services to farmers in our nation so that they may make informed judgments about successful farming in areas where the ratio of extension staff to farmers is low. Among all the variables extension participation was the most influencing attribute for utilization pattern whereas, education, age, scientific orientation and attitude were the important variables contributing to the extent of utilization of KMAS by the farmers. Based on the findings, it is possible to conclude that these variables should be considered while selecting farmers for extension programme implementation.

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Knowledge Level of DAESI and Non-DAESI Dealers for Paddy and Wheat Cultivation in Punjab

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ABSTRACT

The study was conducted during 2020 in Ludhiana and Faridkot district of Punjab to know the knowledge level of DAESI (Diploma in Agricultural Extension Services for Input Dealers) and non-DAESI dealers about paddy and wheat cultivation in Punjab. From the study it was found that DAESI dealers had medium to high level of knowledge on wheat where non-DAESI dealers had medium to low level of knowledge. DAESI dealers had high level of knowledge on cultivation practices of paddy than non-DAESI dealers. In case of DAESI dealers, education, economic motivation, management orientation, decision making, mass media utilization and extension contact had positive and significant relationship with knowledge about cultivation practices of wheat and paddy. But only education had positive and significant relationship with knowledge about cultivation practices of wheat and paddy in non-DAESI dealers.

INTRODUCTION

National Institute of Agriculture Extension Management (MANAGE) has propelled a one-year certificate course titled “Diploma in Agricultural Extension Services for Input Dealers (DAESI)” in the year 2003, which illuminates pertinent and area explicit agricultural instruction to furnish these input dealers with adequate information to change them into para-extension professional to empower them to address the present issues being looked by the farmers at the field level. Picturing this significance of the program, Government of India has pronounced DAESI as Central Sector Plan Scheme since October 2015. In Punjab, the programme has started under Punjab Agricultural Management and Extension Training Institute (PAMETI) in Ludhiana and Agricultural Technology Management Agency (ATMA) in Faridkot district during 2018-19. Till now, three batches at PAMETI, Ludhiana and two batches at ATMA, Faridkot have completed their training from both centres. As per the MANAGE guidelines, a batch of 40 agri-

input dealers participate in this programme every year. PAMETI in Ludhiana focuses upon the training of paddy, wheat, maize, oilseeds while ATMA in Faridkot focuses more in cotton and wheat.

Improving farmers expertise requires hands on education, such as provided by the FFS Kumar et al., 2007; Kumar and Nain, 2013). There has been evidences that trained and non trained stakeholders have significant difference in their knowledge regarding the subject matter (Raina et al., 2017; Kobba et al., 2020a, Kobba et al., 2020b; Singh et al., 2021). Srinivas (2013) revealed that majority (41.70%) of DAESI holders had medium level of knowledge about cotton production technology whereas in case of non-DAESI holders 48.30 per cent had medium level of knowledge about cotton production technology. Regarding paddy, 43.40 per cent DAESI holders had high level of knowledge whereas 45 per cent non-DAESI input dealers had medium level of knowledge. Nain and Bhagat (2005) revealed that the knowledge difference between trained and non-trained women farmer was significant. Chinmayee (2018) discovered that seed and seed production technique (54.90%) had the greatest

impact on knowledge scores. The total knowledge scores obtained by DAESI dealers differed by 35.95 per cent from those obtained by non-DAESI dealers. She observed that majority (60.00%) of DAESI dealers had medium level of knowledge whereas majority (96.66%) of input dealers had low level of knowledge. According to Khatri et al., (2018), most agro-input dealers knew of research recommendations. The majority of agro-input dealers (87%) who had not taken the DAESI course had low to medium knowledge about research recommendations 95.00 per cent DAESI had medium to high understanding about research recommendations. The agro-input traders who had done the DAESI course knew more about plant protection, agricultural techniques, and variety. The studies in other ecologies state the difference of knowledge of two groups but there has not been any specific study conducted on the effectiveness of this programme till date. As such the study was organized to study the effectiveness of Diploma in Agricultural Extension Services for Input Dealers (DAESI) programme in Punjab state.

METHODOLOGY

The study was conducted in Ludhiana and Faridkot districts of Punjab state. Ludhiana and Faridkot districts were selected purposively for research study as DAESI programme conducted

by PAMETI, Ludhiana and ATMA, Faridkot. From 2 selected districts, 60 input dealers (30 DAESI dealers and 30 non-DAESI dealers) from each district were selected through simple random sampling technique, thus making the total sample size of 120 respondents. Knowledge level on wheat and paddy production technology was assessed with specifically designed knowledge test. Relationship with socio personal characteristics was established and multiple regression was performed to analyse the factors affecting the knowledge level about cultivation practices of wheat of input dealers.

RESULTS AND DISCUSSION

Knowledge level of input dealers about cultivation practices of location specific crop

The knowledge of the respondents about the recommended practices of rice and wheat cultivation was measured with the help of knowledge test development for the study. The respondents were categorised into three groups such as low, medium, and high based on range method, as presented in Table 1. Majority of input dealers (51.67%) had medium level of knowledge about cultivation practices of wheat. Majority of DAESI dealers (50.00%) had high level of knowledge about cultivation practices of paddy where majority of non-DAESI dealers (53.33%) had medium level of knowledge.

Table 1. Distribution of respondents according to their knowledge about cultivation practices of wheat crop

S.No.	Parameters	Categories	DAESI % (n=60)	Non- DAESI % (n=60)	Total % (n=120)
1	Knowledge on Wheat	Low (6-9)	8.33	41.67	27.50
		Medium (10-13)	46.67	56.67	51.67
		High (14-17)	40.00	01.66	20.83
2	Knowledge on Paddy	Low (9-12)	16.67	21.67	19.17
		Medium (13-16)	33.33	53.33	43.33
		High (17-20)	50.00	25.00	37.50

Table 2. Difference in knowledge about cultivation practices of location specific crops between DAESI and non-DAESI dealers

S.No.	Parameters	Categories	Mean	Standard Deviation	Z- value
1	Knowledge on wheat	DAESI	12.41	2.359	6.158**
		Non-DAESI	10.01	1.683	
2	Knowledge on paddy	DAESI	15.75	2.814	3.317**
		Non-DAESI	14.20	2.275	

**-. Significant at 0.01 level of probability

Table 3. Relationship of socio-psychological characteristics of input dealers with knowledge level of input dealers

S.No.	Independent Variables	Correlation Co-efficient		Correlation Co-efficient	
		DAESI Dealers	Non-DAESI Dealers	DAESI Dealers	Non-DAESI Dealers
X ₁	Age	-0.157	-0.032	-0.133	0.045
X ₂	Education	0.914**	0.318*	0.909**	0.415**
X ₃	Business Experience	0.247	-0.025	0.205	-0.013
X ₄	Annual Income	0.136	0.146	0.119	0.321*
X ₅	Economic Motivation	0.367**	0.050	0.378**	0.032
X ₆	Management Orientation	0.439**	0.009	0.429**	-0.113
X ₇	Decision Making	0.968**	0.024	0.966**	0.084
X ₈	Self Confidence	0.252	0.272*	0.236	0.021
X ₉	Mass Media Utilisation	0.930**	0.151	0.888**	0.187
X ₁₀	Extension Contact	0.957**	0.032	0.962**	-0.129

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

Table 1 indicated that the mean value of knowledge about cultivation practices of wheat in DAESI and non-DAESI dealers were 12.41 and 10.01 respectively. The calculated value of Z is 6.158 which is more than the tabulated value at 0.01 level of probability. The mean value of knowledge about cultivation practices of paddy in DAESI and non-DAESI dealers were 15.75 and 14.20 respectively. The calculated value of Z is 3.317 which is more than the tabulated value at 0.01 level of probability. Hence, there is a significant difference between knowledge level of DAESI and non-DAESI dealers.

Relationship of socio-psychological characteristics of input dealers with knowledge level

Table 2 indicated that education, economic motivation, management orientation, decision making, mass media utilization and extension contact had positive and significant relationship with knowledge level of DAESI dealers about cultivation practices of wheat and paddy at 0.01 level of probability. Education and self-confidence had positive and significant relationship with knowledge level about cultivation practices of wheat of non-DAESI dealers at 0.05 level of probability. Education had positive and significant relationship with knowledge level about cultivation practices of paddy of non-DAESI dealers at 0.01 level of probability. Annual income had positive and significant relationship with knowledge level on paddy of non-DAESI dealers at 0.05 level of probability.

Determinants of factors affecting knowledge level of input dealers

Data in the Table 4 indicated that the variation in knowledge about cultivation practices of wheat by selected independent variables were explained to the extent of 96 and 32 per cent in DAESI and non-DAESI dealers respectively. Decision making, mass media utilization and extension contact in case of DAESI dealers whereas education and self-confidence in case of non-DAESI dealers contributed significantly for the variation in knowledge about cultivation practices of wheat. Due to the high level of mass media utilization and extension contact DAESI dealers had improved their knowledge about cultivation practices of wheat. That's why mass media utilization and extension contact had contributed significantly to knowledge level of DAESI dealers about cultivation practices of wheat. Due to higher level of knowledge DAESI dealers had made correct decision in their business. So, decision making contributed significantly to variation in knowledge about cultivation practices of wheat. Majority of the non-DAESI dealers had completed graduation. So, education had contributed significantly to variation in knowledge about cultivation practices of wheat in case of non-DAESI dealers.

Data in Table 5; the variation in knowledge about cultivation practices of paddy by selected independent variables were explained to the extent of 97 and 36 percent in DAESI and non-DAESI dealers respectively. Decision making, age, extension contact and self-

Table 4. Multiple regression analysis for the factors affecting the knowledge level about cultivation practices of wheat of input dealers

S.No.	Independent Variable	DAESI Dealers (n=60)		Non-DAESI Dealers (n=60)	
		Regression Coefficient	't' Value	Regression Coefficient	't' Value
X ₁	Age	0.012	1.41	0.021	0.55
X ₂	Education	-0.041	-0.42	0.369**	3.09
X ₃	Business Experience	0.009	0.91	-0.04	-1.00
X ₄	Annual Income	0.002	0.08	0.0994	0.77
X ₅	Economic Motivation	-0.023	-0.54	0.061	0.52
X ₆	Management Orientation	0.026	1.57	-0.052	-1.19
X ₇	Decision Making	0.269*	2.20	-0.0032	-0.03
X ₈	Self Confidence	-0.04	-1.61	0.168*	2.29
X ₉	Mass Media Utilisation	0.645**	3.69	0.224	1.27
X ₁₀	Extension Contact	0.429**	2.89	0.081	0.54
R ²		0.9650		0.3198	

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

Table 5. Multiple regression analysis for the factors affecting the knowledge level about cultivation practices of paddy of input dealers

S.No.	Independent Variable	DAESI Dealers (n=60)		Non-DAESI Dealers (n=60)	
		Regression Coefficient	't' Value	Regression Coefficient	't' Value
X ₁	Age	0.0239**	2.42	0.036	0.79
X ₂	Education	-0.049	-0.43	0.457**	3.27
X ₃	Business Experience	-0.014	-1.18	-0.049	-1.03
X ₄	Annual Income	-0.010	-0.33	0.286	1.91
X ₅	Economic Motivation	0.016	0.33	-0.002	-0.02
X ₆	Management Orientation	0.025	1.32	-0.041	-0.81
X ₇	Decision Making	0.608**	4.32	0.013	0.11
X ₈	Self Confidence	0.063*	2.20	0.049	0.57
X ₉	Mass Media Utilisation	0.0609	0.30	0.221	1.07
X ₁₀	Extension Contact	0.553**	3.24	-0.131	-0.75
R ²		0.9674		0.3614	

confidence in case of DAESI dealers whereas education in case of non-DAESI dealers contributed significantly for the variation in knowledge about cultivation practices of paddy. Decision making and extension contact contributed significantly at 0.01 level of probability where self-confidence contributed significantly at 0.05 level of probability in DAESI dealers. In non-DAESI dealers education contributed significantly at 0.01 level of probability. Due to higher level of knowledge DAESI dealers had made correct decision in their business. So, decision making contributed significantly in variation in knowledge about cultivation practices of paddy. Due to the high level of extension contact DAESI dealers had improved their knowledge about cultivation practices of paddy. High level of self-esteem and self-confidence help the DAESI dealers to acquire more knowledge. DAESI dealers had high level of knowledge about cultivation practices of paddy so they had high risk bearing ability. Majority of the non-DAESI dealers had completed graduation. So, education had contributed significantly in variation in knowledge about cultivation practices of wheat in case of non-DAESI dealers.

CONCLUSION

The assessment of knowledge level of input dealers revealed that there is significant difference between knowledge level of DAESI dealers and non-DAESI dealers about cultivation practices of wheat and paddy crop. DAESI dealers had high level of knowledge about cultivation practices of paddy and wheat crop than non-DAESI dealers. Further, this study would throw light on the relationship as well as direct and indirect effects of personal and socio-economic factors associated with knowledge level of input dealers on recommended practices of paddy and wheat crop. The study revealed that DAESI programme helps in improving knowledge level of input dealers about cultivation practices.

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Assessment of Farmer's Attitude and Social Vulnerability to Climate Change in the Semi-arid Region

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ABSTRACT

This study was conducted in the semi-arid region, Agra of Uttar Pradesh, during 2016-19 to assess farmers' perceptions and attitudes about climate change and farmers' social vulnerability; and identify the significant factors that influence social vulnerability. Primary data was collected from 120 farmers using a well-structured interview schedule. Results revealed that most respondents recognized the decline in the rainfall quantum and rise in temperatures and the increase in the frequency of hot days and droughts. Almost all respondents believed that soil and water conservation measures were most effective in mitigating the adverse effects of climate change. The social vulnerability index illustrated that more than half of respondents were moderate socially vulnerable in climate-changing scenarios. The multiple regressions results confirmed that land size, total income, perception, knowledge, awareness of climate change phenomena, and adaptive capacity were significant predictor variables for social vulnerability to climate change. There is a need to improve knowledge and perception and change attitudes among the respondents through an educational campaign, mass media exposure, and individual contact with trained extension personnel to effectively cope with the consequences of climate change.

INTRODUCTION

Agriculture is expected to be the most affected sector due to climate change (IPCC, 2007). Climate change and extreme hazards like floods and severe droughts lead to substantial crop losses, volatility of food prices, and livelihood insecurity. The projection assesses that 2.5°C to 4.9°C rises in temperature will lead to a 32-40 per cent drop in rice yields and 41-52 per cent in wheat productivity in India, which can cause a GDP drop of 1.8-3.4 per cent (Gupta & Pathak, 2016). Climate change is likely to have adverse environmental and socio-economic impacts on Indian agriculture, especially rainfed agriculture. These impacts depend on farmers' perceptions, attitudes, and adaptive capacity to climate change. Previous studies (Banerjee et al., 2015; Ravikumar et al., 2015; Dupdal et al., 2021) reported that climate change adaptation

strategies could not be effective without understanding farmers' perceptions, knowledge, and attitude toward climate change. Even the extension professional knowledge regarding impact of climate change in agriculture was reported to be low to moderate (Ghanghas et al., 2015). With farmers' perception, knowledge and perspective, vulnerability is also one of the critical components of risk. Its assessments offer insights and allow investigation of the complex relationships between humans and their socio-physical environments (Fraser et al., 2011). The social vulnerability has emerged as the least known element under the changing climatic scenario. It explicitly deliberates on all socio-economic and demographic factors affecting the magnitude of impacts of climate change (Heinz, 2002). Information on social vulnerability also helps establish actions by informing policymakers and practitioners, alerting the public, raising awareness, stimulating discussion, gaining

funding, etc. Vulnerability's impact on the individual's behaviour depends on their perception of risks and their capability to confront such risks. The situation recalls an urgent need to develop and deploy enhanced adaptation and mitigation strategies to provide quality of life under changing climate scenarios. In India, research on social vulnerability and the role of soil and water conservation technologies in mitigating the effects is limited. Still, there are multiple works on measuring social well-being, inequalities, poverty, and social exclusion. Therefore, it is crucial to assess how society responds to climate change and identify the significant driver of social vulnerability under changing climate scenarios.

METHODOLOGY

The ICAR-Indian Institute of Soil and Water Conservation, Research Centre in the semi-arid region of Agra, India carried out the study during 2016-19, as Agra is one of the highly vulnerable districts to climate change (Ramaraio et al., 2014). A multiple-stage sampling procedure was employed to select a sample of 120 respondents. Three blocks from Agra and one village from each selected block were selected randomly. Primary data from respondents was collected through a well-developed and pre-tested interview schedule. Perception and attitude towards climate change were measured on a Likert types scale of 1-5 (strongly agreed, agreed, undivided, disagreed, and strongly disagreed), and attitude statements included 11 positive and four negative statements). A scoring pattern of 5 to 1 for positive statements and 1 to 5 for negative statements was used in the study. A composite social vulnerability index was calculated and respondents were grouped into highly vulnerable, moderately vulnerable, and less vulnerable categories based on the social vulnerability index. The values of each social vulnerability indicator were normalized by applying the following formula:

Index value = (Actual value – Minimum value)/ (Maximum value – Minimum value)

The index value was reversed for the indicator with a negative connotation (1- index value). The overall index was estimated from

the sub-indices weighted average, and the respective weights for sub-indices were drawn from literature and experts' opinions. The overall equation for the model employed in the study is mentioned below:

$$HSVI = \sum (I_i * W_i) \quad \dots(1)$$

HSVI refers to household social vulnerability index; I_i means sub-index, and W_i was weighted by the sub-index. The HSVI range from 0 to 1; close to 0 means high vulnerability, and 1 means high resilience. Since indicators are dynamic, HSVI provides a general picture that allows comparisons among communities, identifying vulnerable households, and appropriate policy for climate change adaptation.

A stepwise multiple regression approach was used to identify the significant drivers of the farmer's social vulnerability. In this article, age (A), land size (L), education (E), number of livestock (N), income (I), social participation (S), mass media exposure (M), extension agency contact (C), awareness about climate change (AC), attitude (T), perception about climate change (P), knowledge (K) were used as the explanatory variables. The following specific multiple regression model was used in this study.

$$SV = f(A, L, E, N, I, S, M, C, AC, F, T, AC, P, K) \quad \dots(2)$$

$$SV = b_0 + X b + \epsilon \quad \dots(3)$$

RESULTS AND DISCUSSION

Respondent's perception and attitude towards climate change

The farmer's perception of climate change is vital for effectively implementing any policy/strategies on climate change in actual field situations (Arunachalam et al., 2020). The weighted mean of statements above 4 showed that most of the respondents identified significant indicators of climate change in the form of irregular, untimely, and enhanced frequency of extreme rainfall, increase in temperature or heatwaves droughts and water shortage (Table 1). Thus, most farmers perceived that climate change was a severe issue. Similarly, results showed that farmers believed that climate change affects agriculture in their area. Respondents

Table 1. Distribution of respondents according to their perception of climate change

Statement	Weighted mean
Climate change is real	4.02
Climate change is a severe problem	3.78
Climate change is affecting agriculture	4.10
Industrialization is responsible for climate change	3.74
Heavy use of fossil fuels has led to rapid global climate change	3.76
Large-scale deforestation is a reason behind the present climate change	3.94
Compared to the past; the monsoon rainfall occurs earlier now	2.58
Compared to the past, nowadays, the monsoon rainfall retreats earlier	3.79
Nature and intensity of rainfall have become more unusual	4.12
Droughts have become more frequent than in the past 10-20 years	3.95
In the coming 10-20 years, the frequency of droughts will be decreased due to climate change	2.89
In the coming 10-20 years, the monsoon rainfall will occur much earlier than now	2.67
In the coming 10-20 years, problems of water shortages or stress will be increased due to climate change	4.05
In the last 10-20 years, there has been an increase in heatwaves	4.17
Low yields of crops in the recent past are due to climate change	4.07
In the next 10-20 or so years, livestock will be more adversely affected	3.99
Changing the sowing date and time would be a better strategy to adapt to climate change	3.45
In the coming years, desertification of arable land will be increased	3.77
Heard about different climate-resilient technologies?	2.95

perceived that climate change had a powerful negative impact on crop and livestock yields. The results showed that the respondents identified industrialization, heavy use of fossil fuels, and large-scale deforestation as reasons behind climate change. However, most of the respondents were not well aware of the climate-resilient strategies such as zero & minimum tillage, cover crops, mulching, conservation agriculture, *etc.* to overcome or tackle the adverse effects of climate change. Therefore, there is a need for an educational campaign to increase awareness among farmers about climate change and its causes. Climate Resilient Agriculture (CRA) must be motivated and mobilized to adopt proper adaptation measures and mitigation practices to cope with the adverse events effects of climate change.

Table 2 presented revealed the weighted mean score of attitude toward climate change results showed that the highest mean score (3.85) was found for the statement that scientists could find solutions to the problems of climate change, followed by the statement that humans could find ways to adapt to the vagaries of climate change (3.58). The weighted mean of most statements ranged from 3.00 to 3.50. It revealed that the predisposition of the respondents is mixed due to variations in the belief system and personality. Respondents showed a negative attitude towards protecting the environment, maintaining ecological balance and biodiversity. Nevertheless, respondents showed an attitude of dependency on external agencies, the Government, for managing problems being given rise by climate change. The data could not deduce farmers' attitudes toward self-initiated adoption behaviour. Hence, it is imperative to provide motivational, attitudinal, and infrastructural support to the people to develop their capabilities to adopt village-centric adaptive mechanisms and measures.

Social vulnerability and influencing factors

The household social vulnerability index (HSVI) scores ranged from 0.104 (most vulnerable) to 0.572 (least vulnerable). About 62 per cent of respondents fall under the moderately vulnerable group, while about 21 per cent fall in the highly vulnerable group. These findings are in line with Raghuvanshi et al., (2020). The description, mean, and SD of explanatory variables used in the model for identifying significant variables are presented in Table 3.

The results of significant factors influencing social vulnerability presented in Table 4 and the coefficient of land size (0.33) showed that farmers who have a larger size of own land are more climate-resilient than farmers who have marginal landholding as a positive sign of coefficient showed the resilience to climate change or less social vulnerability. Similar results were found by Sugden et al., (2014). The coefficient of total income (0.26) revealed that income is also a key driver of social vulnerability as it enhances education access, wealth, physical assets ownership, and coping capacity (Rufat et al., 2015). The coefficients of perception (0.31), knowledge (0.23), and awareness (0.18) were positively significant at a 95 per cent confidence level, and these results showed that households those having a high level of perception, awareness, and knowledge were more climate-resilient. Thus, these variables are significant drivers of social vulnerability to climate change; the positive significant coefficient of knowledge is in line with the previous studies' results that reported education commonly correlates positively with adopting agriculture conservation practices or climate-resilient technologies (Meena et al., 2020). The coefficient of adaptive capacity of households was found positively significant at a 99 per cent significance level, which showed that households with more adaptive capacity were less socially vulnerable to climate change. Further, these factors are also positively associated with extension agencies' contact, mass media exposure, and social participation (Harvatt et al., 2011). Thus study identified the land size, total income, perception, knowledge, awareness of climate change phenomena, and adaptive capacity as the leading empirical drivers of social vulnerability to climate change. Therefore, policymakers should focus on improving perception and awareness through improving access to information and education level (through effective use of extension system and mass media exposure) to promote the adoption of adaptation strategies for coping with the adverse effects on agriculture and women's drudgery needs to be addressed in this era of climate change (Bishnoi et al., 2014).

Results presented in Table 5 illustrated that more than 75 per cent of the respondents believed that change in cropping patterns might be beneficial to overcome the adverse impact of climate change. The majority of the respondents expressed casual labour,

Table 2. Distribution of respondents according to their attitude toward climate

Statement	Weighted mean
Do worry about the loss of flora and fauna	3.28
Humans can find ways to adapt to the vagaries of climate change	3.58
The Scientists will find solutions to the problems of climate change	3.85
The indigenous knowledge system of the area holds the potential to find solutions to climate change problems and make sustainable adaptations for livelihood and survival	2.80
Climate change is beyond control - it is too late to do anything now	3.60
It is the wrath of God for the greed and unhealthy ways of humans toward nature	3.25
The effects of climate change are too far in the future to worry	3.43
The environment is a low priority compared to livelihood and other things	3.11
It takes too much effort to do environmentally friendly things	3.26
hard to change habits to be more environmentally - friendly	3.27
Individual behaviour, everyday lifestyle, and livelihood activities contribute to climate change	3.15
Can afford to lose some of the area's biodiversity to meet the livelihood demands of the people of the area	2.94
There is nothing that individuals can do personally to help stop the loss of biodiversity	3.04
The Government must maintain ecological balance in the area	3.82
The community has a more significant role than the Government in checking ecological degradation in the area	3.48

Table 3. Definition and descriptive statistics of variables employed in the analysis

Variables	Description	Weighted Mean	SD
Age	Years	54.24	12.23
Land size	ha	1.38	1.17
Education	Farmer's education level; If illiterate = 0 Can read and write = 1, Primary -2, Middle school-3, Secondary school -4, Higher Secondary-5, Graduate-6, Above graduate-7	2.21	1.68
Total income	Net income annually (Rs.)	149414	12292
Social participation	Membership in farmer's organization/association; If a non-member-0, member-1	0.98	0.59
Mass media exposure	Index worked out on a scale of 0-2; 0 = Never, 1 = occasionally, and 2 = regularly	0.37	0.28
Extension agency contact	Index worked out on a scale of 0-2; 0 = Never, 1 = occasionally, and 2 = regularly	0.31	0.24
Awareness	Number of Yes and No answers to a question related to awareness of climate change (If Yes- 1, No -0)	0.60	0.26
Fatalism	Value orientation of fatalism about climate change measured with an index computed on a scale of 1-5	3.42	0.41
Attitude	An attitude of farmers toward climate change is measured with an index computed on a scale of 1-5	3.11	0.22
Adaptive capacity	Number of correct answers about skills related to adaptation practices (If correct-1, Incorrect-0)	0.31	0.27
Perception	The perception of farmers about climate change was measured with an index computed on a scale of 1-5	3.85	0.39
Knowledge	Number of correct answers about adaptation practices (If correct- 1, Incorrect -0)	0.67	0.26

Table 4. Major factors influencing the social vulnerability

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	SE				Tolerance	VIF
Constant	-0.140	0.089		-1.578	0.120		
Knowledge	0.090	0.041	0.229	2.200	0.032	0.531	1.884
Land size	0.026	0.007	0.330	3.884	0.000	0.799	1.252
Extension agency contact	0.064	0.034	0.158	1.872	0.067	0.815	1.226
Total income	3.0E-07	0.000	0.264	3.132	0.003	0.811	1.233
Perception	0.082	0.027	0.312	2.994	0.004	0.531	1.882
Adaptive capacity	0.086	0.030	0.242	2.837	0.006	0.792	1.262
Awareness	0.038	0.017	0.185	2.300	0.025	0.895	1.117
R ²	0.688						
Adjusted R ²	0.648						

Note: SE= standard errors, VIF= variation inflation factor

selling of trees from fields, and bore-well as adaptive strategies to deal with climate change. Based on the socio-economical and psychological characteristics of the respondents, it is inferred that the people in the semi-arid area need a concerted approach in their capacity building for improving their adaptive potential. Thrust areas of intervention in the semi-arid region include an emphasis on afforestation, intensification of research, promotion of conservation agriculture and climate-resilient technologies, Govt. financial support in the implementation of SWC structures, building up the preparedness to face the climate change apart from enlightenment campaign, educating people in health and environment protection, etc. (IISWC, 2020).

Table 5. Adaptive technologies to climate change

S.No.	Coping Strategies	Percentage of Respondents
1	Migration	3
2	Bore-well	33
3	Change in cropping pattern	76
4	Partial sale of livestock	23
5	Distress selling off assets	9
6	Casual labours	36
7	Selling of tress from field	36

SWC practices as a mitigating strategy for climate change

Table 6 depicted that all respondents believed that soil and water conservation (SWC) measures, viz. contour bund, farm pond, Nala bund, check dam, recharge filter are beneficial in mitigating the effects of climate change. Similarly, more than two-thirds of farmers perceived that bunding and leveling are very helpful in mitigating the impacts of climate change. Thus, the SWC measures were considered a pivotal strategy for mitigating the impact of climate change on agriculture and improving farmer's income (Meena et al., 2021).

Table 6. Soil and water conservation practices

S.No.	Conservation measure/ practice	Help in mitigating the effects of Climate Change		
		Fully	Some What	Not at All
1	Bunding	33.33	35.19	38.89
2	Contour Bund	100.00		
4	Vegetative bund		15.00	85.00
5	Broad bed furrow	14.29		85.71
6	Summer Ploughing			88.89
7	Farm Pond	100.00	100.00	
8	Nala bund	100.00	100.00	
9	Check Dam	100.00	100.00	
10	Recharge filter	100.00	100.00	

CONCLUSION

Results reveal that most respondents recognize the change in climate change indicators such as an increase in temperatures and heatwaves and fluctuation in the rainfall pattern and intensity. Respondents attributed industrialization, heavy use of fossil fuels, and large-scale deforestation to climate change. Respondents have a negative attitude toward protecting the environment and maintaining ecological balance and biodiversity. Interestingly, respondents think that scientists and humans can solve climate change. Results confirm that soil and water conservation plays a significant role in mitigating climate change's adverse effects. The social vulnerability index reveals that about two-thirds of respondents were moderately socially vulnerable to climate change. Farmer's perception, awareness, and knowledge of climate change, adaptive capacity, and land size are the significant drivers of social vulnerability in climate-changing scenarios. There is a 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 by evolving farmers-centric long-term climate adaptation and mitigation policy.

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Social Media Use Profile of Farmers in Haryana

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ABSTRACT

Social media are digital networks that are used to share and discuss user generated information - opinion, video, audio, and multimedia spreading far and wide even in remote areas of the country and has changed the way farmers communicate and interact. This study was conducted in 2021, with an objective to understand the use of social media by farmers and to analyze its relationship with economic profile characteristic. The data were collected personally from Hisar and Sonapat districts of Haryana, with a sample size of 200 respondents comprising 25 farmers from eight villages through a structured interview schedule. Findings revealed that 69.00 per cent of the respondents were in medium category of social media use. Garrett ranking analysis revealed that watching videos was the most preferred purpose of social media use among farmers followed by chatting/ connecting with peers. Also, YouTube was found to be most preferred social media followed by WhatsApp and Facebook. Further, education, family income, cosmopolitaness-localiteness, social participation, extension contact and extension participation showed positive relationship with social media use while age had negative relationship. Also, regression analysis showed that the eleven personal variables selected for the study could explain 53.30 per cent variation in the social media use.

INTRODUCTION

Social media are web-based tools of electronic communication that allow users to personally interact with others individually or in groups for the purposes of exchanging information, sharing thoughts and opinions, influencing and facilitating decision-making by creating, storing, retrieving and exchanging information in any form (text, pictures, video, etc.) by anyone in the virtual world (Saravanan & Suchiradipta, 2016). These are digital networks that are used to share and discuss user generated information - opinion, video, audio, and multimedia (Andres & Woodard, 2013). As per digital 2020, the number of mobile phone users in world is 5.2 billion while the number of internet users is 4.66 billion. The active social media users worldwide stood at 4.14 billion, a 53.00 per cent

penetration. The world combine spends 10 billion hours on social media everyday with an average active user spending 2 hours 29 minutes per day on different social media platforms. India with a population of over 1.3 billion has 1.06 billion mobile phone connections. The number of social media users in India are 450 million as in 2020. WhatsApp is the most used social media with 53 crores active users followed by YouTube (448 million) & Facebook (41 million). Instagram, Twitter and Telegram have 21 million, 4 million and 1.75 million active users respectively (Digital 2020 and GOI data published in India today, 2021).

Social media has now become a mainstream form of communication across the globe, and its influence is increasing with the rise in the number of smart phone users (Lathiya et al., 2015) although television, radio, agriculture officer and progressive farmers

and other personal sources still dominate into strong group of information sources usefulness and overall agricultural information system (Ravikumar et al., 2015; Nain et al., 2015).

ICT tools are mostly used to get benefit of general communication and entertainment purpose and less for marketing and other productive purpose (Panda et al., 2019). Social media platforms are not confined to transfer and sharing of agricultural information but also provide farmers with holistic knowledge about ongoing developments in their surroundings. The extension mechanism for purposeful farmer to farmer learning exchange is also created which in turn may be a step towards innovative farmer led extension delivery mechanism (Nain et al., 2019). Social media also helps farmer to connect with extension agents and specialists to get real time solution to their specific problems. Many progressive farmers are able to sell their products directly to the retailers and consumers by using social media. Keeping these observations in view, this study aims to get an insight on the use of social media by farmers, purpose of social media use and preferred social media platforms.

METHODOLOGY

The study was conducted in Hisar and Sonipat districts which were selected from west and east zones of Haryana respectively. Two blocks Hansi-1 and Hisar-2 were selected randomly from Hisar districts while Rai and Kharkhoda blocks were selected from Sonipat district. Further, two villages were selected from each of the four blocks randomly. In Hisar, Umra and Garhi were selected from Hansi-1 block whereas, Balsamand and Arya Nagar were selected from Hisar-2 block. In Sonipat, Manouli and Halalpur were selected from Rai block while Kanwali and Rohat were selected from Kharkhoda block. Also, Twenty-five farmers having smart phone facility were selected from each of the villages, thus a total of 200 farmers were selected for the study. The data were collected through personal interview technique with the help of structured interview schedule and analyzed using MS Excel and Statistical Package for Social Sciences (SPSS). In order to measure social media use, the respondents were asked questions about use of different social media, time spent on social media, purpose of using social media, perceived benefits of using social media, pattern of social media use and usefulness of social media, etc. The scores for these questions were added to get overall score of a respondent and then respondents were categorized into low medium and high based on his/her total score using mean and standard deviation. Also, to get more clarity on the use of social media respondents were asked to

rank in order of preference the purpose for which they use social media, what social media means to them and which social media were most preferred by them and the ranking done by all of the respondents were analyzed using Henry Garret ranking technique. Additionally, Correlation and regression analysis was carried out to understand the relationship between social media use and socio-economic traits of the farmers.

RESULTS AND DISCUSSION

Social media use

The data in Table 1 reveal that more than two-thirds of the respondents (69.00%) belonged to medium category with respect to overall social media use followed by high category (18.50%). It can be concluded from the data that vast majority of farmers were actively using social media although their extent of use differs. Affordable smart phones, improved connectivity in villages, cheaper data plans and increasing awareness about ICT might be the reasons for these results. The findings were also supported by Jat et al., (2021) who revealed that majority of farmers (59.70%) were in medium group of ICT use followed by low and high group.

Table 1. Distribution of respondents on the basis of overall use of social media

S.No.	Category	Frequency	Per centage
1	Low (<43)	25	12.50
2	Medium (43-67)	138	69.00
3	High (>67)	37	18.50

Preference and ranking of purpose of social media use by the respondents

It can be inferred from Table 2 that watching videos (rank 1st) with average value of 65.16 was the most preferred option when it comes to purpose of social media use by the respondents followed chatting/connecting with friends, peers and relatives (rank 2nd) and getting agriculture related information (rank 3rd) with average value of 60.70 and 57.21 respectively. Interacting with buyers and sellers (rank 7th) and connecting with agricultural institutions and government agencies (rank 6th) were the least preferred options with average value of 28.94 and 39.71 respectively, when the respondents were asked to rank the purpose of their social media use. It can be concluded here that respondents use social media more for entertainment and personal use than for professional purposes like building a network of potential buyers and sellers or connecting

Table 2. Preference and ranking of purpose of social media use by the respondents (n=200)

S.No.	Purpose of social media use	Total Value	Average Value	Rank
1	To get agriculture related information	11442	57.21	3
2	Learning about new innovations & techniques	10980	54.90	4
3	To connect with agricultural institutions & Govt. agencies	7942	39.71	6
4	Chatting/ connecting with friends, peers & relatives	12141	60.70	2
5	Watching Videos	13023	65.15	1
6	Interacting with buyers and sellers	5788	28.94	7
7	Any other*	8884	44.42	5

*includes leisure activities, casual browsing & searching, group and video calls

with govt. departments, agencies and agricultural institutions. Although, some progressive farmers were using social media for the purpose of learning about new innovations and techniques developed in the field of agriculture. The findings are in line with Kumar et al., (2019) who stated that, online chatting, entertainment, news, networking and browsing were the main social media activities in which farm youth were engaged in. Further, they concluded that most farming youth lack proper knowledge of social media use in agriculture.

Preference and ranking of what social media means to the respondents

It was evident from Table 3 that of all the factors ranked by the respondent, social media as a means of entertainment is ranked 1st with the highest average value (63.16), followed by source of information (rank 2nd) and source of leisure time (rank 3rd) with average value of 56.90 and 54.89 respectively. Social media as a source of income and source knowledge were the last and 2nd last with average value of 26.61 and 43.55 respectively. It can be concluded from the table that respondents give more preference to social media as a source of entertainment and source of information over other options. This can be attributed to the fact that social media is yet to reach its full potential in rural India. At present, farmers view social media mainly as a means of entertainment and focus more on contents related to personal consumption like music videos, short videos, sharing jokes etc. over professional contents. The results are supported by Jain & Sanghi (2016) who stated that people of rural India access internet mainly for consumption of contents related to new and videos.

Table 3. Preference and ranking of what social media means to respondents

S.No.	Social media means	Total Value	Average Value	Rank
1	Source of entertainment	12633	63.16	1
2	Source of information	11380	56.90	2
3	Source of leisure time	10979	54.89	3
4	Source of Knowledge	9111	43.55	6
5	Source of income	5322	26.61	7
6	Basic need	10719	53.59	4
7	Source of Personal Communication	10056	50.28	5

Preference and ranking of different social media by the respondents

It can be concluded from Table 4 that YouTube (rank 1st) was the most preferred choice of social media among the respondents with average value of 64.74 followed by WhatsApp (rank 2nd) and Facebook (rank 3rd) with average value of 63.90 and 61.81 respectively. The results are in line with the findings of Balkrishna & Deshmukh (2017), who observed that YouTube, WhatsApp and Facebook were the most popular social media applications. Also, Instagram was ranked 4th while Twitter (rank 6th) was the least preferred social media among the farmers. Moreover, while Facebook, WhatsApp and YouTube were preferred by respondents across all categories, Instagram was generally preferred more by

Table 4. Preference and ranking of different social media by the respondents (n=200)

S.No.	Social Media	Total Value	Average Value	Rank
1	Facebook	12362	61.81	3
2	WhatsApp	12781	63.90	2
3	YouTube	12948	64.74	1
4	Twitter	5964	29.82	6
5	Telegram	7609	38.04	5
6	Instagram	8336	41.68	4

young farmers as compared to middle and old farmers whereas only a small group of well-educated farmers preferred Twitter. The findings are similar to Joshi & Dhaliwal (2019) who revealed that more than half of the farmers were regularly using Facebook while 82.00 per cent and 78.00 per cent farmers were using WhatsApp and YouTube respectively. Further, they revealed that more than 80.00 per cent farmers never used Twitter while 78.00 per cent farmers never used Instagram. The results were also supported by the study of Khou & Suresh (2018) which stated that YouTube was the most popular social media followed by Facebook & WhatsApp.

Relationship between profile of the respondents with social media use

It can be concluded from Table 5 that personal variable of the respondents' such as education, family income, landholding, cosmopolitaness-localiteness, mass media exposure, social participation, extension contact and extension participation were significant and positively correlated (at 0.01% level of probability) with social media use while age had significant but negative relationship with social media use. This might be due to the fact that young farmers use a greater number of social media and for multiple purposes as compared to old farmers who use lesser number of social media (mainly Facebook, WhatsApp and YouTube) and for limited purposes. This is supported by the study of Kaur (2014), which revealed that social media use varied between

Table 5. Relationship between profile of respondents with social media use

S.No.	Personal Variables	Correlation coefficient ('r' value)	Regression coefficient (B value)
1	Age	-0.257**	-4.815
2	Gender	0.015	0.281
3	Education	0.443**	2.352
4	Family type	0.011	0.354
5	Family income	0.407**	0.723
6	Land Holding	0.197**	0.342
7	Cosmopolitaness-Localiteness		
I	Personal Localite	0.377**	0.403
II	Personal Cosmopolite	0.482**	0.331
8	Mass Media Exposure	0.317**	0.561
9	Social Participation	0.406**	1.159
10	Extension Contact	0.526**	0.768
11	Extension Participation	0.361**	1.312

R² = 0.533, Constant=17.972

** Correlation is significant at 0.01 level of significance; NS = Non-Significant

different age groups and young generation spend greater time on social media than the older generation. Also, as social participation, contacts with extension functionaries and participation in extension activities increases use of social media increase as farmers tend make more use of social media to build relationship, make connections and interact with peers and experts. Similarly, education makes farmer more capable of understanding the benefits of ICTs like social media and make their better utilization. The findings are similar to Joshi & Dhaliwal (2019) who revealed that age had negative relation with social media utilization while education has positive relationship. Further, Family income also showed significant relationship as higher incomes means greater affordability which in turn affects availability and accessibility of modern ICT tools such as smartphones, desktops and laptops. The results are also supported by the Raghuprasad et al., (2012) who found that education, landholding & annual income had positive and significant relationship with utilization of ICT tools.

The regression analysis gave value of R^2 as 0.533 which revealed that 53.30 per cent variation in the social media use could be explained by the eleven variables selected in the study.

CONCLUSION

The study concludes that majority of farmers were in medium category of social media use. Watching videos is the most preferred purpose of social media use followed by chatting/connecting with friends and peers. Social media is viewed by respondents as source of entertainment followed by source of information. YouTube is the most preferred social media followed by WhatsApp and Facebook. Socio-personal traits of farmers such as education, family income, cosmopolitaness-localiteness, social participation, extension contact and extension participation show positive relationship with social media use while age show negative relationship. It can be implied from the study that while social media are used by farmers, it is yet to reach its full potential when it comes to making its productive use for agriculture related activities. Farmers are using social media more often for personal purposes such as entertainment rather than using it for professional reasons.

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Perception of the Jute Growers on Attributes of Innovation- CRIJAF SONA

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ABSTRACT

To improve the quality of the jute fibres CRIJAF SONA was developed and disseminated by ICAR- Central Research Institute of Jute and Allied Fibres (CRIJAF). A study was carried out on 2021 in North 24 Parganas and Nadia districts respectively to assess the various aspects of CRIJAF SONA as perceived by the randomly selected 80 jute growers using structured interview schedule. The index values of perceived attributes of CRIJAF SONA for relative advantage, compatibility, complexity, observability and trialability were calculated as 93.87, 88.25, 43.08, 93.33 and 94.69 respectively. The technology effectiveness was found as 85.41 which shows that the technology is having favourable perception in selected jute growing areas.

INTRODUCTION

Jute is one of the major commercial crops in West Bengal, traditionally grown for its fiber through a microbial process called 'retting'. Usually, the mature stem of the harvested jute plant is soaked in pond. Retting is a preferred rotting process that split up the fibers from the jute stem without degrading the cellulose fibers. Microbes that assist in retting consume non-fibrous materials i.e., pectin and hemicellulose. Retting is one of the significant operations that determine the quality of jute yarn and therefore its price. In order to improve the quality of the jute fibres a microbial formulation, CRIJAF SONA, was developed by ICAR-Central Research Institute of Jute and Allied Fibres (CRIJAF) (Majumdar et al., 2011). The technology is very promising as retting of jute by the microbial formulation is completed within a shorter time than the conventional methods and also improves the grade of fibre. The talc-based formulation has been disseminated to the clientele group, so that the technology could become the integrated part and parcel of their farming practices. But only extension efforts are not sufficient to transfer the technologies to the farmers but also the perceived attributes of technology are the important factors that affect the transfer of technology process (Jamanal & Sadaqath, 2018).

The attributes of any technology refer to its typical characteristics that determines its position, its relation with the

existing beliefs and values in any social system and thus differentiates it from other innovations in terms of its adoption and sustenance. The selection and purchase of farm innovations are related with the attributes of the technologies like relative advantage, trialability, durability, implement's simplicity and initial cost (Patil & Kokate, 2021). Moreover, the extent of adoption of modern technologies are substantially affected by attributes like relative advantage and observability, while, the complexity enforces a relatively negative impact on adoption (Singh et al., 2021).

The farmers' perceptions of the attributes of any innovation cannot be the equivalent to that of the experts' perceptions. The strength of need of the different components were perceived differently by both the stakeholders (experts as well as farmers), the experts concentrated on accuracy of information, practicability of information, use of language, profitability, clarity of information, economic parameters, technical details and procedural details in order as prime focus, whereas the farmers expressed the high relevance for materials required, technical details, precautions to be taken, clarity of information, procedural details, accuracy and practicability of information and use of illustrations (Nain et al., 2019). Therefore, farmers' perception of the attributes about any technology is very important for the extension scientists/ researchers that affect its rate of adoption as well as its sustainability (Rogers, 2003). In this context, the specific objective to measure the

perception of the respondents with regard to attributes of CRIJAF SONA was framed in order to carry out the present study.

METHODOLOGY

The ICAR-CRIJAF has disseminated the innovative jute production technology i.e., CRIJAF SONA in their adopted villages of North 24 Parganas and Nadia districts in 2014. So, Kumra village under Habra Block, North 24 Parganas District and Brahmapur village under Haringhata Block, Nadia District were purposively selected for the present study. For the selection of respondents those farmers who have adopted the innovative jute technology, CRIJAF SONA, were considered; accordingly, 40 adopter jute growers from each village were selected as respondents following simple random sampling method. Thus, the total respondents were 80 jute growers adopting CRIJAF SONA. Exploratory research design was followed to carry out the present study as the study aims to explore the perception of the jute growers towards the technology.

Perception was operationalized in the present study as practical understanding of the jute growers regarding the utility and interpretation of various aspects of the technology, CRIJAF SONA during its adoption. The way how the attributes of a technology perceived by a farmer was classified into five ways i.e., relative advantage (extent to which a technology is perceived better than the previous one), compatibility (extent to which a technology is perceived as compatible with the existing beliefs, values and previous knowledge of adopters), complexity (extent to which a technology is perceived as difficult to comprehend and apply), observability (extent to which the consequences of a technology are visible prominently) and trialability (extent to which a technology may be applied and experimented in the limited area). To measure the perceived attributes of CRIJAF SONA, an index consisting of 26 items pertaining to the above-mentioned perceived attributes of the talc-based microbial formulation were selected through judge's rating which were having inter-rater reliability of more than equal to 60 per cent. Among the 26 items, 7 items of relative advantage, 5 items each of compatibility, complexity, observability and 4 items under trialability of CRIJAF SONA considered most relevant by the experts were selected for final administration to a sample of 80 jute growers. During administration to the respondents these items were rated on three-point continuum i.e., disagree, undecided and agree with scores 1, 2, 3 respectively. The total perception score for individual respondent was calculated by summation of individual score in each sub items elicited by the individual farmer.

$$\text{Perceived attributes of technology index} = \frac{\text{Sum of actual score obtained}}{\text{Sum of maximum possible score}} \times 100$$

Technology effectiveness was operationalised as the average perceived attributes of the technology that determined its rate of adoption in a positive way.

$$\text{Technology Effectiveness} = \frac{\text{Relative advantage} + \text{compatibility} + \text{non complexity} + \text{observability} + \text{trialability}}{5}$$

The data were collected with the help of structured interview schedule in the month of March 2021. The responses were recorded and tabulated in order to carry out appropriate statistical analysis.

RESULTS AND DISCUSSION

Relative advantage of CRIJAF SONA as perceived by the jute growers

The data in Table 1 revealed that majority of the respondents have perceived that CRIJAF SONA could reduce the retting period along with improvement of the quality of fibres which had less root content and brought better market value. Some farmers also believed that the fibre recovery was improved due to the absence of the root content in the resultant fibre they got from using the microbial formulation. Approximately, three fourth respondents felt that it could be used in the same water source for repeated retting purpose and for subsequent retting relatively less formulation was required. In relation to the relative advantage of the technology previous studies found that application of CRIJAF SONA helped in retting of jute within 13-15 days duration and led to upgradation of the jute fibres by 1-2 grade(s) with golden yellow colour, strong and more lustrous (Majumdar et al., 2011). There was 9.7 to 12 per cent higher fibre recovery as compared with the conventional method (Das et al., 2017). Resultant fibres through improved retting by using the formulation had 3-4 per cent root content as compared to 18-20 percent in conventional retting (Das et al., 2012). The previous findings implied that the use of the technology had a relative advantage over the conventional retting.

Compatibility of CRIJAF SONA as perceived by the jute growers

A perusal of Table 1 revealed that majority of the adopters perceived the technology as well compatible with their social and cultural system. It was also compatible with 'jaks' of different varieties of jute i.e., JRO 524, CO-58, JRO 128, JRO 8432, Rani etc as reported by the respondents. Some of the respondents perceived the talc-based formulation was well adapted with different sources of stagnant water available in their locality. The perception of the farmers with respect to compatibility of the technology was found to be parallel with the previous studies as well. The All India Network Project on Jute and Allied Fibres (AINP on JAF, 2013-14) reported the formulation is environmentally friendly and does not have any antagonistic effect on the aquatic flora and fauna or on humans or other terrestrial animals making the technology environmentally compatible. The improved jute retting using the

Table 1. The attributes of CRIJAF SONA as perceived by the jute growers

S.No.	Attributes perceived by the adopters	Mean Perception scores	Standard Deviation	Perceived Attributes Index
	Relative Advantage			
1.	Shortening of retting period	3.00	0.00	100.00
2.	Enhancement of fibre quality	2.96	0.19	98.75
3.	Improved fibre recovery	2.65	0.55	88.33
4.	Ease of fibre extraction	2.96	0.19	98.75
5.	Feasibility for repeated retting	2.69	0.54	89.58
6.	Absence of root content in resultant fibre	2.51	0.73	83.75
7.	Better Market price	2.94	0.24	97.92
	Average Relative Advantage Index			93.87
	Compatibility			
8.	Fitted well in the prevailing cultural & social system	3.00	0.00	100
9.	Compatible with different sources of water for retting	2.56	0.67	85.42
10.	Compatible with different varieties of jute 'jak'	2.94	0.29	97.92
11.	Suitable for all climatic conditions	1.74	0.82	57.92
12.	Economically compatible	3.00	0.00	100.00
	Average compatibility Index			88.25
	Complexity			
13.	Difficulty in understanding the procedure of application	1.05	0.27	35.00
14.	Difficulty in application	1.00	0.00	33.33
15.	Difficulty in availability	1.71	0.90	57.08
16.	Difficulty in making pre requisite arrangements before application	1.36	0.64	45.41
17.	Difficulties in taking precautions to be taken care of	1.34	0.64	44.58
	Average Complexity Index			43.08
	Observability			
18.	Better gradation of fibre than traditional practice	2.93	0.31	97.5
19.	Ease of extraction of fibres	2.98	0.16	99.17
20.	Requirement of short period for retting	3.00	0.00	100.00
21.	Less labour requirement	2.61	0.70	87.08
22.	Less requirement of formulation for subsequent usage	2.49	0.60	82.92
	Average Observability Index			93.33
	Trialability			
23.	Formulation can be applied on small scale for trial purpose	2.93	0.38	97.50
24.	Applied in small/stagnant water sources	2.91	0.40	97.08
25.	Applied in small bundles of jute or 'Jak'	2.91	0.40	97.08
26.	Provision of pre-requisite arrangements for trial	2.61	0.72	87.08
	Average Trialability Index			94.69

formulation is user friendly and has got minor amendment over the conventional method (Majumdar et al., 2014) making it well compatible with their existing beliefs and values. The optimum retting temperature is around 34°C. Retting is delayed if temperature fluctuates from 34°C. Heavy rainfall during retting time also delays the retting process because of sharp fall in the retting water temperature (Majumdar et al., 2013), and not suitable for adverse climatic conditions with high rainfall and low temperature as reported by half of the respondents. Majumdar et al., (2019) reported that the quality of the retting water was enhanced by using the formulation and hence its compatibility with different sources of water. Farmers have been benefitted from this product and is required @ 25 kg/ha entailing an investment of around 1100/- (Rs. 44/- per kg) making it highly economically compatible even for small farmers (Das et al., 2017).

Complexity of CRIJAF SONA as perceived by the jute growers

Table 1 shows that majority of the respondents did not find it difficult to understand the method of application of the

formulation and also during practical application in field conditions. Although most of them found it relatively easy to make the pre-requisite arrangements before application as well as precautions to be taken during its application. But almost half of the respondents reported for non-availability of the authentic products in their nearby markets. Certain degree of complexity was observed in the areas where the jute growers should be very careful about the quantity of the talc-based formulation which is applied on the bundles. Over retting causes cellulosic fibre degradation, whereas under retting causes incomplete removal of gummy materials, pectic substances. Both under retting and over retting which are very difficult to regulate results in low-grade jute fibre (Banik et al., 2003). Complexity was also observed during pre-requisite arrangements made before application where farmers were using empty cement bags filled with sand, soil, aquatic weeds like azolla, water hyacinth etc. as covering material for immersion of 'jaks' or jute bundles into the water instead of mud and banana plants as covering material (Saha & Maiti, 2021).

Observability of CRIJAF SONA as perceived by the jute growers

As indicated in Table 1 majority of the respondents clearly visualized the better quality of jute fibres which could be extracted easily within a short period of time as well as reduction in labour requirement during fibre extraction. While only half of the farmers experienced that less amount of formulation was required during subsequent retting of jute fibres. By using the microbial formulation, the extraction process gets accelerated which in turn leads to reduction in the man power for fibre extraction up to an extent of 3-man days/ ha (Das et al., 2017) which was prominently observed by the jute growers. Research found that recommended amount of this microbial formulation was evenly spread over each of the layers of jute bundles during drenching for first time only. For second time retting the doses of formulation is relatively halved and for retting for the 3rd time no talc-based microbial formulation could be used (Das et al., 2017). The farmers could not prominently observe that the doses of the formulation were gradually reducing if it was applied during subsequent retting in the same water source. But with continuous use of the formulation for a considerable period of time, the farmers would be able to know this typical characteristic of CRIJAF SONA.

Trialability of CRIJAF SONA as perceived by the jute growers.

Table 1 indicated that a greater proportion of respondents agreed that CRIJAF SONA could be applied on a very small scale for trial purpose in stagnant water sources. It is also applied in small bundles of jute stems i.e., 'jaks' and for that purpose adequate provision was available to them for setting up pre-requisite arrangements for retting using the formulation.

The perceived attributes index of CRIJAF SONA

Table 1 presents the index values of perceived attributes of CRIJAF SONA i.e., relative advantage, compatibility, complexity, observability and trialability that were estimated as 93.87, 88.25, 43.08, 93.33 and 94.69 respectively. Accordingly, by using the formula the technology effectiveness was calculated as 85.41.

$$\text{Technology Effectiveness} = \frac{\text{Relative advantage} + \text{compatibility} + \text{non complexity}^* + \text{observability} + \text{trialability}}{5}$$

$$= \frac{93.87 + 88.25 + 56.92^* + 93.33 + 94.69}{5} = 85.41$$

(*Complexity index is 43.08, it means 56.92 percent (100 – 43.08) technology was not complex, hence in the calculations index of non-complexity was considered)

Hence higher the value of the technology effectiveness index implies that the technology is well perceived by the jute growers. The technology had high relative advantage, compatibility, observability, trialability and relatively low complexity. Hence the jute growers preferred to take up the technology of talc-based formulation for retting purpose in the study area.

CONCLUSION

The farmers have perceived the technology of CRIJAF SONA as having relatively advantageous than previous technologies in terms of retting aspects. This microbial formulation was also considered as well compatible, having prominent observable results and easily triable within their farms. Results of the study revealed that farmers had more complexity with respect to the pre-requisite arrangements made before application as well as the precautions to be taken care of. These factors were important for proper utilization of the formulation for retting of jute fibers it drags the attention of extension agents and scientists to intensify their efforts in these areas. The effective extension methods like a series of awareness programmes, field days, field visits, interaction sessions along with adequate training and demonstrations would be employed to reduce the complexity of the technology (Patel et al., 2019).

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Socio-ecological Factors Influencing Farmers' Perceptions on Water Management under Conservation Agriculture

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ABSTRACT

Conservation agriculture (CA) is about conserving natural resources through optimum usage along with adopting proper management measures to cut down on excessive use of inputs. Minimum tillage and retention of crop residues on the field help in the conservation of soil moisture and will result in the saving of irrigation water. To inculcate the beneficial effects of CA for conserving water into the minds of the farmer, it is necessary to understand the existing perception of the farmers on water management and also the social as well as ecological factors that influence the perception build up in the farmers. The study was conducted in two districts i.e. Nadia and Hooghly of West Bengal under the new alluvial zone during the year 2018-19, depending on the agricultural intensity and propensity to arsenic contamination in the groundwater. Seventy-five respondents were identified through the snowball sampling method. The results show that variables like age of the farmer, fragmentation of land, income of the farmer per unit of land and stubble height maintained by the farmers have a strong correlation with the perception development of the farmers on water management.

INTRODUCTION

Agriculture in India is the robust consumer of available groundwater and it is close to 78 per cent (CWC, 2020). The indiscriminate depletion of groundwater will lead to a water famine by 2040 as mentioned in the sixth annual report submitted by IPCC on climate change. Sustainable use of groundwater involves well quantified processes in its recharge and discharge. This will also lead to frequent droughts in the summer months putting the production and productivity of the major crops to an almost unanswerable question (Sundstrom & Allen, 2019). In recent years, the world has seen a serious water crisis and more droughts than ever in the century. Agriculture in India is mostly irrigated, using a thousand gallons of water every year. Unscientific irrigation practices and puddling fields lead to wastage and exploitation of groundwater (Malik, 2016). Conservation agriculture (CA), a

relatively new agricultural practice, aims to conserve and make better use of natural resources by maintaining productivity as well (Chatterjee et al., 2021). It can bring about many positive benefits such as reduced soil erosion, better soil water retention and nutrient availability for crops, and increased soil organic matter accumulation (Busari et al., 2015). However, the rapid adoption of this system has outpaced the scientific understanding of the principles of CA (Chatterjee & Acharya, 2021). There is lack of information on the impact of the introduction of CA on nutrient and water use efficiency, soil organic matter dynamics, control of weeds and crop disease, and the interactions between them (Bera et al., 2022). The farmers prefer to consult the information sources of immediate availability and their concern to subject and policies (Peer et al., 2011). Research is therefore required to develop optimal CA management practices adapted to local needs and conditions. The smallholder farming households, especially in rice–wheat production

system require adequate information, input support, awareness as well as incentives and technical knowhow for the uptake of adaptable PCAPs (Shitu et al., 2018). Natural resources like water are free goods and seem to be available in abundance (van Ginkel et al., 2018). Thus, managing such natural resources requires rigorous and focused training of the farmers so that they could develop insights on the importance of managing water in terms of enhancing productivity and restoring ecological resilience together (Saha et al., 2022). The present study elicits the marker variables making a decisive impact on water management and sustainable agriculture. Both participatory and non-participatory approaches have been followed for the alluvial zone, the agro-climatic zone that has already been depleted in favor of agricultural modernization and now is facing the reversal in the form of impoverishment, productivity decline, and biodiversity losses. The present study was undertaken to explore the key factors and issues related to farmers' perceptions of water management under conservation agriculture practices in the New Alluvial Zone (NAZ) of West Bengal. NAZ is one of the six agro-climatic zones of West Bengal with high agricultural importance for crop diversity, production, and productivity. Most of the agriculturally important districts of the state, viz., Nadia, Hooghly, East Bardhaman, Howrah, etc. comes under this agro-climatic zone. The study was intended to extract the nature of the water management behavior of alluvial farmers and to isolate the most dominant variables for a befitting policy formulation toward socializing conservation agriculture.

METHODOLOGY

This study was conducted in the purposively selected two districts, Nadia and Hooghly, from the NAZ of West Bengal. Three community development blocks viz. Balagarh block from Hooghly district and Haringhata and Chakdaha blocks from Nadia district were selected purposively. Thirteen villages, four villages from each block in Nadia district and five villages from Balagarh block in Hooghly district were selected purposively for the present study. A sample of 75 farm households with 369 family members were interviewed from the thirteen villages following a non-random snowball sampling method using personal interview schedules. Respondents were mostly farmers who followed one, two, or all of the three criteria, namely, reduced soil disturbance, permanent soil cover, or crop rotation. Since CA is a new technique in the research locations, only few farmers were practicing CA either partially or fully. Before taking up actual fieldwork, a pilot study was conducted to understand the area, its people, institution, communication, and extension system, and the knowledge, perception, and attitude of the people towards climate change and energy conservation. Data collection for the study had been completed during 2018 to 2019 which corresponds, to maximum agricultural activities. The structured interview schedule used in the present study consists of both open and closed questions consisting of two sets of variables (i) Socio-ecological variables (x_1 - x_{20}) and (ii) dependent variable (y). Farmers' perception of water management(y) was measure during a pre-tested structured interview schedule, and its association with the twenty variables was examined using quantitative approaches such as coefficient of correlation, stepwise regression, and path analysis using IBM SPSS

v26.0 and the web-based programme OPSTAT (Sheoran et al., 1998).

RESULTS AND DISCUSSION

Relation between farmers' perception on water management and selected socio-ecological variables

The perception of farmers' on water management in CA has empirically been tested by developing a set of stimuli statements, which have subsequently been elucidated by experts in the relevant domain. This has been done as to calibrate the farmers' cognitive and functional competency in water management so that the prime objectives of CA can well be socialized among the farmers. Here the perception has been estimated through a set of socio-ecological characters.

Table 1 presents the coefficient of correlation between farmers' perception of water management (y) and socio-ecological variables (x_1 - x_{20}) considered as dependent and independent variables, respectively. It is discernable from the table that the variables, age of the respondent, and stubble height retention have recorded positive and significant correlations, whereas the number of fragments and income per unit of land has recorded negative but significant correlation with the dependent variable under discussion.

The results suggest that the higher the age of the farmers; the better has been the water management. This is because aged farmers are more experienced in water requirements and water stress conditions and how to overcome that strategically through managing the resources. The negative correlation with income per unit of land reveals that the farmers' perception of water management has failed to make any positive contribution to the income of the farmers in the alluvial zone. A similar study shows that socio-economic, institutional, psychological, and biophysical aspects influenced

Table 1. Correlation coefficient of farmers' perception of water management (y) and selected socio-ecological variables (x_1 - x_{20})

Independent Variables	'r' Value
Age (x_1)	0.448**
Education (x_2)	0.192
Family size (x_3)	-0.171
Farm size (x_4)	0.153
Cropping intensity (x_5)	-0.088
No. of fragments (x_6)	-0.426**
Annual income (x_7)	0.044
Income per capita (x_8)	0.143
Income per unit of land (x_9)	-0.434**
Annual expenditure (x_{10})	-0.062
Stubble height (x_{11})	0.480**
Volume of residue (x_{12})	0.140
Scientific orientation (x_{13})	0.014
Innovativeness (x_{14})	0.104
Extension agency contact (x_{15})	0.150
Information seeking behavior (x_{16})	0.157
Residue management score (x_{17})	-0.055
Perception on natural resource degradation (x_{18})	0.083
No. of livestock (x_{19})	0.140
Mass media utilization (x_{20})	-0.030

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

farmers' willingness to invest in soil and water conservation technologies (Moges & Taye, 2017). Water conservation and crop management proficiency may be increased through training and farmer-to-farmer contact, which implies that conservation knowledge gaps may be resolved, and adoption does not appear to be an enormous challenge (Dalton et al., 2014). While the fragmentation hinders the adoption of efficient water management since it makes farms more cost-prodigious (Breen et al., 2018). Since the area enjoys a rainfall regime ranging from 1700 to 1900 mm per year, farmers do not pay additional attention to water management on their farms. This offers a challenge for the socialization of CA in terms of water management wherein the farmers are already blessed with the bounty of water, both in terms of groundwater regime and total annual precipitation.

Predicting relative contribution of selected socio-ecological variables on farmers' perception of water management

CA technologies ensure advantages to minimize agricultural costs, conserve water and nutrients, enhance yields, diversification of crops, improve resource efficiency, and help the environment although, there are many barriers to CA technology adoption (Bhan & Behera, 2014). Table 2 presents the path analysis of the dependent variable, farmers' perception of water management (y), wherein the total effect (coefficient of correlation) has been decomposed into direct, indirect, and residual effects. It has been recorded that the variable stubble height retention has exerted the highest direct effect on farmers' perception of water management (y). It implies that for the alluvial agroecosystem, water management perception has got a collateral impact exerted by stubble height retention. This is because stubbles help to conserve soil moisture by covering the ground surface and reducing evaporation loss. This curbs down the water requirement of the next crop, especially during the sowing time. Thus, stubble height retained in the field by the farmers has direct implications on their water management strategies. Farmers' irrigation methods differ due to the uneven availability of

canal and tube well water, which may affect salt and water balances in the fields (Kazmi et al., 2012). The highest indirect effect has been exerted by exogenous variable income per capita.

This is extremely important that income has been a strong determinant in deciding the extent of water management by the farmers. The research continuously points out that without consideration of the economy of CA, the ecology of CA cannot be addressed. The variable income per unit of land has routed the highest indirect effect in as many as eight variables to ultimately characterize and scale up the level of water management. A parallel study also reveals that, despite the farmers' positive perceptions of inadequate irrigation water management practices as the prime reasons for increasing water shortages, low crop yields, productivity reduction, and negative environmental consequences, their overall adaptation measures were insufficient (Yohannes et al., 2017). Farmers are limited in their capacity to manage irrigation water effectively due to a lack of technical expertise, a weak enforcement capability of the Water Users Association (WUA), and insufficient irrigation infrastructure (Yami, 2013). The consequent study also reveals that the greatest strategy to boost rural farmers' water productivity and livelihood preservation is to employ integrated rainwater harvesting from agricultural lands and then put it to numerous uses in their crops (Kumar et al., 2021) as well as understanding farmer socio-personal characteristics and production environment in which the farmer operates, are the prerequisite for the dissemination of any soil and water conservation technologies at the farm level for greater acceptance (Arya et al., 2019). The residual effect being 0.428 means 42.8 per cent of the variance could not be explained by the present set of socio-ecological variables (exogenous variables).

Table 3 shows that variables, stubble height retention (x_{11}), age of the respondent (x_1), number of fragments (x_6), and income per unit of land (x_9) have been retained at the last step. The R square value is 51.80 per cent that reveals that these four variables together explain 51.8 per cent of the variance embedded in the

Table 2. Path analysis of farmers' perception on water management (y) vs. socio-ecological variables

Variables	TE	DE	IE	HIE
Age (x_1)	0.448	0.268	0.180	0.087(x_6)
Education (x_2)	0.192	0.002	0.190	0.050(x_9)
Family size (x_3)	-0.171	-0.117	-0.054	-0.088(x_6)
Farm size (x_4)	0.153	0.071	0.082	0.101(x_9)
Cropping intensity (x_5)	-0.088	0.005	-0.093	-0.066(x_9)
No. of fragments (x_6)	-0.426	-0.312	-0.114	-0.075(x_1)
Annual income (x_7)	0.044	0.023	0.021	-0.065(x_8)
Income per capita (x_8)	0.143	-0.115	0.258	0.076(x_{10})
Income per unit of land (x_9)	-0.434	-0.269	-0.165	-0.105(x_{11})
Annual expenditure (x_{10})	-0.062	0.131	-0.193	-0.070(x_3)
Stubble height (x_{11})	0.480	0.319	0.161	0.089(x_9)
Volume of residue (x_{12})	0.140	0.023	0.117	0.073(x_9)
Scientific orientation (x_{13})	0.014	-0.151	0.165	0.066(x_9)
Innovativeness (x_{14})	0.104	-0.011	0.115	0.033(x_{11})
Extension agency contact (x_{15})	0.150	0.111	0.039	0.025(x_9)
Information seeking behavior (x_{16})	0.157	0.093	0.064	0.092(x_9)
Residue management score (x_{17})	-0.055	0.010	-0.065	-0.097(x_{11})
Perception on natural resource degradation (x_{18})	0.083	-0.041	0.124	0.041(x_{19})
No. of livestock (x_{19})	0.140	0.114	0.026	0.034(x_{11})
Mass media utilization (x_{20})	-0.030	0.047	-0.077	-0.056(x_6)

TE = Total Effect, DE = Direct Effect, IE = Indirect Effect, HIE = Highest Indirect Effect, Residual effect: 0.428

Table 3. Stepwise regression analysis of farmers' perception of water management (y) and selected socio-ecological variables ($x_1 - x_{20}$)

Variables	Reg. coeff. B	S.E. B	Beta	t value
Stubble height (x_{11})	0.451	0.143	0.286	3.155
Age of the respondents (x_1)	0.067	0.022	0.273	3.072
No. of fragments (x_6)	-0.186	0.055	-0.302	-3.368
Income per unit of land (x_9)	0.000	0.000	-0.300	-3.298

R square = 51.80 per cent, Std. error of the estimate = 2.175

farmers' perception of water management. Stubble height is an important part of conserving soil moisture. When the optimum amount of stubble is retained, it helps a farm to save on their water requirement; more during the sowing season. Aged farmers with a better experience in managing water stress conditions. Fragmentation of holding has got a deleterious impact on the energy and cost management of a farm (Friedrich et al., 2012). With more fragmented land, the drudge of management will automatically increase, turning the farm energy and cost prodigal. This is the reason fragmentation as a functional variable is so important to predicting water management. A similar study also reveals that farmers' conservation decisions and the extent to which they adopt better water conservation technology are favourably and significantly influenced by the educational level of the household head, extension contact, and the slope of the land, distance from home, livestock holding, and farmland productivity (Nurie et al., 2013). The results rightly direct the attention of the conservationists in agriculture to the need for upscaling return, that too into a happy return, through pursuing efficient and cost-effective water management. Thus, in designing and implementing CA technologies, it is critical to have a deeper grasp of the restrictions that affect farmers' perceptions. A greater understanding of the effects of CA advantages requires frequent communication between farmers and extension professionals, as well as ongoing agricultural training (Andersson & D'Souza, 2014).

CONCLUSION

Getting off to a start in this empirical research and passing through a series of analytical discourses, it has rightly been detected that the variables stubble height, age of the respondents, number of fragments, and income per unit of land have contributed substantially to the perception building of farmers on water management in CA. This indicates that unabated fragmentations of smallholdings have substantially damaged the conservation dimension of water management, albeit stubble height has to contribute to the restoration of ecological resilience as well. A collateral prospect of environmental economics, ecological resilience, and perceptual growth of operating farmers in making conservation agriculture a success was revealed. In addition, access to water, water sharing, water auditing, and monitoring may go further to characterize the dictum and direction of CA and it is simply because water is the prime for any kind of production or existence of life.

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Pulses Yield Gap Minimization: Consequences of CFLD-Pulses in India

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ABSTRACT

The present study is the analysis of large scale data (31949 ha area and 79873 farmers) generated through the CFLD on pulses across the major pulses growing states under the ICAR-ATARIs of Kanpur, Jodhpur, Pune, Jabalpur, Kolkata, Guwahati, Hyderabad, Bangalore and Patna. The present analysis represented the pulse crops of *kharif* (pigeon pea-5556 ha, black gram-6067 ha and green gram-2689 ha), *rabi* (chickpea-8376 ha, lentil-3747 ha and field pea-1890 ha) and summer (green gram-3624 ha) seasons. The average performance data of CFLD were obtained for the above states during the cropping seasons of 2016-17 and 2017-18. Thus, CFLD data were analyzed from across minimum of 13 states (green gram) and maximum of 19 states (black gram). The major variables analyzed were average yield obtained from the check plots and demonstrations plots. These yields were computed for yield advantages and also compared with the reported district level, state level, National level yields and the potential yields of the respective crops in the given states (data procured from secondary sources for the year 2017-18). Accordingly the yield gaps and yield gap minimized at various levels were analyzed using appropriate methods and their degree of variation was also computed for the seasons and crops.

INTRODUCTION

India has the lion's share of growing the largest varieties of pulses in the world contributing about 38 per cent (area) and 33 per cent (production) followed by Canada, China, Myanmar and Brazil. In India, it is considered as "A poor man's meat" being the cheapest and concentrated source of dietary amino acids and protein demand of vegetarian population. Pulse crops are considered as the wonderful gift of nature as they have an ability to fix the atmospheric nitrogen (N_2), thereby helping in N cycling within the ecosystem. Major pulse-producing states in India are Madhya Pradesh, Maharashtra, Uttar Pradesh, Rajasthan, Andhra Pradesh, Karnataka, Gujarat, Chhattisgarh, and Bihar, and the major pulse crops in India are chickpea (*Cicer arietenum*, or garbanzo bean), pigeon pea (*Cajanus cajan*, also known as 'arhar' or 'tur' or red gram), green gram (*Vigna radiata*, the mung bean), black gram (*V. mungo*, or 'urad'), lentil (*Lens culinaris* subsp. *culinaris*), and

field pea (*Pisum sativum*, or green pea). The area, production, and productivity of pulses tend to fluctuate. Kumar (1998) projected the national demand for pulses at 30.9 Mt (million tonnes); Mittal (2006) put it at 42.5 Mt by 2020; and the Indian Institute of Pulses Research (IIPR 2011) in its *Vision 2030* document, at 32 Mt by 2030. Mittal (2006) suggested that to meet the growing demand, domestic production (supply) of pulses should grow annually at 6.5 per cent; IIPR (2011) put the figure at 4.2 per cent; and Reddy et al., (2013), at only 3.35 per cent. These estimates are greatly affected by the differences in yield and even more so by the gap between the observed average yield and potentially attainable yield. Yield gaps are expressed as the difference between potential yield and the average yield obtained by farmers over a given area or a given span of years (Evans, 1993; Van Ittersum et al., 2013). The techniques of analysing yield gaps for major crops on regional and global scales and in different contexts have improved over time (Poonia & Pithia, 2011). A further complication is that the yields

farmers actually obtain vary greatly over time and space, and reliable, long-term yield data are scarce.

With the objective to demonstrate the production potential of improved pulses varieties and also to bridge the yield gap, the Government of India has initiated the National Food Security Mission having a target of raising total pulse production by 4 Mt by the end of the 12th Five-Year Plan, i.e. by 2016-17. And it was to meet this target that the Government of India launched a fresh initiative, namely Cluster Front Line Demonstrations (CFLDs) on Pulses, from the *rabi* season of 2015-16 as part of the food security mission and entrusted the responsibility to the Division of Agricultural Extension of ICAR, the Indian Council of Agricultural Research. The division enlisted 638 centres, the *Krishi Vigyan Kendras* across 29 states in the country

The paper aims at analyzing the large scale data emanated from CFLD pulses across various states of India for the parameters like yield gap and yield gap minimized because of CFLD-P interventions.

METHODOLOGY

The present study draws on data from eleven major Indian zones in each of which the Agriculture Technology Application Research Institute (ATARIs) of the ICAR has a presence, namely in Kanpur, Uttar Pradesh; Jodhpur, Rajasthan; Pune, Maharashtra; Jabalpur, Madhya Pradesh; Kolkata, West Bengal; Guwahati, Assam; Hyderabad, Andhra Pradesh; Bengaluru, Karnataka; Ludhiana, Punjab; and Patna, Bihar. The seasons and the crops were *kharif*, or the rainy season, typically from June to September (pigeon pea-14 states, black gram-19 states, and green gram-13 states); *rabi*, or the winter season, roughly from October to March (chickpea-15 states, lentil-13 states, and field pea-10 states); and summer, typically April and May (green gram-13 states). The data from CFLDs plots were obtained for the above states on all the crops and the three cropping seasons that made up two crop years viz., 2016-17 to 2017-18. The data were, thus, drawn from at least 13 states (for green gram) to as many as 19 (for black gram). The major variables were the average yields obtained from check plots (which served as control plots) and from CFLD plots, and the differences between the two were compared to the district- and state-level yields and to the potential yields of the respective crops in different states growing those crops (data from secondary sources for 2017/18). The crucial values were the yield gaps (the differences between potential yield, which is taken as the maximum attainable yield set by the crop scientists, yields obtained in demonstration plots, and yields obtained by farmers), and yield gap minimized (the difference between the yield gap and the yield advantage in absolute as well as percentage terms). These values were estimated for different spatial scales (Dubey et al., 2018) for all the crops across the three seasons. The major variables used in the study included; Yield gap and Yield gap minimized as suggested by Rimal & Kumar (2015) and Dubey et al., (2018).

The data were subjected to both descriptive and inferential statistics. The descriptive statistics utilized were average, percent and range. The inferential statistics used were Coefficient of Variation (CV) to draw the meaningful implications. The analyzed data were presented in tabular as well graphical form.

RESULTS AND DISCUSSION

Analysis of yield gaps

The widest yield gap was in lentil with respect to its national-level yield (1.45 t/ha), which was slightly lower than that of field pea (1.55 t/ha) and higher than that of chickpea (1.16 t/ha) (Table 1). The *kharif* pulses showed smaller yield gaps at all levels. The yield gap in percentage terms showed a similar pattern. In *kharif* pulses, the variation in yield gap (Figure 1) for the check plots and state-level yields was high for pigeon pea (36% and 38%, respectively) and black gram (35% and 38%) and especially so for *kharif* green gram (45% and 32%) and the least for *rabi* lentil (10.5% and 9%) and field pea (12% and 18%). Singh et al., (2016) had also reported that there was yield gap in lentil to the extent of 15.0–22.5 per cent in selected lentil-growing states, namely Bihar, Madhya Pradesh, Uttar Pradesh, and West Bengal. With reference to Uttar Pradesh, Dubey et al., (2018) also reported the absolute yield gap in lentil to be 0.99–1.51 t/ha, and the current findings confirm that report. Potential yield is still the great challenge to be achieved for pulses in India as indicated by the wider gap with respect to the reported yield at all level i.e. state, national and farmers' yield. Results have shown better picture when trials' yields were compared, the yield gap was observed highest only for *kharif* (180.48%) and summer (106.33%) green gram for reported state yield and for other crops, the gaps were lowest (22.78%) for lentil to as high as 82.05 per cent for pigeon pea for state and national level reported yield. With respect to check plots, the gap was still lower ranging from 23.06 per cent (lentil) to 50.23 per cent for summer green gram. The result has manifold implications. Large scale (space) on-farm demonstrations, if repeated longitudinally (over time) may improve the reported state level and ultimately the national level yields of different pulses in India. Secondly, the yield gap of check plot (farmers' level yield) of different pulses could be further minimized if the assessed and appropriate varieties are disseminated in space and time. Mondal (2011) also quantified the yield gap in rice in different Asian countries including India and estimated it to varies from as low as 3.38 per cent in China to as high as 50.00 per cent in Thailand. India stood a reasonable and manageable level of yield gap (27.78%) in rice which is at lower level when compared with pulses (38.57%). Likewise from the Bundelkhand region of Uttar Pradesh, Sah et al., (2021) reported that there was greater stability in pulses area in the region which may be attributed to the scale based application of modern technologies. Kumbhare et al., (2014) compared pulses with cereals in term of yield gaps of pulses with cereals and found higher gap in pulses whereas Nain et al., (2014) viewed adoption gap as the determinant of instability in pulse production. In mustard and sesame, the CFLD helped to reduce to the extension gap and technology gaps significantly (Singh et al., 2019). A study from Bihar pointed out that yield gap-II i.e. demonstration plot yield and farmer's field yield for all the pulse crops were recorded as 36.33% in pigeon pea, 24.38 per cent in chickpea, 23.40 per cent in lentil and 49.39 per cent in green gram (Kumari et al., 2020). Three years ago also, almost similar extent of yield gap in pulses were reported from Maharashtra and Madhya Pradesh states by Gireesh et al., (2017); Nain et al., (2015) across the major pulse growing states.

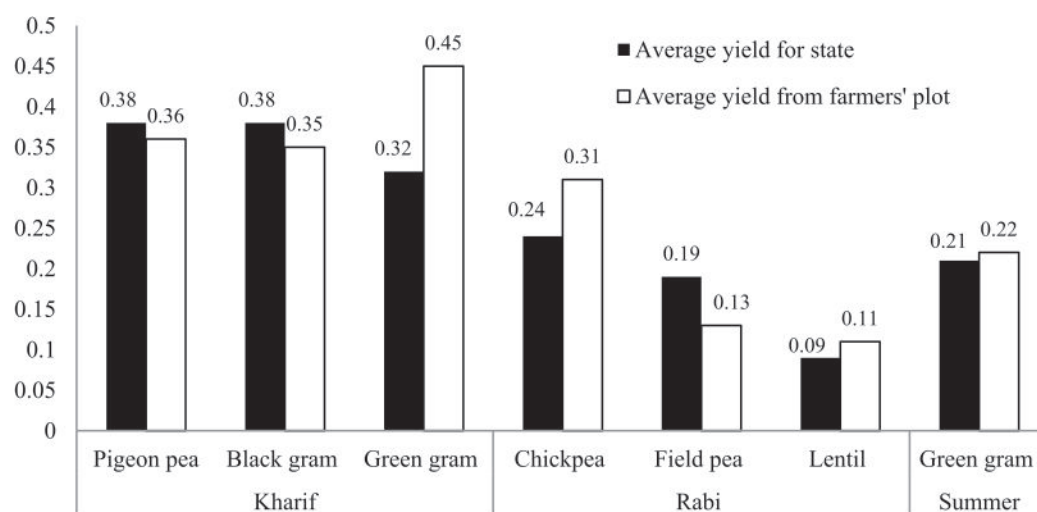
Table 1. Yield gap (tonnes per hectare) in pulse crops across seasons and pulse-growing states in India

No.	Crop	Data scale and range	Absolute yield gap (t/ha) between recorded and potential yields			Yield gap as a percentage of potential and trials' yield		
			State average	National average	Average from check plots	State average	National average	Average from check plots
Kharif (rainy season)								
1	Pigeon pea [19] ^a	19 states	1.045±0.399 (0.854) ^b	1.221±0.463 (0.779)	0.952±0.333 (0.984)	125.41 {66.27} ^c	179.82 {82.05}	101.27 {44.30}
		Range	0.390–1.568	0.521–1.721	0.510–1.459			
2	Black gram [10.66]	21 States	0.511±0.196 (0.556)	0.440 ±0.137 (0.627)	0.486±0.173 (0.580)	97.18 {53.05}	70.12 {35.72}	87.51 {46.72}
		Range	0.185–0.704	0.273–0.573	0.327–0.715			
3	Green gram [10.66]	23 states	0.614±0.196 (0.333)	0.528±0.103 (0.515)	0.403±0.180 (0.698)	187.56 {180.48}	113.10 {81.35}	78.70 {33.81}
		Range	0.569–9.78	0.485–0.685	0.145–0.588			
Rabi (winter) season								
1	Chickpea [20.63]	21 states	1.171±0.218 (0.893)	1.157±0.066 (0.907)	0.886±0.369 (1.177)	151.01 {82.89}	129.29 {71.33}	93.87 {32.03}
		Range	0.500–1.751	0.553–1.401	0.549–1.412			
2	Field pea [25.00]	17 states	1.255±0.244 (1.254)	1.559± 0.011 (0.941)	1.2.44±0.159 (1.255)	108.89 {37.10}	165.67 {81.04}	102.39 {36.01}
		Range	1.010–1.500	–	1.085–1.404			
3	Lentil [21.50]	19 states	1.280±0.121 (0.869)	1.450±0.086 (0.700)	1.282±0.143 (0.867)	157.83 {22.78}	207.15 {52.42}	159.05 {23.06}
		Range	1.095–1.400	1.300–1.500	1.448–1.075			
Summer season								
1	Green gram [12.00]	13 states	0.741±0.156 (0.458)	0.688±0.00 (0.515)	0.571±0.124 (0.629)	190.06 {106.33}	133.01 {83.49}	99.32 {50.23}
		Range	0.490–0.903	–	0.411–0.758			

^anumbers in square brackets are average potential yields of various crops across states.

^bnumbers in parentheses are average reported yields.

^cnumbers in { } indicate the percent yield gap with respect to trials' plot yield

Figure 1. Variation in different categories of yield gaps in six pulse crops in India

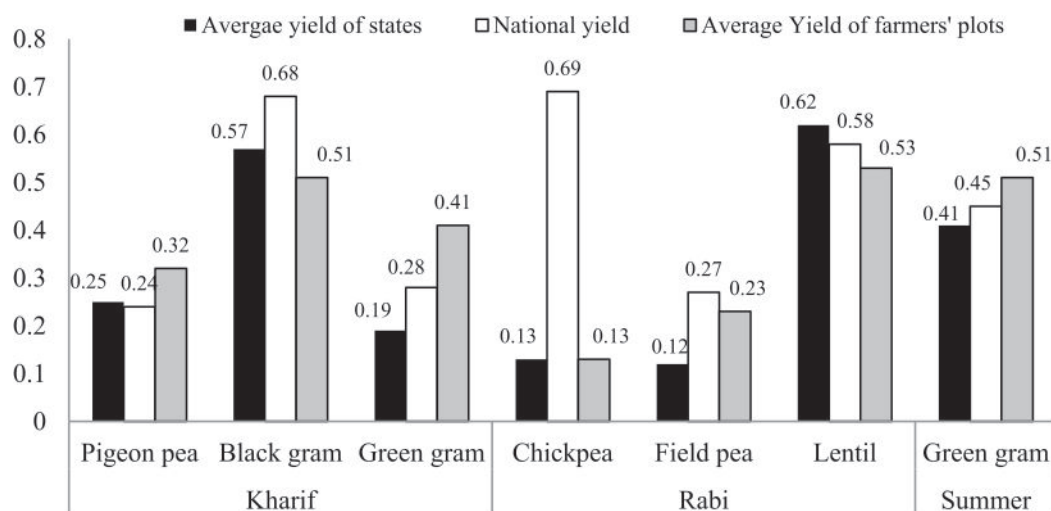
Yield gap minimized

As discussed, the yield gap were greater for *kharif* pulses—the yield gap minimized conformed to the same pattern (Table 2), being the widest at the state-level (35.9%–85.3%) and at the national level (35.9%–79.3%) in all three seasons. At the farmers' level, the gap was the widest for green gram (79.96%) and the narrowest for field pea (37.43%, SD=8.05). It should also be noted

that the variation in the yield gap minimized due to CFLDs was maximum for black gram and chickpea at the national level (about 65%), which reflects the variation in the yield advantage in those crops across states (Figure 2), probably a reflection, in turn, of the variation in terms of the relatively greater space given to the two crops in cropping systems. The least variation in the yield gap minimized was seen in field pea (10%–25%) and green gram (15%–40%) at all three levels. Literature, however, showed that researchers

Table 2. Effect of CFLD-P on yield gap minimized in pulse crops in India.

No.	Crop	Scale and range	Yield gap minimized (%) with respect to		
			State-level yield	National-level yield	Yield from check plots
Kharif (rainy) season					
1	Pigeon pea	19 states	58.61±15.11	64.51±15.77	55.21±17.64
		Range	32.00–84.62	39.34–88.48	37.04–88.24
2.	Black gram	24 states	71.31±40.77	60.55±41.55	64.19±32.88
		Range	23.41–147.57	9.77–132.23	24.08–123.91
3	Green gram	23 states	85.30±16.08	79.30±22.24	79.96±32.66
		Range	66.77–105.98	52.55–107.01	123.45–44.73
Rabi (winter) season					
1	Chickpea	21 states	49.35±51.09	50.24±48.48	68.75±89.71
		Range	81.40–132.28	64.01–132.82	3.69–345.40
2	Field pea	17 states	37.71±42.52	49.17±13.31	37.43±8.65
		Range	33.33–42.08	35.86–62.48	28.77–46.08
3	Lentil	19 states	35.91±22.41	42.00±24.32	37.48±19.86
		Range	16.93–74.00	10.54–78.33	15.54–69.77
Summer					
1	Green gram	13 States	63.60±26.29	62.77±28.61	56.49±28.63
		Range	30.59–103.61	24.82–104.38	32.06–105.26

Figure 2. Variation in different categories of yield gaps minimized in six pulse crops in India

in past had mainly focussed on quantifying the yield gaps in rice, cotton, etc (Aggarwal et al., 2008) and pulses (Shrivastava et al., 2017). However, quantifying the yield gap minimization in pulses was only reported by Dubey et al., (2018). With references to paddy, the on-farm technology assessment minimized the extension gap to the extent of -0.59 to -1.21 kg/ha (Singh et al., 2020).

CONCLUSION

The investigation objectively disclosed several implications. Firstly, the scale at which these CFLDs are being conducted is sufficed for discerning the tangible impact. As a result, the average yield gain was quite encouraging and in some cases passing even the potential yields. Secondly, the cross sectional variation in the reported yield, yield gap and yield advantages across the states implicate for evolving the pulses varieties and technologies which are more unique to the given state or region. Thus, the researchable agenda for the pulses variety improvement programme is emanated.

Thirdly, the focused and mission mode approach for enhancing pulses production in India not only enhanced the total pulses production, the per capita pulses availability was also increased.

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Leveraging Social Media Platforms for valuing Agri-Entrepreneurship in Punjab, India

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ABSTRACT

Social media tools offer a huge opportunity to value digital engagement for agribusiness stakeholders. The rapid pace of developing digital platforms calls for substantial growth in agri-entrepreneurship in Punjab. The present study analyzed the usage pattern of different social media platforms by agripreneurs in Punjab and examined the significance of their demographic characteristics in the usage of these online communication platforms. The data were collected from 200 agripreneurs, who got or were getting training from Punjab Agricultural University during the year 2019. The findings highlighted that WhatsApp and Facebook were the two topmost used social media applications for agribusiness pursuits in Punjab, followed by Instagram, YouTube, Twitter, and LinkedIn. Among various demographic attributes, age, educational qualification, and marital status of the agripreneurs were found to have significant relationships with their usability in agribusiness. The young, highly educated, and unmarried agripreneurs recorded more use of social media tools for agribusiness undertakings as compared with older, less educated, and married agripreneurs. It can be concluded that all agribusiness stakeholders should encourage the synchronized use of such digital platforms to make the right information available at right time to the agripreneurs.

INTRODUCTION

With technology becoming ubiquitous in today's agribusiness sector, the prominent social media platforms (Facebook, YouTube, WhatsApp, Twitter, Instagram, Snapchat, Facebook Messenger, Pinterest, etc.) offer a convenient way to actively share information, seek expert advice, reach large audiences, ensure better supply-chain management, and promote modern agribusiness practices in India. The number of social media users in India stood at 518.92 million in the year 2020, and they comprised approximately 37.6 per cent of the total population in India (Datareportal, 2021; Statista, 2021). The dynamics of social media presented many factors affecting the deployment of social media tools for the dissemination and subsequent use of agrarian information. The landholding size, annual income level, education, and subsidiary occupations other than

agriculture were considered the key factors affecting the use of information sources (Linh et al., 2016). On the other hand, lack of internet access, and inadequate skills & knowledge were primarily taken as curbs to impeccable use of social media in agribusiness (Chisenga et al., 2014; Pandey et al., 2020; Singh et al., 2021). Although social media users give opinions and express emotions through content sharing on multiple online platforms to satisfy the need for self-expression, but the personal characteristics, social needs, contentment needs, and technological attributes are also posited as the pioneers in the adoption of social media (Venkatesh et al., 2003; White et al., 2014; Zolkepli & Kamarulzaman, 2015).

Evidence from the recent literature suggests that social networks are not only reliable, but quite essential in helping small farmers in their challenging times, minimizing disruptions to agribusiness value chains, and extending long-term business value

(Nain et al., 2019; Miklian & Hoelscher, 2021). The adoption of social media leverages the paradigm shift in accessing the agri-advisory services, along with bridging the opportunity gaps between small farmers and emerging markets (Zolkepli & Kamarulzaman, 2015). A recent case study conducted by McKinsey & Company (2021), based on an analysis of 400 digital solutions in Sub-Saharan Africa, suggests the use of a digital food balance sheet (FBS) for gauging the produce yields, trade prices, and inventory levels. This could be used in India by deploying data from various agribusiness actors, both public and private units, which would help provide reliable agribusiness information, allocate government subsidies, encourage investments in the food business, and display agri-market information in public. The Government could use advanced digital media tools for helping the agrarian community by providing food subsidies, supporting food security, and managing the inventories in public warehouses. Additionally, the customization of such digital technologies could be done to reduce all prevalent risks and provide a competitive advantage to the firm, especially small and medium agri-food enterprises (SMEs) (Yang et al., 2021).

Several studies demarcate the significant role of propagating agribusiness knowledge on social media platforms and sharing robust content driven by audiences' emotions in building positive attitudes towards agri-entrepreneurship (Raina et al., 2016; Kapinga et al., 2019; Reichstein & Brusch, 2019; Panda et al., 2019; Chi Nawi et al., 2022; Jayalakshmi, 2022). Hence, this study aims at determining the practice of using various social media tools by agripreneurs and examining the significance of demographic variables (such as age, gender, education, marital status, family size, landholding size, annual income, and farming experience) for realizing advantages in agribusiness in Punjab.

METHODOLOGY

This study targeted agripreneurs, who got training or were getting training for the last five years under the Skill Development Centres (SDCs) and the Krishi Vigyan Kendras (KVKs) (District-level Farm science institutes) of Punjab Agricultural University (PAU), Ludhiana, Punjab. Firstly, the agripreneurs across all agribusiness product classes were populated, and then, they were classified into the following ten major categories depending upon their agribusiness products, such as Mushroom growers, Bee-keepers, Product developers, Agro-processing complexes, Vegetable growers, Diversified new crop growers, Floriculturists, Seed growers, Organic agripreneurs, and Aromatic & medicinal agripreneurs. The structured non-disguised questionnaires (both offline and online using Google forms) were specifically designed and distributed among the targeted respondents of the study. Subsequently, the data were collected from a sample of 200 respondents using stratified random sampling with a disproportionate scheme. Moreover, this classification resulted in uneven groups of agripreneurs, but our study targeted fair representation of different classes of agripreneurs. So, 20 respondents were randomly selected from each group, making a total sample of 200 respondents. This procedure was also repeated with other groups, resulting in the selection of 10 sub-samples for this study. Besides using primary data, additional data sources such as agricultural journals, magazines, and other published material were

also referred to. The compiled data were analyzed with the help of appropriate statistical methods using Statistical Package for Social Sciences (SPSS version 20). Since the collected data were measured on an ordinal scale, so non-parametric test i.e. Kruskal-Wallis test was applied to test the significance of various demographic variables (age, gender, education, marital status, family size, landholding size, annual income, and farming experience) in the extent of using social media platforms.

RESULTS AND DISCUSSION

Among the different social media platforms (Table 1), WhatsApp (96.55%) and Facebook (90.8%) were documented as the two topmost used applications for agribusiness activities in the Punjab state, followed by Instagram (37.36%), YouTube (35.06%), Twitter (16.67%), and LinkedIn (11.49%).

Table 1. Social media penetration among respondents

Social media platforms	Percentage
WhatsApp	96.55
Facebook	90.80
Instagram	37.36
YouTube	35.06
Twitter	16.67
LinkedIn	11.49

*Data are based on multiple responses

Age of the agripreneurs and social media

The adoption and frequency of using social media platforms are greatly affected by certain demographic characteristics of social media users. The data in Table 2 shows the significance of the relationship between the age groups of respondents and the use of social media platforms for agribusiness pursuits. There were statistically significant differences in use-scores of Facebook ($X^2(3) = 9.163$, $p = 0.027 < 0.05$) and WhatsApp ($X^2(3) = 13.290$, $p = 0.004 < 0.01$) among the different age groups. Facebook and WhatsApp were considered advantageous tools for developing and maintaining better customer relations. Sturiale & Scuderi (2013) observed that young agripreneurs tend to use Facebook more than the elder ones. The significance of the age factor to the use of the internet was also supported by Fawole & Olajide (2012); Linh et al., (2016). Agripreneurs in the age group of 21 to 40 yrs documented the maximum use of Facebook and WhatsApp for marking their presence on various digital platforms and sharing their experiences among others. The statistical analysis of using YouTube, Twitter, LinkedIn, and Instagram did not find any significant relationship with the age groups of respondents.

Education of the agripreneurs and social media

The analysis of the relationship between the educational attainment and the use of different social media platforms for agribusiness activities revealed that there were significant differences in the use scores of Facebook ($X^2 = 12.218$, $p = 0.016$) and LinkedIn ($X^2 = 6.438$, $p = 0.040$) among the different educational groups. The agripreneurs with Post-Graduation marked the maximum average use of Facebook (7.52 hrs per week) and LinkedIn (4 hrs

Table 2. Demographic variables vs. Social media platforms: Kruskal-Wallis test

Social media tools	Age			Education			Marital status		
	Chi-square	df	Sig.	Chi-square	df	Sig.	Chi-square	df	Sig.
Facebook	9.163	3	0.027*	12.218	4	0.016*	11.160	1	0.001**
Twitter	2.779	2	0.249	1.238	2	0.538	2.565	1	0.109
WhatsApp	13.290	3	0.004**	14.236	4	0.007**	6.734	1	0.009**
YouTube	2.940	2	0.230	2.832	2	0.243	0.008	1	0.929
LinkedIn	1.570	2	0.456	6.438	2	0.040*	4.348	1	0.037*
Instagram	6.148	2	0.054	4.489	2	0.106	0.293	1	0.588

*Significant at the 0.05 level of significance; **Significant at the 0.01 level of significance

per week) for their agribusiness endeavors, while the agripreneurs, who didn't pass even their matriculation qualification, recorded the least average use of Facebook (1 hr per week) and no use of LinkedIn for agribusiness pursuits. The significance of educational qualification in internet use was also evidenced by Linh et al., (2016). Moreover, the use-scores of WhatsApp for agripreneurs confirmed the compliance of social media platforms for agribusiness tasks. There was a significant difference between agripreneurs belonging to different educational groups and the extent of using WhatsApp ($X^2 = 14.236$, $p = 0.007$) for agribusiness purposes. The agripreneurs with Graduation demonstrated the maximum average use of WhatsApp (9.42 hrs per week), while the agripreneurs with below matriculation qualification marked the least average use of WhatsApp (1.67 hrs per week) for their agribusinesses. Education of the agripreneurs had not depicted any significant relationships with the use of Twitter, YouTube, and Instagram.

Marital status of the agripreneurs and Social media

The results were quite similar in the case of studying the usage extent with respect to the marital status of respondents. The significant differences were present between the marital status of respondents and the use scores of Facebook ($X^2 = 11.160$, $p = 0.001$), WhatsApp ($X^2 = 6.734$, $p = 0.009$) and LinkedIn ($X^2 = 4.348$, $p = 0.037$) in agribusiness. On the other hand, the use-scores of Twitter, YouTube, and Instagram did not have any significant relationship with the marital status of respondents. Unmarried agripreneurs recorded more use of all social media platforms like Facebook, Twitter, WhatsApp, YouTube, LinkedIn, and Instagram in comparison to married agripreneurs. LinkedIn (2.31 hrs a week) and Instagram (2.21 hrs a week) were among the least used applications by married agripreneurs, whereas unmarried agripreneurs marked the least average use of YouTube (3.25 hrs a week) and LinkedIn (3.14 hrs a week) on an average basis.

Other demographic variables and social media

While taking other demographic variables, such as gender, family size, landholding size, annual income, and farming experience, no statistically significant relationship was established with the utilization of social media tools in agribusiness tasks. It was instructive to note that, the young agripreneurs were active social media users, who look forward to making the best use of social media platforms for undertaking agribusiness pursuits.

However, the present study has important implications for the agribusiness stakeholders, such as building a good social network

of agripreneurs, enhancing the effectiveness of the agribusiness value chain, accessing, utilizing resources in a better manner, and supporting development in the agribusiness sector. This study was restricted in its scope to only PAU-trained agripreneurs of the last five years and can be extended to other states for intra-state as well as inter-state comparisons. Nevertheless, the subjectivity could not be ruled out from the study. As the respondents in the study area found it challenging to use new social media applications, so more user-friendly features tailored to the socio-demographic characteristics of agripreneurs should be incorporated into social media platforms. Additionally, the agricultural extension personnel should impart agribusiness training and conduct agripreneurship programs in both offline and online modes, so that the senior agripreneurs could share their agribusiness experiences with the young agripreneurs and the young ones could share the latest updates in using social media applications. 'Speech to text' feature in social media applications would also work well in collaboration with the automatic transcription option. Also other wide range of social media lingo, including clipping, abbreviation, alphanumeric homophony, vowel deletion, grapheme, and other slang terms, among other things may be used (Asare et al., 2021). It may help in integrating AI (Artificial Intelligence) into the agribusiness system in the future.

CONCLUSION

Retrieving and publicizing useful agribusiness information is the key agenda behind the success of using any digital tool in agribusiness so that the agribusiness stakeholders could reap its benefits along with serving the market demands. It has become essential to urge all the agribusiness market actors to utilize these trending social media tools and stay updated with market variations. The results of the study corroborate the general disposition of using social media platforms, that is, maximum use of Facebook and WhatsApp among the young social media users, while the older people use them only when seems necessary. A similar trend is witnessed in this case, where using Facebook, WhatsApp, and LinkedIn is quite common among the educated and unmarried agripreneurs. The uses of such digital tools must be better comprehended in the farming communities to uncover the benefits served by social media tools in agribusinesses. Nevertheless, the Government and other agribusiness stakeholders should ensure digital literacy for agripreneurs, good power supply, and digital access facilities, which could help raise the sustainability of agribusinesses.

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What Motivates Rice Farmers to Adopt Hybrid Rice Technology in Assam, India?

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ABSTRACT

To feed the rising population there is need for improved technologies like hybrid rice cultivation which gives comparatively higher yield than other rice varieties. A study was conducted to find the factors affecting the adoption of hybrid rice in Nagaon district of Assam using logistic regression analysis in the year 2018. The results revealed that, adoption of hybrid rice was positively and significantly affected by socio-economic factors such as occupation, number of extension agent contact, while the age of the farmers and farm size were found to affect the rate of adoption negatively indicating that rate of adoption of hybrid rice was higher with main occupation as agriculture and more extension agent contact of the farmer whereas older farmers and large farmers were reluctant to grow hybrid rice. The major problem faced by the hybrid rice adopters was rain during harvesting time and by the non-adopters was poor cooking quality of hybrid rice. For increasing the adoption of hybrid rice varieties, government need to consider the problems faced by the farmers in its adoption and provide community threshing floor, timely supply of seed in sufficient quantity and awareness on new technology to the farmers through the extension personnel.

INTRODUCTION

Rice (*Oryza sativa* L.) is the primary source of food for the millions of the people in the Asia-Pacific region. The majority of the people in India make out their existence directly or indirectly from farm-related economic activities (Pradhan et al., 2020). Rice is the one of the most important cereal crops in India and has been highly labour and energy-intensive crop (Bhatt & Singh, 2022). To meet the growing demand, rapid increase in the rice cultivation is needed and with the availability of modern farm inputs, it was possible for farmers to generate higher levels of income (Kisku & Ghosh, 2017). Therefore, some improved technologies like hybrid rice has the potential to transform rice cultivation in India as it could enhance rice productivity, increased on-farm incomes for smallholders (Spielman et al., 2014). Hybrid rice typically displays hybrid vigor such that when it is grown under the same conditions as comparable high-yielding inbred rice varieties it can produce up to 15-20 per cent more rice (Azam, 2014; Janaiah et al., 2010) and

hybrid technology has contributed significantly to food security, environmental protection and employment opportunities (Yan et al., 2010).

Assam was producing 5127 million tonnes of rice during 2016-17 from an area of 24.67 lakh hectares. The highest total production was recorded during winter (*sali*), followed by Summer (*boro*) and autumn (*ahu*) seasons. Total area under high yielding variety rice was 19.18 lakh hectares during 2016-17 and area under hybrid rice was 160.5 thousand hectares (Government of Assam, 2018). Growth in Summer (*boro*) rice planting was getting momentum because, unlike the *ahu* and *sali* seasons, which were affected by flood, the *boro* rice season was relatively less risky, which means that improved rice production techniques could be adopted more fully, and there is ample scope for area expansion by bringing the chronically flood-affected and deep-water rice areas under *boro* rice cultivation by creating irrigation facilities. Hybrid rice was grown mainly in the *boro* season in the state under different schemes such as National Food Security Mission- Rice that was implemented for

increasing food grains and pulse production through introduction of interventions in rice, wheat and pulses among targeted districts of the country (Mottaleb et al., 2014; Khatik et al., 2017) and Bringing Green Revolution to Eastern India (BGREI). The average yield of high yielding variety and hybrid variety of rice was reported to be 4.5-5.5 tonnes hectare⁻¹ and 5.0-6.1 tonnes hectare⁻¹ in the state (Government of Assam, 2015) showing the yield advantage of hybrid rice (Gogoi et al., 2020). However, still the adoption of hybrid rice was mostly confined to only central part of the state. Therefore, a question arises: what motivates the farmers of this part to adopt hybrid rice? With this background, the study was conducted to explore the factors affecting hybrid rice adoption and the problems faced by the farmers in its cultivation.

METHODOLOGY

A multi stage random sampling design was used for the present study. In the first stage Nagaon district was purposively selected as the district has the highest area (9547 ha during 2018) under hybrid rice in Assam. In the second stage, two blocks were selected from the district at random based on the number of farmers adopting hybrid rice cultivation. In the final stage, sixty farmers growing both hybrid rice and non-hybrid rice and thirty farmers growing only non- hybrid rice were selected from two blocks resulting in 90 sample respondents.

Farmer's adoption of hybrid rice was studied using the logistic regression model to empirically quantify the relative influence of various factors in the decision of the respondents to adopt hybrid rice varieties. This study postulated that the probability of a farmer adopting hybrid rice varieties (Y_i) depends on the attributes like age, literacy level of farmers, farm size and number of extension agent contacts. The index variable Z_i (Z_i is a dichotomous variable) indicating whether a farmer was adopting hybrid rice varieties or not has been expressed as a linear function of the independent variables.

Thus, the logit regression model has been specified as the following equation:

The probability of adoption, P_i , for a given set of values of variables is given by the logit model

$$Z_i = \ln \left(\frac{P_i}{1 - P_i} \right) = \beta_0 + \sum_{i=1}^n \beta_i X_i + u_i$$

The logistic model could be written in terms of the odds and log of odds, which helps to understand the interpretation of the coefficients. The odds ratio implies the ratio of the probability (P_i) that an individual would choose an alternative to the probability ($1-P_i$) that he/she would not choose it.

$$1 - P_i = \frac{1}{1 + e^{Z_i}}$$

The odds ratio is expressed as

$$\frac{P_i}{1 - P_i} = e^{Z_i}$$

Where β_i 's are logit coefficients for the n explanatory variables X_i 's, and u is the error term.

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5$$

Where, Y_i = Farmer's adoption of hybrid rice varieties (1 for adoption and 0 for non-adoption); and X_i = Independent variables (X_1 = Literacy level of farmers; 1 if graduate; 0 if otherwise, X_2 = Occupation; 1 if agriculture; 0 if non agriculture, X_3 = Farm size; 1 if medium; 0 if marginal and small, X_4 = Age of the respondents (years), X_5 = Extension agent contacts; 1 if contact; 0 if otherwise)

Simple ranking technique was applied to measure the problems faced by the farmers in hybrid rice cultivation from study area and each farmer was asked to mention about the problems in hybrid rice cultivation in order of degree of difficulty.

RESULTS AND DISCUSSION

Estimation of the factors influencing adoption of hybrid rice cultivation

The adoption of hybrid rice cultivation was found to be affected by various factors (Table 1). The logit framework clearly indicated that occupation and number of extension agent contact were positive and statistically significant while education of farmers was found to be positive but not statistically significant. Similarly, Ghimire et al., (2015) mentioned that, education, farm size, seed access, extension service, yield potential and consumers' acceptability of rice varieties were the factors affecting the probability of adoption.

The odds-ratio of 2.580 for education implied that other things being kept constant, the odds-ratio in favour of adopting hybrid rice increased by 2.58 times as farmers' education level increased by one unit. Literate farmers were aware about the yield advantage of hybrid rice through different print and electronic media hence, literacy level of the farmers was found to have positive effect on adoption of hybrid rice and they were ready to face risks and experiment with the new technology. The study is in line with Nonvide (2020), where it was reported that farmers with more education were more likely to adopt improved rice varieties and have more ability in collecting information on new technologies than the non-educated farmers. Likewise, the contact with extension agent increased the adoption of hybrid rice technology by 3.493 times. The extension supports from government and other private sources enhanced the promotion of the technology through the provision of advice, information and technical support to farmers, thereby increasing the adoption rate (Shah et al., 2014a; Momtaz et al., 2020). The farmers depending on agriculture as main occupation increased the odds of adopting hybrid rice technology by 7.228 times. The age and farm size were found to affect the

Table 1. Parameter estimates for logit model

Variables	Coefficients	Standard Error	Odds ratio
Intercept	-0.834	1.382	0.000
Education	0.948	1.314	2.580
Occupation	1.978*	0.935	7.228
Farm size	-0.158	0.620	0.854
Age	-0.027	0.026	0.973
Extension agent contacts	1.251*	0.594	3.493

Source: Field survey, 2017-18

*Significant at 10 per cent probability level

Table 2. Problems faced by farmers adopting hybrid rice cultivation and non-adopter

Hybrid rice adopter		Non-adopter	
Types of problem	Percentage	Types of problem	Percentage
Rain during harvesting time	36.67	Poor cooking quality	33.33
Lack of threshing floor	21.67	High cost of seed	20.00
Higher requirement of labour and fertilizer	18.33	Low output price	16.67
Lower price due to grain quality	11.67	High incidence of pest and disease	13.33
Lack of storage facility	8.33	More labour intensive	10.00
High cost of irrigation	3.33	Lack of training and awareness	6.67

Source: Field survey, 2017-18

rate of adoption negatively and also not statistically significant. Older farmers were reluctant to embrace new technology outrightly, hence, adoption of hybrid rice was found to have negatively affected by age, though not significantly. The farmers with higher farm size were not interested to adopt hybrid rice cultivation because they grow different types of crops, but for farmers with smaller holding had to grow rice for household consumption. Further the government schemes mostly target the small farmers as beneficiary and thus the small farmers were adopting the technology. Similar findings were reported by Nirmala et al., (2016) where they mentioned that the farmers having small holdings of half to one acre grow rice for household consumption and have distinct preference for hybrid rice.

Problems faced by hybrid rice adopter and non-adopter

Hybrid rice cultivation was found to be 49.01 per cent of total rice area. Nearly 50 per cent of the area was yet to be covered under hybrid rice despite its yield advantage. It was observed that (Table 2) among adopters, the major problems observed was rain during harvesting time which makes the hybrid seed to sprout in the field if kept for more than one day in rain, followed by lack of threshing floor, labour intensive cultivation and also high requirement of fertilizer, lower price due to grain quality like broken rice during milling along its stickiness considered. The study was in line with Janaiah et al., (2002) where they mentioned that, although hybrid rice had a yield gain of about 15-20 per cent over the existing high-yielding modern varieties outside China, which was not attractive to farmers because of higher input costs and lower market prices due to its inferior grain quality. Lack of storage facility in case of high production from hybrid was a problem faced by farmers, high cost of irrigation because of more water requirement was mentioned by small percentage of the respondents. Difficulty in threshing of hybrid varieties was main complexity reported by all sampled farmers in the study conducted by Kumar et al., (2017) in Jammu. The fuel cost for irrigating the hybrid rice field was not bearable to the resource poor small adopter farmers hence appeared as a problem. Prakash et al., (2017); Pandit et al., (2017) reported similar findings where, the high seed cost of hybrid seed coupled with unawareness of management practices restricted farmers to adopt recommended hybrid rice production technology.

In case of non-adopters, it was observed that (Table 2), the poor cooking quality of hybrid rice was the major problem. Similar findings by Saeed et al., (2013) reported that the disadoption of hybrid rice was due to serious problem of marketing and lower price

and also disliking of hybrid rice due to poor quality of grain and inferior taste. High cost of seed which was also needed to be purchased every year, low price of the hybrid rice per quintal compared to other rice varieties, overlooking the higher production, infestation of the pest and disease were also among the reported problems. Severe infestation of insects and pests and lack of irrigation facilities were the problems faced by farmers revealed in the findings of Singh et al., (2011); Shah et al., (2014b) and (Dasgupta & Roy, 2014).

CONCLUSION

Rice being the staple food crop in the state, farmers started adopting hybrid varieties to increase the yield. Farmers and extension personnel should have more contacts for better technical guidance frequently. Timely supply of hybrid seeds with associated input should be made available to the rice farmers. Provision should be made for covered community threshing floor at the village level to avoid the problem of rain. Proper research has to be done to improve the grain quality as well as early maturing variety to solve the problem of poor grain quality and rain during harvesting time in summer season, respectively. Exposure visit of farmers to demonstration plots is expected to accelerate the adoption. Government programs need to widen the scope to small and marginal farmer. Success story of hybrid rice growers need to be focused through various advertising media so as to attract the rice farmers to grow hybrid rice.

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Usage Pattern of Social Media among Higher Secondary School Students of Haryana

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ABSTRACT

Social media is most modernistic form of media and acquire many features and characteristics. It has many facilities like as texting, communicating, images sharing, audio and video sharing, fast publishing, gaming, blogging, linking with all over world, direct connecting. Social media provides an opportunity for students to improve social networking and learning processes, which promotes knowledge in society. The study was conducted in year 2017-18 between rural and urban areas of Hisar district of Haryana. Thus total of 160 students were selected randomly. Results highlighted that the students keep themselves updated with latest know and how through newspaper (30.00%), television (83.70%), mobile phones (62.50%), and mobile with internet connections (43.70%). Majority of the students were aware and utilizing social media such as Facebook (90.00%), WhatsApp (95.00%), YouTube (75.00%), Messenger (47.50%) and Wikipedia (30.00%) respectively. The social media use was positively correlated with age, sex and stream of study and negatively associated with the academic performances of the students.

INTRODUCTION

In the present context, social media networks are significant in different aspects of life, particularly in education (Malik & Godara, 2020). It is a means of connections among users, because of its ease, speed and reach, social media is fast changing the public discourse in society and setting trends. It is also a set of information technology that facilitates interaction and networking among peoples. Social media has brought the world together regardless of its geographical limits. Social network plays a pivotal role in the student's life to developing, sustaining, or even revitalizing connections and boosting kids' learning skills (Tayseer et al., 2014). It enables various online technology that enable people to communicate easily and people use social media to share information, text, audio, video, images, podcasts, and other multimedia communication in virtual communication and networks (Kaplan & Haenlein, 2010). Social media have the possibility of creation of social wealth in the form of discussion forums (Nain et

al., 2019). People used for expressive, directive, commissive, or declarative purposes for effectively passing their messages to the intended parties. (Duhoe et al., 2021). Students, who work in groups, employ a wide range of social media lingo, including clipping, abbreviation, alphanumeric homophony, vowel deletion, grapheme, and other slang terms, among other things (Asare et al., 2021). Social media is an emerging tool to popularize and to increase the visibility of the useful technologies at a great extent and to educate the individuals and development of youth to save the time and resources. Large number of young generation's social and emotional development is occurring on internet and cell phones. The amount of time students spend on these social networking sites has an influence on their quality of life. It has an effect on their physical, emotional and spiritual well-being (Saini et al., 2020). Social media, the fast triggering the mean of virtual communication, internet based technologies changed the life pattern of young generation. Presently, the use of social media have both advantages as well as disadvantages, mostly its benefits seen in terms of easy

accessing course contents, video clip, transfer of the instructional notes etc. Overall students feel that social media and mobile devices are the cheap and convenient tools of obtaining relevant information. The advantages of social media for the students were convenience in keeping in touch with friends, ease to learn new technology, knowledge of various academic institutions for higher studies across the country. The major disadvantages for the students were less physical activity, cybercrime, and privacy issues (Devi & Sornapudi, 2022).

METHODOLOGY

A descriptive method was used to conduct present investigation and survey type research was conducted through the questionnaire. The study was conducted in Haryana state. It was a comparative study between urban and rural areas of Hisar district. For this, list of higher secondary schools in Hisar city was prepared (both government as well as private schools). From this list, one government and one private higher secondary school was selected randomly. From the selected block, a list of villages having government higher secondary schools and private higher secondary schools was procured from district education office. Out of this list, one government and one private school was selected randomly. Finally four schools (two private and two government higher secondary schools) were selected from both the areas for the study. From the selected schools, lists of 11th and 12th class students were procured from school records. From these lists, 40 students (both male and female) were selected randomly from each school. All gathered information was put into an SPSS sheet for analysis, separation of findings, and presenting of data in proper form, as well as the creation of diagrams and tables.

RESULTS AND DISCUSSION

Extent of communication sources and social media used by the students

Data presented in the Table 1 shows the utilization of communication sources for students in rural and urban areas. The utilization was measured on three continuum i.e. always, seldom and never. In rural areas, data showed that newspaper had highest access in the print media 1.66 WMS followed by leaflet/pamphlets 1.06 WMS and magazine 1.03 respectively. Data regarding the utilization of electronic media of communication sources by the students of the rural areas used were television 2.60 WMS with highest score followed by mobile phones 1.86 WMS and mobile with internet 1.45 WMS and other sources were 1.31 and 1.27

Table 1. Utilization pattern of communication sources by the students

Communication sources	Rural (WMS)	Urban (WMS)
Print media		
Newspaper	1.66	1.75
Magazines	1.03	1.16
Leaflet/pamphlets	1.06	1.35
Electronic media		
Telephones/landline	1.06	1.25
Mobiles phones	1.86	2.57
Mobile with internet	1.45	2.21
Television	2.60	2.76
Computer/laptop	1.31	1.86
Computer/laptop with internet	1.27	1.90

*Multiple responses

respectively. For urban area, data showed that newspaper had highest access in the print media 1.75 WMS followed by leaflet / pamphlet 1.35 WMS and magazine 1.16 respectively. From electronic media data showed that highest utilization of television 2.76 WMS followed by mobile phones 2.57 WMS and mobile with internet 2.21 WMS and other sources were 1.90 and 1.86 respectively. It can be concluded that, in print media most of the students were reading newspaper regularly to keep up-to-date their knowledge and information. In respect of electronic media; students were watching television regularly to entertain and enhance their knowledge via latest technology and followed by the mobile phones. The results are in conformity with the findings revealed that the newspaper had the most owners, followed by mobile phones, television, computers, magazines and radio (Rajput, 2007).

As shown in Table 2, in rural area half of the students (47.50%) were passed with 60-70% marks followed by 70-80% (32.50%). On the other hand in urban area more than half of the students (53.70 %) were passed with 60-70% marks followed by 70-80% (21.30%). From the given data concluded that performance of students in urban area is good as compared to rural area with little differences and the no.

Extent of use of social media by rural students

The data showed in Table 3 the most preferred recreational sites of government school students were WhatsApp with weighted mean score 2.10 followed by YouTube 2.05 WMS and Facebook 1.92 WMS and other sites weighted mean score were 1.77, 1.57, 1.32, 1.27, 1.10 etc. Data regarding online shopping most preferred sites were Flipkart with weighted mean score 1.47 followed by IndiaMART 1.47 WMS and Amazon with 1.35 WMS and other

Table 2. Academic performances of the students in previous class

Academic performance	Respondents					
	Rural		Urban		Total	
	Govt.	Private	Govt.	Private	Govt.	Private
Distinction	2(5.00)	5(12.50)	4(10.00)	6(15.00)	7 (8.70)	10(12.50)
80-90%	3(7.50)	2(5.00)	3(7.50)	7(17.50)	5(6.30)	10(12.50)
70-80%	17(42.50)	9(22.50)	11(27.50)	6(15.00)	26(32.50)	17(21.30)
60-70%	14(35.00)	24(58.00)	22(55.00)	21(52.50)	38(47.50)	43(53.70)
Failure	4(10.00)	-	-	-	4(5.00)	-

Table 3. Extent of use of social media by rural and urban students

Social media	Rural		Urban	
	Govt. (WMS)	Private (WMS)	Govt. (WMS)	Private (WMS)
Recreational				
Facebook	2.12	2.27	2.20	2.22
WhatsApp	1.42	1.57	2.12	2.27
Instagram	1.37	2.00	1.42	1.57
YouTube	1.17	1.47	1.37	2.00
Snapchat	1.67	1.77	1.17	1.47
Messenger	1.15	1.25	1.67	1.77
Telegram	1.02	1.05	1.15	1.25
Twitter	1.67	1.72	1.02	1.05
Wikipedia	1.65	1.57	1.67	1.72
Shopping				
Amazon	1.72	1.50	1.17	1.62
Flipkart	1.32	1.42	1.72	1.50
Snapdeal	1.15	1.37	1.32	1.42
Myntra	1.27	1.30	1.15	1.37
Olx	1.45	1.57	1.27	1.30
Shopclues	1.62	1.45	1.45	1.57
IndiaMART	1.32	1.30	1.62	1.45
Paytm Mall	1.17	1.27	1.32	1.30
Academic sites				
npTEL.ac.in	1.45	1.17	1.07	1.12
edX.org	1.25	1.25	1.12	1.10
indiaeducation.net	1.10	1.15	1.20	1.30
academicearth.org	1.07	1.20	1.20	1.17
eshiksha.com	1.27	1.32	1.37	1.27
ecollegeofindia.com	1.20	1.42	1.32	1.32
bigthink.com	1.20	1.22	1.27	1.50
brightstorm.com	1.30	1.32	1.20	1.35
admissionnews.com	1.30	1.40	1.02	1.15

*Multiple responses

sites were with their weighted mean score with rank 1.20, 1.17, 1.07 and 1.05 respectively. With regard to academic sites, the most preferred sites were npTEL.ac.in with weighted mean score 1.45 followed by brightstorm.com and admissionnews.com with WMS 1.30 and eshiksha.com 1.27 WMS and other sites were with their weighted mean score values 1.25, 1.20, 1.10 and 1.07 respectively.

It's possible that the widespread knowledge of WhatsApp is due to its popularity and features such as free text messaging and phone calls. Furthermore, it is the most customized social media, with the ability to communicate one-on-one as well as in groups with friends and family. Because Twitter is an older application when compared to other social media networks, it has a lower level of awareness than other apps. The most preferred recreational sites of private school students from rural background showed that majority of the students were using Facebook with 2.32 WMS followed by WhatsApp 2.07 WMS and YouTube 2.02 WMS and others sites with mean score values; 1.67, 1.65, 1.57, 1.35 and 1.17 respectively. Regarding online shopping sites most preferred sites were Flipkart 1.52 WMS followed by Snapdeal 1.37 WMS and Myntra 1.32 WMS and other shopping applications with mean score 1.27, 1.22, 1.12 and 1.10 respectively. We explore that the most preferred sites academic sites were ecollegeofindia.com 1.42 WMS followed by admissionnews.com 1.40 WMS and

brightstorm.com 1.32 WMS and other WMS were 1.25, 1.22, 1.20, 1.17, 1.15. From this data we can conclude the most preferred recreational sites i.e. Facebook, WhatsApp, YouTube, Wikipedia and Instagram respectively. On the other hand; most likely online-shopping applications were used by the students i.e. Amazon, Flipkart, Myntra, Snapdeal and IndiaMART etc. Study supported that social networking apps were most frequently visited by the students followed by entertainment and educational apps. Data revealed that personality traits viz.; age, education, medium of schooling, schooling, annual expenditure, mass media exposure and information seeking behavior exhibited positive and significant correlation with their usage behavior of mobile (Malik et al., 2021). Most of the students used social media networks like Google (20.00%) and YouTube (18.00%) they were browsing sites by using e-gadgets like smart phone (36.00%) and laptop (33.00%). Study showed that majority of females were using social media for socializing and connecting with their family members, whereas males are more focused on task-oriented actions and gaming (Cheung et al., 2015).

Further, the data showed in Table 3 most preferred recreational sites of government school students from urban background showed were Facebook with 2.20 WMS followed by WhatsApp 2.12 WMS and Messenger 1.67 WMS and others sites were 1.42, 1.37, 1.17 and 1.02 WMS respectively. Data regarding online shopping sites showed that most preferred sites were Flipkart with 1.72 WMS followed by IndiaMART 1.62 WMS and Shopclues 1.45 WMS and other sites were with WMS following 1.32, 1.27, 1.17 and 1.15 respectively. Among the academic sites the most preferred sites were eshiksha.com 1.37 WMS followed by ecollegeofindia.com 1.32 WMS and bigthink.com 1.27 WMS and other sites were with mean score values 1.20, 1.12, 1.07 and 1.02 respectively. From the data we can conclude that mostly using sites for making contact with their loved ones were Facebook, WhatsApp and Messenger.

The data of private school students from urban background were WhatsApp 2.27 WMS followed by Facebook 2.22 WMS and YouTube 2.00 WMS and other sites with mean score value were 1.77, 1.72, 1.57, 1.47, 1.25 and 1.05 respectively. Data regarding online shopping sites showed that most used sites were Amazon 1.62 WMS followed by Shopclues 1.57 and Flipkart 1.50 WMS and other sites mean score values were 1.45, 1.42, 1.37 and 1.30 respectively. It might be due to majority of students preferred Facebook and YouTube as a teaching tool it provides all kind of video lectures and attend webinar, workshop and training programme etc. that help to understanding various topics in easy mode.

Among the academic sites the most preferred sites using by the students were bigthink.com 1.50 WMS followed by brightstorm.com 1.35 WMS and ecollegeofindia.com 1.32 WMS and other sites with their WMS value 1.30, 1.27, 1.17, 1.15, 1.12, 1.10 respectively. From the data concluded that most preferred sites by the students were WhatsApp, Facebook, Messenger and YouTube were using for the communication, entertainment and for education purpose. The results showed that WhatsApp emerged as the most popular platform for sharing messages, photographs and videos. There was a significant difference in how peoples used social media and what they shared. The most frequently used social platform to increase awareness by using social media such as Facebook,

Twitter, websites etc. (12.50%) and mobile applications (3.75%) (Rohit et al., 2021). Younger students used Facebook more frequently than older students to stay in touch with high school or local acquaintances (Pempek et al., 2009). No association was observed between type of mass media used by participants and their creative abilities (Sheoran et al., 2021).

The correlation coefficient of the personal, socio-economic variables with use of the social media by the students has been employed. The data presented in Table 4 reveals that all the variables viz., age is positively at $p < 0.05$, sex and stream of study correlated at $p < 0.01$ and academic performance found to be negatively correlated at $p < 0.01$ level of significance. The findings showed that students who used social networks and internet more than average had a poor academic achievement and low level of concentration in the classroom (Upadhayay & Guragain, 2017). The results of another study showed that grades points of students in class lower among students who were using the social media sites as compared to other students (Al-Yafi et al., 2018). The addiction to social networking in the male students was significantly higher than female students (Azizi et al., 2019). Logistic regression analysis showed that male students and students under the age of 20 were the most important predictors of internet addiction among students (Ghamari et al., 2011).

Time spent per day on social media by the students

The data furnished in the Table 5 showed that the most of the government school students i.e. 18.70 per cent spent more than two hours per day on social media followed by 12.50 per cent spent two hours on social media. But, in private school 30.00 per cent students spent more than two hours on social media followed by 20.00 per cent were spent two hours daily. Hence, the analysis of the data presented in the table showed that at present all the students irrespective of the area of residence it was concluded that all the student's use social media on daily basis with slight amount of time differentiation.

Table 4. Relationship between independent variables and use of social media by

Independent variable	Use of social media	
	Correlation coefficient (r)	p-value
Age (between 15-18)	0.167*	0.034799
Sex	0.463**	<0.00001
Stream of study	0.223**	0.004591
Academic performance	-0.307**	0.000079

** Significant at 1% level, $p < 0.01$ (2-tailed), * Significant at 5% level ($p < 0.05$)

Table 5. Time spent on social media by the students

Hours spent/ Day	Rural		Urban		Total	
	Govt. (n=40) F(%)	Private (n=40) F(%)	Govt. (n=40) F(%)	Private (n=40) F(%)	Govt. (n=80) F(%)	Private (n=80) F(%)
1 hour	-	2(5.00)	2(5.00)	-	2(2.50)	2(2.50)
2 hour	6(15.00)	8(20.00)	4(10.00)	8(20.00)	10(12.50)	16(20.00)
More than 2 hours	5(12.5)	9(22.5)	10(25.00)	15(37.50)	15(18.70)	24(30.00)

Most of the students significant problem and the users need to address their problematic use of social media those students were spending too much of their time on social media and that was having serious deleterious effect onto their education, co-curricular, social and interpersonal activities. Results highlighted that the most commonly used social media platform was WhatsApp and most of the students reported actively engaging in this social media application time between 31 to 60 minutes on a daily basis (Akakandelwa & Walubita, 2017). Another study was conducted by Stollak et al., (2011) found that time spent on social networking sites was mostly on Facebook (78.30%) majority of students (77.20%) spent more than 30 minutes a day and similar findings by Manjunatha, (2013). The results are in conformity with the findings of (Stephan & Thanuskodi, 2014) and Hussain et al., (2017) revealed that half of the students spend 1 to 2 hours per day on social networking sites. It was also noticed by Kaviarasu et al., (2019), revealed that the majority of students spent 2- 3 hours per day on social media.

CONCLUSION

In study, usage pattern of social media among higher secondary school students Facebook and WhatsApp was the most preferred sites to share text messages, photos, and videos. It was found that most of the students were using television, mobile phones and mobile with internet and newspaper to keep themselves update with the latest know and how. The only difference observed was in the taste and purpose for which they are using the media. The amount of time spent per day on social media by the students revealed that more than half of the students spent more than two hours daily on social media. Use of social media is negatively correlated with the academic performance of the students and positively correlated with age, sex and stream of study. Hence it concluded that today all the students irrespective whether they belong to urban or rural, all are using social media on daily basis with amount of time differentiation spent by them. It became very typical to see individuals engaging more in cyberspace than in the physical world.

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Comparing the Nutrient Management Pattern in Soybean and Rice based Cropping Systems by Soil Health Card holders and Non-holders

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ABSTRACT

The paper discusses about the importance of Soil Health Card (SHC) based nutrient management based on a study carried out during 2017-18 on 100 SHC beneficiary farmers and 50 SHC non-beneficiary farmers of Madhya Pradesh. Significant differences between the beneficiary and non-beneficiary farmers of soil health card in the nutrient use pattern in soybean and rice-based cropping systems were found. Majority of the SHC beneficiaries failed to adopt the fertilizer nutrients as per recommendation. Major reasons identified behind this negative trend were difficulty in understanding the SHC information without the help of an agricultural/ extension officer and lack of knowledge about the importance of SHC & benefits associated with adopting soil test based nutrient management. Further, the positive correlation of micro and secondary nutrients application with the yield and income from the adopters' farm fields reaffirms the key role scientific nutrient management plays in improving agriculture based rural economies. More efforts from the promoting agencies required to convince farmers to adopt SHC based nutrient recommendation.

INTRODUCTION

Soil is an important land resource that supports agriculture and the basis of sustenance for diverse life forms on earth. To sustain the life of its dependents, soils also need to be healthy. Unhealthy soils that do not hold enough moisture and nutrients often fail to support proper growth and development in crop plants. These soils in general need more external inputs but generate less crop yield per unit of input as they use inputs inefficiently. Moreover, soils with poor health are highly susceptible to further degradation and their productivity potential gets weakened with time (Katyal et al., 2016). In a scenario where 33 per cent of the world soils are reportedly degraded due to various reasons, lots of efforts are required to achieve the target of 60 per cent increase in global agricultural production by 2050, to meet the global food requirement (FAO, 2015). An assessment of degraded lands in India showed nearly 120.72M ha of arable land and open forest under

the degraded and waste land category with ≥ 14 M ha degraded and waste land in Rajasthan, Uttar Pradesh and Madhya Pradesh each (ICAR and NAAS, 2010). To make the land-based livelihoods sustainable and ensure food security for the future generations, the first and foremost step in the country needs to be the management of its soil resources that includes rejuvenation of degraded and wastelands (Aulakh & Sidhu, 2015).

Realising the importance of soil health for ensuring enough food for the growing population of the country, the government of India launched a soil health management programme in the year 2015 under the National Mission for Sustainable Agriculture (NMSA). The programme emphasized sustainable soil health management promoting judicious application of fertilizers and manures through issuing soil health cards (SHCs) to all farmers of the country in every three years (GoI, 2016). Scientific use of chemical fertilizers through SHCs expected to economize the fertilizer use in the country by reducing their consumption in the areas where soil

fertility is built up and increasing their use in the areas where it is required. That in turn ensures enhanced productivity sustainably (Acharya & Srivastava, 2017). The government of India data (<https://soilhealth.dac.gov.in/>) show distribution of nearly 10,73,89,421 SHCs to the farmers of different states in the first phase of the programme.

Generating nearly 163,89,077 SHCs, Uttar Pradesh ranked on the top of SHC distribution in the first phase of the Scheme, followed by Maharashtra (40,70,904) and Madhya Pradesh (38,78,333). Studies on impact of SHC in different parts of Madhya Pradesh conveyed an increased awareness among farmers about the importance of scientific application of manures and fertilizers for different crops (Niranjan et al., 2018; Ghaswa et al., 2019). Several SHC beneficiaries in Madhya Pradesh adopted SHC based nutrient management and benefitted in terms of yield and income (Singh et al., 2019). However, not many studies are available on the changing trend in the use of plant nutrients with the introduction of SHC. This paper analyzed the impact of SHCs on the fertilizer use behaviour of farmers as well as crop productivity in central India.

METHODOLOGY

The study was conducted in the Raisen district of Madhya Pradesh during 2017-18. An ex-post-facto research design was adopted for the study. Raisen district was selected for the study considering its good performance in distributing SHCs to a large number of farmers within the time frame in the cycle-I of the SHC scheme i.e., 2015-16 and 2016-17. (<https://soilhealth.dac.gov.in/PublicReports/ProgressReportDistrictWise>). Two blocks of the district viz., Sanchi and Gairatganj were selected purposively as the implementing agency of SHC scheme in the district, Krishi Vigyan Kendra (KVK), Raisen, distributed SHCs mainly in these two blocks, in the first phase. Further, to constitute the sample size of one hundred SHC beneficiary and fifty SHC non-beneficiary farmers, fifty SHC beneficiaries and twenty five SHC non-beneficiaries were randomly selected from each of the two blocks. Data collection was carried out through personal interview of the respondents with the help of a semi structured and pre-tested schedule. Nutrient management pattern of respondents was assessed on a three-point scale from 0 to 2. No adoption, Partial adoption and Full adoption were scored 0, 1, 2, respectively. If the farmer applied the recommended fertilizer(s) in more or less equal dose as per SHC it was considered as 'full adoption' whereas, if he/she applied it in a relatively lower or higher dose than recommended it was considered as 'partial adoption' and 'no adoption' if he/she failed to adopt the SHC recommendation. Level of adoption of fertilizer products was calculated using Adoption Quotient explained by Singh (1981) with slight modification.

To analyze the constraints, a list of constraints faced by the SHC beneficiary farmers in different parts of the country were

prepared from the available literature and seven statements were selected based on judges rating. Farmers were asked to rank those statements based on their experience and their responses were analyzed using Garrets ranking technique. Other statistical tools used for data analysis were descriptive statistics, and non-parametric tests like Mann-Whitney U test and Spearman's rank correlation.

RESULTS AND DISCUSSION

Crop diversity and cropping pattern

The study confirmed crop diversity in the farmlands of both groups of respondents. Major crops grown in the study area on commercial basis during *kharif* season were soybean and rice whereas, that of *rabi* season were wheat and gram. However, farmers also integrated many other crops like maize, pigeonpea, green gram and different vegetable crops in their farming system mainly for family food requirement. These crops had been commercially cultivated by nearly 10 per cent of the SHC beneficiary and 24 per cent of the SHC non-beneficiary farmers. Majority of the farmers were practising monocropping of soybean and rice (52% of SHC beneficiary and 62% of the non-beneficiary farmers) in the *kharif* season. However, the *rabi* crop wheat had been cultivated as a monocrop in hardly 14 per cent of SHC beneficiary and 26 per cent of the non-beneficiary farm fields. Multiple cropping of commercial crops such as soybean and rice in the *kharif* season was identified as regular practice in 31 per cent SHC beneficiary farm fields. Whereas, multiple cropping of wheat, gram, and lentil in the *rabi* season was practiced by both SHC beneficiary (69%) and non-beneficiary (34%) farmers.

Nutrient management practices, productivity and profitability

Analysis to identify discrepancies in the nutrient management pattern of the SHC beneficiary and non-beneficiary farmers showed significant differences between the two groups of farmers in the adoption of nutrients in their farmlands (Table 1). Higher mean ranks of SHC beneficiaries for NPK (83.75), MSN (88.46) and FYM (82.46) than SHC non-beneficiaries indicate that the nutrient management practices of SHC beneficiaries were much improved and balanced compared to SHC non-beneficiaries. Further analysis to understand the adoption pattern of different nutrients by the two groups of respondents showed the entire group of SHC beneficiary as well as non-beneficiary farmers adopted NPK nutrients but, in varying doses. However, hardly 2 per cent of the SHC non-beneficiaries adopted micro and secondary nutrients. Also, FYM application was not adopted in 24 per cent of the non-beneficiary farmlands. Use of different manures (pre-digested or semi digested) in agriculture limited to nearly 60 per cent farm fields in Madhya Pradesh (Motiwale et al., 2020).

Table 1. Comparison of two groups for the nutrient management pattern

Nutrients	Mean Rank		Mann-Whitney U	p value
	SHC beneficiary	SHC non-beneficiary		
Major nutrients (NPK)	83.75	59.00	1675.00	< 0.001
Micro & secondary nutrients (MSN)	88.46	50.10	1230.00	< 0.001
Farmyard manure (FYM)	82.46	61.59	1804.50	0.001

For the SHC beneficiaries, as there were prescribed doses of fertilizer nutrients based on the soil test values of their farmlands, analysis was done to understand the trend of nutrient use in terms of manures and fertilizers. Results (Table 2) showed that all the SHC beneficiaries were adopters of NPK fertilizer products such as urea, DAP/SSP and MOP but, majority of them were only partial adopters. The higher mean AQ value for the K fertilizer MOP compared to N and P fertilizers (Urea, DAP, SSP) conveyed its increased use. Findings of the study on impact of SHC scheme carried out by the National Institute of Agricultural Extension Management (MANEGE) supported these results as they reported a twenty per cent increase in the use of K fertilizers along with a slight decline in the use of N fertilizers (9%) and P fertilizers (7%) among the paddy framers of the country due to SHC scheme (PIB, 2021). According to fertilizer statistics of FAI (2020), consumption of N and P fertilizer products were more in Madhya Pradesh agriculture than K fertilizer. In the case of other nutrient products, many farmers failed to adopt micro and secondary nutrient fertilizers (40%) and FYM (13%) recommended in their SHCs. Studies on adoption of SHC based nutrient recommendation in Andhra Pradesh also confirmed many SHC beneficiary farmers as partial adopters and fertilizer dose is mostly based on their own perception (Chowdary & Theodore, 2016). Majority of this group of adopters applied fertilizer nutrients in higher doses than recommended expecting a higher yield performance (Chowdary et al., 2018). One of the main reasons behind the non-adoption of micronutrients by a lion share of SHC beneficiary farmers in the country was reported to be low awareness and knowledge about the benefits of micronutrients (Kumar & Rani, 2018).

The correlation analysis (Table 3) revealed that application of micro and secondary nutrients had positive correlation with average crop yield and income of SHC beneficiary farmers., this practice showed positive correlation even with the average crop yield of SHC non-beneficiary farmers. Increase in the net farm income with the adoption of SHC based nutrient application from the farm fields of Madhya Pradesh was earlier reported by Singh et al., (2019).

Though application of FYM did not show any significant correlation with crop yield the practice showed moderate correlation with the net income of the SHC beneficiary farmers. Positive impact of using straight fertilizers on the net farm income, if they were applied based on the soil test value was reported by Jayalakshmi et al., (2021). Possible reason for the positive impact of FYM on net farm income here might be due to the application of this locally available-low cost input in a required/higher dose with a proportional decrease in the dose of fertilizer nutrients.

Multiple cropping of rice and soybean in kharif season along with wheat and gram in rabi season were mostly adopted by the SHC beneficiary farmers. The average yield of crops from the system were 36.6 q ha⁻¹ for rice, 2.5 q ha⁻¹ for soybean, 37.4 q ha⁻¹ for wheat and 14.2 q ha⁻¹ for gram crops. From the rice based cropping systems, average yields obtained from SHC beneficiary and non-beneficiary farm fields for rice crop were 33.2 q ha⁻¹ and 30.2 q ha⁻¹, 30.8 q ha⁻¹ and 26.6 q ha⁻¹ for wheat crop, and 15.4 q ha⁻¹ and 13.8 qha⁻¹ for gram crops. Average yield of soybean, wheat and gram crops for the SHC beneficiary farmers from soybean based cropping systems were 2.84 q ha⁻¹, 28.9 q ha⁻¹ and 10.9 q ha⁻¹ respectively and for the non-beneficiary farmers yield values of these crops were 1.55 q ha⁻¹, 24.9 q ha⁻¹ and 7.4 q ha⁻¹ respectively. Possible reasons for the lower yield from the soybean crop could be erratic rainfall and outbreak of yellow mosaic virus along with pest attack occurred in the state widely during the study period as well as in the previous two kharif seasons (Srivastava et al., 2021). Farmers cultivated mostly the soybean varieties JS 93-05 and JS 95-60 and both of these varieties are reportedly susceptible to the yellow mosaic virus disease (JNKVV, n.d).

Constraints associated with the Use of SHC

The Garret's ranking analysis showed the most prominent constraint faced by the SHC beneficiary farmers of the study area as 'difficulty in understanding the information given in SHC without the assistance of an agricultural/extension officer' (Table 4). lack of knowledge about what is SHC and its use even after receiving the

Table 2. Extent of adoption of SHC based nutrient doses through fertilizers

Recommended Fertilizers in SHC	Full adoption (%)	Partial adoption (%)	No adoption (%)	Mean AQ (%)
Farmyard manure	29	58	13	58.0
Urea	4	96	—	52.0
Di Ammonium Phosphate (DAP)/ Single Super Phosphate (SSP)	13	87	—	53.8
Muriate of Potash (MOP)	22	77	1	60.5
Zinc fertilizer	30	30	40	45.0
Sulphur fertilizer	30	30	40	45.0

Table 3. Correlation between nutrient use and average yields from cropping systems

Nutrients	Spearman's rho			
	Average system yield		Net Income	
	Beneficiary	Non-beneficiary	Beneficiary	Non-beneficiary
NPK nutrients	0.0	-0.137	0.0	0.134
Micro & secondary nutrients	0.505**	0.337*	0.290**	0.176
Farmyard manure	0.159	0.301	0.282**	0.081

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

Table 4. Ranking of constraints associated with SHC use through Garret's ranking

S.No.	Constraints	Mean Score	Rank
1.	Difficulty in understanding the SHC information without the help of an agricultural/extension officer	45.24	I
2.	Unavailability of recommended quantity of FYM for farming	16.35	III
3.	Lack of trust in the information given in SHC	9.33	VI
4.	High cost of fertilizers recommended in SHC	7.02	VII
5.	Unavailability of SHC before the crop season	15.57	IV
6.	Lack of knowledge about the importance of SHC and the benefits associated with adopting the soil test based nutrient management even after receiving the card	22.2	II
7.	Other personal constraints associated with illiteracy/low education	10.95	V

card and unavailability of recommended quantity of FYM for farming were also ranked among the top three constraints associated with the use of SHC. Other researchers have also reported similar issues faced by the farmers while adopting the SHC based nutrient recommendations in different parts of the country (Ghaswa et al., 2019; Gogoi et al., 2021; Senthamizhselvan et al., 2022). This calls for the need for more extensive efforts from the promoting agencies of SHC such as government and other extension agencies to enhance the knowledge level of farming community about the use as well as benefits associated with SHC through different capacity building programmes. Thus, farmers could develop more understanding about this innovative technology and that in turn lead to its proper adoption.

CONCLUSION

Significant differences observed in the nutrient use between the SHC beneficiary and non-beneficiary farmers confirm the effectiveness of SHC in generating awareness among the farmers about soil test based fertilizer use. However, many factors prevent the diffusion of the technology deep into the farming community such as difficulty in understanding SHC and lack of knowledge about scientific nutrient management. Correlation of application of micro & secondary nutrients with yield and net income of SHC beneficiary farmers is a visible result of this innovative tool. This study has revealed that the SHC scheme can have higher impact in the judicious use of plant nutrients through fertilizers and manures, if the farmers become successful in properly interpreting the information given in their SHCs as well as the direct and indirect benefits of SHC based nutrient management. This innovation may take lot more years to penetrate into the farming systems if the promoters fail to impart need based training/awareness programmes through targeted approach.

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Factors Affecting Perception of Extension Agents Towards Effective Social Media Utilization Behaviour

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ABSTRACT

Changing times demand an in-depth analysis of the unexplored opportunities which social media offers. As extension agents are the front line of the extension and advisory services a study focused on analyzing their perception towards effective social media utilization behaviour and factors affecting their perception was carried on in the IT revolutionized Andhra Pradesh state during 2021. The survey method was used to collect data from 160 extension agents selected through a proportionate random sampling method from three districts namely Chittoor, Srikakulam, and Guntur of Andhra Pradesh. It was found that 51.88% of the extension agents had a neutral perception. It was found that scientific orientation, job perception, technology management orientation, innovative proneness, information management orientation, and orientation towards the extension service profession of the extension agents had a significant and positive correlation with the perception. Stepwise regression analysis revealed that eight variables namely technology management orientation, orientation towards extension service profession, innovative proneness, scientific orientation, perceived workload, education, gender, and work experience, were a good fit with an R-square of 55.1 per cent.

INTRODUCTION

Traditional agricultural extension services in India and other developing countries confront several constraints that restrict their effectiveness in providing services. To deal with these challenges it is necessary to explore the potential of ICT-based platforms that provide two-way continuous communication and feedback. Studies on ICT-based extension have put forward many new extension models and strategies to increase the reach of agricultural extension services. Study conducted by Kale et al., (2016) found that the scientists had a positive perception of the ICT-based extension. Social media is one such ICT-based platform that can lead to enhanced smallholders' access to timely information services. Social media also decreases the cost of personal visits and facilitates two-way contact between farmers and extension agents, improving the

quality of services given. Because of its potential, it is a very effective and beneficial tool for extension agents to engage with their clients and colleagues. Social media utilization behaviour has a lot to do with attitude rather than age (Saravanan, 2016). Since extension agents play a crucial role in mainstream extension, frontline extension, and private extension services it is highly essential to include their viewpoints on effective social media utilization behaviour. Social media have the capability to create extension mechanism for purposeful farmer to farmer learning exchange (Nain et al., 2019). A majority of farmers were using social media for receiving and sharing agricultural information according to the study conducted by Nain et al., (2015); Panda et al., (2019); Singh et al., (2021). James et al., (2020) showed that three-fourths 78.13 per cent of KVK scientists shared a strong or better perception of social

media. He further reported that 77.02 per cent of scientists had a good to a better perception of social media. It was also found that job performance, job experience, scientific orientation, job involvement, organizational climate, abroad exposure, mass media involvement, education, achievement motivation, number of publications, innovative proneness, e-readiness, competition orientation, field activities conducted, and training of KVK Scientists had a significant to a highly significant relationship with their perception regarding social media. Considering the given potential of social media the study was conducted on the extension staff of all the extension organizations such as state government, KVKs, SAU, ATMA, Input dealers, and NGOs to analyze their perception of social media and the socio personal job-related characteristics affecting their perception.

METHODOLOGY

The study was conducted in three districts namely Chittoor, Guntur, and Srikakulam of Andhra Pradesh through random selection. From the pool of extension agents working in the three districts under the frontline extension and field extension, a proportionate random sampling method was used to select 160 extension agents (60 from Guntur, 60 from Chittoor, and 40 from Srikakulam). Well-structured questionnaires were designed for data collection for survey. The perception towards effective social media utilization behaviour was operationalized as the degree to which an individual believes that using a particular system would enhance his or her job performance. To measure the perception the scale developed by Kale et al., (2016) with modifications was used. To evaluate the perception, extension agents were requested to respond to 20 items listed in the questionnaire against a five-point continuum. Based on the overall score obtained each respondent was categorized into unfavourable, neutral, and favourable perception. The socio-personal and job-related variables included age, gender, education, background, work experience, social

participation, training attended, achievement motivation, innovative proneness, scientific orientation, perceived workload, job perception, job performance, technology management orientation, information management orientation, and orientation towards extent service profession. Categorical variables were analyzed through frequency and percentage whereas continuous variables were analyzed and categorized into low, medium, and high based on mean and standard deviation. To find the relationship of independent variables on perception towards social media, different statistical analyses such as the chi-square and Fisher's exact tests for categorical variables and correlational analysis for continuous variables were done. To study the most parsimonious variables that show the combined effect of independent variables in explaining the variation on the dependent variable (perception), the stepwise multiple regression analysis was carried out. The model excludes the variables which do not significantly contribute to the dependent variable.

$$Y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 \dots \dots \dots b_n X_n$$

Where, b_0 = Constant, Y = Dependent variable, $X_1 \dots X_n$ = Independent variable, $b_1 \dots b_n$ = Regression coefficient for respective variables.

RESULTS AND DISCUSSION

Majority of the extension agents had a neutral perception towards social media usage in agriculture extension service delivery which accounted for (51.88%) and (28.75%) had unfavourable perception. These results were consistent in good agreement with other study by James et al., (2020).

The item-wise analysis of the positive and negative items was done for each item. The results in Table 1 state that the statement, videos are very useful for educating farmers on improved practices and technologies was the item that has scored the highest as videos also help illiterate farmers in better understanding. Adding up the scores of the extension agents across the item the score accounted for 706 which takes the strongly most agreed item. It was

Table 1. Item wise analysis of perception

S.No.	Perception items of social media utilization behaviour	Weighted score
1.	Creative application of social media can lead to enhanced quality and use of the information disseminated.	673
2.	Social media help in strengthening the research-extension-farmers linkage	679
3.	Through using social media, statistical analyses of the research data become very easy	655
4.	Social media are more useful tool for extension agents when dealing with illiterate farmers (-)	395
5.	Videos are very useful for educating farmers on improved practices and technologies	706
6.	Social media reduce the workload of KVK staff and enhanced the productivity of scientists	628
7.	Use of social media is very cumbersome for agricultural extension activities (-)	263
8.	Internet is an important source for collecting current information on every aspect of agriculture	683
9.	Social media reduce interpersonal relationships between extension agents and farmers (-)	510
10.	Social media help carry out extension activities like training, demonstration, field day, Kisan Mela, campaign, etc	688
11.	The use of social media is very time consuming and boring in extension work (-)	546
12.	Due to eye pain, headache the use of social media is decreasing (-)	500
13.	Mobile phone is an emerging ICT tool for extension work in India	678
14.	Social media are not suitable for extension activities in rural India (-)	569
15.	The application of social media saves time, covers the masses in a short period, and reduces the distance	680
16.	ICTs like multimedia, video, and PowerPoint can be used to create a constructive and interesting learning environment	679
17.	Social media promote communication and coordination among KVKs, research institutes, and SAUs	665
18.	Preference for mobile phones for disseminating knowledge, market, and weather information to the farmers is increasing	677
19.	Preference for sending the Short Message Service (SMS) in extension is decreasing (-)	517
20.	Social media tools offer real advantages over traditional methods of training and extension	655

Table 2. Relationship between socio-personal, job-related variables with perception

Variables	Test	Values	Significance
Gender x Perception	Chi-square test	5.93	0.052 ^{NS}
Background x Perception	Chi-square test	2.89	0.236 ^{NS}
Education x Perception	Fisher's Exact test	11.14	0.023*
Work Experience x Perception	Fisher's Exact test	4.12	0.121 ^{NS}
Social participation x Perception	Chi-square test	10.06	0.007**
Training x Perception	Chi-square test	1.76	0.415 ^{NS}

NS = Non significant, * Significant at 0.05 level of significance, ** Significant at 0.01 level of significance

supported by the research study conducted by Tambade et al., (2019) whereas agricultural videos played a vital role in improving the skill and knowledge of the farmers. The item social media help carry out extension activities like training, demonstration, field day, Kisan Mela, campaign, etc. was the second most accepted item well supported by the research study of Sharma et al., (2020) whereas social media became the preferred source for getting and sharing agricultural information and other social messages. The item social media are not suitable for extension activities in rural India' was the negative item that scored 569. It was interpreted as a item that was highly disagreed as it was contradictory to all the research findings.

Relationship between socio personal job-related variables and perception towards social media

The results in Table 2 indicate that among the categorical variables cross-tabulation was done, chi-square and fisher's exact test were used to find out the association of the variables with the perception. The gender, background, work experience, and training received by extension agents did not show any significant relationship with the perception. It may be interpreted that a positive perception towards social media can be developed among the extension agents irrespective of their gender, background, work experience, and training received. Variables such as education ($p < 0.05$) and social participation ($p < 0.01$) showed significant association with the perception towards social media. The results are compatible with Kale et al., (2016); Nirmalkar et al., (2022).

The data in Table 3 indicate the relationship of the continuous variables with the perception towards social media through a correlation analysis. The results of the correlational analysis state

Table 3. Correlational analysis of the independent variables with dependent variable

Independent variables	Correlation with Perception
Age	0.065 ^{NS}
Achievement Motivation	0.124 ^{NS}
Innovative Proneness	0.373**
Scientific Orientation	0.316**
Perceived Work Load	-0.159*
Job perception	0.397**
Job Performance	0.169*
Technology Management Orientation	0.541**
Information Management Orientation	0.423**
Orientation Towards Extension Service Profession	0.527**

NS = Non significant, * Significant at 0.05 level of significance, ** Significant at 0.01 level of significance

that age and achievement motivation were not significantly related with the perception towards social media. Job performance had a significant and positive relationship with perception towards social media at 0.05 level of significance. It was also evident that perception towards social media showed a negative relation with the perceived workload where an individual who felt that they were filled with workload cannot perceive the new platforms such as social media. Hence the organizations need to take up stress control measures and make employees free from their perceived workload which will increase their positive perception towards social media in order to indirectly help decrease their workload.

Variables such as innovative proneness, scientific orientation, job perception, technology management orientation, information management orientation, and orientation towards the extension service profession had a significant and positive correlation with the perception towards social media at a 0.01 level of significance. It can be interpreted that the development of these qualities among the extension agents through capacity development programmes can lead to an increase in positive perception among the extension agents towards the effective social media utilization behaviour. These results are consistent with other studies like James et al., (2020).

Based on the results in Table 4 it is revealed that in stepwise analysis, eight variables dominated in the estimation of perception towards social media. The model with all these eight variables was a good fit with an R-square of 55.1 per cent which revealed that 55.1 per cent variation in the perception towards social media could be explained by these eight variables (independent) selected in the study. It can be interpreted that variables namely technology management orientation, orientation towards extension service profession, innovative proneness, scientific orientation, perceived workload, education, gender, and work experience, determine the variation in the perception of extension agents. It can be interpreted that change in these variables can contribute to change in the perception of extension agents. Hence it is an opportunity for all the grassroots extension organizations to work on these qualities of extension agents which leads to change in their levels of perception towards effective social media utilization behaviour.

CONCLUSION

Most of the extension agents had a neutral perception regarding social media in advisory services. It indicates that some additional support from different extension institutes and exposure to different types of social media platforms would help to increase and develop a positive perception among the extension agents. It is easy to increase the positive perception of the extension agents irrespective of their age, gender, background, work experience,

Table 4. Stepwise multiple regression

Coefficients		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta		
1	(Constant)	21.965	5.572		3.942	.000
	Technology Management Orientation (X_{14})	.510	.086	.378	5.941**	.000
	Orientation towards Extension Service Profession (X_{16})	.340	.087	.257	3.897**	.000
	Innovative proneness (X_9)	.527	.196	.162	2.688**	.008
	Scientific Orientation (X_{10})	.373	.145	.153	2.573*	.011
	Perceived work load (X_{11})	-.426	.141	-.188	-3.023**	.003
	Gender=Female (d_{female})	-1.943	.769	-.141	-2.526*	.013
	Education=UG (d_{ug})	1.809	.810	.133	2.232*	.027
	Education=PG (d_{pg})	1.294	1.266	.060	1.022	.309
	Education=Ph.D. (d_{phd})	6.334	2.474	.146	2.560*	.011
	Work Experience=Junior level (d_{junior})	1.271	1.425	.056	.892	.374
	Work Experience=Senior level (d_{senior})	-5.417	2.734	-.124	-1.981*	.049

a. Dependent Variable: Perception

R²=55.1%

$$Y_1 = 21.965 + 0.510 X_{14} + 0.340 X_{16} + 0.527 X_9 + 0.373 X_{10} - 0.426 X_{11} - 1.943 d_{female} + 1.809 d_{ug} + 1.294 d_{pg} + 6.334 d_{phd} + 1.271 d_{junior} - 5.417 d_{senior}$$

previous training attended, and achievement motivation. The variables namely technology management orientation, orientation towards extension service profession, innovative proneness, scientific orientation, perceived workload, education, gender, and work experience had dominated the estimation of perception towards social media. Extension organizations should work on these qualities among the staff so that it may lead to a higher contribution in the way they perceive and take benefits from using technologies such as social media platforms.

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Migration Behaviour of Rural Youth in Haryana

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ABSTRACT

Rural to urban migration has become an unavoidable event in the last 25 years with increased industrialization, growing service industry, better food security, access to improved healthcare and educational facilities in the cities apart from the rising ambitions of the youths. Agriculture always had a vital role in a village economy but this sector has not been financially rewarding in the past few decades and as a consequence of which, young generations from villages are leaving their family enterprises and migrating to cities for acquiring modern education and skills to secure a job in private sector. The study was conducted to find out the migration behaviour of rural youth in Bhiwani and Hisar districts of Haryana. A sample size of 192 rural youths i.e., 96 fully migrated & 96 partially migrated, were selected for the study. Findings revealed that unstable income, lesser employment, repeated crop failures were the push factors responsible for migration of rural youths. Higher wages, better jobs and better standard of livings in cities were the major pull factors motivating rural youths to migrate towards cities. Further, socio-economic & psychological variables such as age, education, farm size, non-farm skills, income expectancy, comfort expectancy, risk orientation, self-reliance & self-confidence had significantly positive correlation whereas, farm size, stimulation expectancy and affiliation expectancy had negatively significant relationship with migration behaviour of rural youth. Also, regression analysis showed that, seventeen independent variables selected for the study could explain 59.40 per cent variation in the migration behaviour of rural youths.

INTRODUCTION

Youth is the time of life when one is young. It's the time period between the childhood and maturity (Merriam Webster). Youth form the basis for any future development programmes related to socio-economic growth or sustainability. Their importance can be realized from the fact that the 2011 was declared as the International Year for Youth by United Nations General Assembly. India is a land of young people. It possesses the largest proportion of young population in the world. As per 2011 Census, there are about 550 million youth including adolescents in India (Draft National Youth

Policy, Ministry of Youth Affairs and Sports, 2012). That's why, it is even more important for India to use this demographic dividend to the best of its capacity.

Rising urbanization is regarded as a sign of growth and progress of a country. The urbanization in India is expected to reach 40.00 per cent by 2030 as (UN World Urbanization Prospects, 2005). The absolute increase in the population of urban areas between the periods of 1991-2001 was 31.20 per cent while in the rural areas, the increase in population was only 17.90 per cent (NSSO, 2008). Rural to urban migration has become an unavoidable event in the last 25 years with increased industrialization, growing service

industry, better food security, access to improved healthcare and educational facilities in the cities apart from the rising ambitions of the youths. As per the UN Migration Agency (IOM) any person who is moving or has moved across a national territory or within a State away from his/her native place is a migrant, regardless of whether the person has legal status to do; the nature of movement (voluntary or involuntary), the causes of this movement and the length of the stay in the migrated place.

Agriculture always has a vital role in a village economy but this sector has not been financially rewarding in the past few decades due to several risk factors that affects farmers (Hari et al., 2013). Also, lack of adequate literacy, lack of knowledge on agricultural information and technology and lack of enough skills in handling the modern agricultural technologies in youth means they cannot achieve the desired level of production (Chinchmalatpure & Tekale, 2019). As a result, rural youths are leaving their family enterprises and migrating to cities for acquiring modern education and skills to secure a job in private sector rather than working in fields (Maurya et al., 2021). Unless significant change is made in the way farming is done and agriculture becomes a profitable enterprise, it would be difficult to retain or attract rural youth in agriculture (Som et al., 2018). Keeping the above facts in mind, this study wants to find the factors influencing the migration behaviour in rural youths.

METHODOLOGY

Bhiwani and Hisar districts of Haryana were chosen randomly for the study. Additionally, two blocks Tosham and Bawani Khara were selected from Bhiwani district where as Hansi-1 and Hisar-2 were selected from Hisar district randomly. Further, four villages were chosen randomly, from each block. Also, 12 youths (6 fully migrated and 6 partially migrated) having education up to 12th standard were selected from each of the villages, thus a total of 192 youths (96 fully migrated and 96 partially migrated) were selected for the study. Rural youth in this study was operationalized as 15-30 years male from the village. Also, fully migrated youth was defined as a rural youth who has permanently moved out of his family's agricultural enterprise and relocated to a town or city for the purpose of acquiring new skills and getting a job while partially migrated youth was defined as a rural youth who temporarily relocates to a town or city in search of employment opportunities during lean periods while returns back to his village to take part in agricultural activities in peak seasons of such as harvest, sowing etc. Personal interview technique was used for the collection of data after developing well-structured interview schedule and analysis was done using MS Excel and Statistical Package for Social Sciences (SPSS, 26th version). For measuring the socio-economic and psychological characteristics of rural youth, seventeen variables were selected viz., age, education, occupation, farm size, farm skill, non-farm skill, proximity to town, prior migration experience, economic motivation, achievement motivation, risk orientation, self-reliance, self-confidence, income expectancy, comfort expectancy, stimulation expectancy and affiliation expectancy were selected for the study. Also, in order to study the migration behavior of rural youth, questions were asked to access the direct indicators, perception indicators and factors

influencing migration from both groups of respondents i.e., fully migrated and partially migrated youth. Further, correlation and regression analysis were done to understand the relationship between migration behavior and the socio-economic & psychological profile of the rural youths.

RESULTS AND DISCUSSION

Direct indicators of migration behaviour

Table 1 reveals that, for nature of migration the average mean score for fully migrated youths (3.00) was higher than the score for partially migrated youths (1.54). For nature of work table 1 reveals that both fully and partially migrated youth had similar average mean score. The main factors responsible for this could be the fact that the partially migrant youth return to their native place to participate in agricultural activities during peak seasons. Also, it is evident from table 1 that the average mean score in terms of work place distance from the village was higher for fully migrated youth (2.91) as compared to partially migrated ones (2.43). This could be explained by the fact that fully migrated youth who don't wish to return back, relocate to industrialized hubs like Delhi, Bahadurgarh, Rohtak, etc. In comparison, the partially migrant youths prefer to labor in places nearby to his native village, as it would allow them to seasonally return to take part in agricultural activities.

Also, for migration decision making the fully migrated youths (2.06) scored higher than partially migrant youths (1.68). The primary reason for this could be that fully migrant youths has more (previous) movement familiarity w.r.t. to partially migrated youths and that increase their self-decision making. Further table 1 reveals that for migration network the average mean score of partially migrated youths were higher (2.41) than fully migrated youths (1.71). The seasonal involvement of partially migrant youths in agriculture would make them take temporary breaks from their work in towns which would require the partially migrant youths to build a strong interpersonal link to get knowledge about new job openings and places to live.

The data in Table 1 reveals that for family migration norm, fully migrant youths (2.43) scored higher than partially migrant ones (2.28). The major reason behind it could be that the income from work in town, post migration would act as an additional financial support in lean periods. Moreover, it can be concluded from table 1 that in case of intention to re-migrate the average mean score for fully migrated rural youth (2.84) was higher as compared to partially migrated rural youths (2.28). In spite of the fact that the fully migrant youths are permanent immigrants, they still possess the desire to return back to their villages.

Perception indicators of migration behaviour

Table 2 reveals that in case of aspirations, the average mean score for the fully migrant youths (2.60) was higher than the partially migrant youths (2.47). Fully and partially migrated rural youth have the ambitions of accomplishing a respectable social and financial position, possession of property and materials. Further, in terms of creativity Table 2 reveals that for fully (2.10) and partially migrant youths (2.06) the average mean score was

Table 1. Direct indicators of migration behavior

S.No.	Indicators	Mean scores	
		FM (96)	PM (96)
1	Nature of migration	3.00/3.00	1.54/3.00
	Temporary	-	44 (48.83%)
	Circular	-	52 (54.17%)
	Permanent	96 (100.00%)	-
2	Nature of work	1.00/2.00	1.00/2.00
	Agriculture	-	-
	Non-agriculture	96 (100.00%)	96 (100.00%)
3	Work place distance from village	2.91/4.00	2.43/4.00
	Up to 25 km	03 (03.13%)	15 (15.63%)
	25-50 km	17 (17.71%)	40 (41.67%)
	50-100 km	32 (33.33%)	26 (27.08%)
	More than 100 km	44 (45.83%)	15 (15.63%)
4	Decision making (Migration)	1.68/3.00	2.06/3.00
	Self	35 (36.46%)	29 (30.21%)
	Family members	43 (44.79%)	32 (33.33%)
	Others	18 (18.75%)	35 (36.46%)
5	Migration network	1.71 /3.00	2.41/3.00
	Family or relatives	35 (36.46%)	10 (10.42%)
	Friends/neighbors	54 (56.25%)	37 (38.54%)
	Agencies	07 (07.29%)	49 (51.04%)
6	Family migration norm	2.43/3.00	2.28/3.00
	Motivate to migrate	52 (54.17%)	43 (44.79%)
	No idea	24 (25.00%)	37 (38.54%)
	Do not encourage to migrate	20 (20.83%)	16 (16.67%)
7	Intention to re-migrate	2.84/5.00	2.28/5.00
	Intend to return in one year	16 (16.67%)	18 (18.75%)
	Intend to return within five years	32 (33.33%)	46 (47.92%)
	Intend to return within 5 to 10 years	16 (16.67%)	19 (19.79%)
	Intend to return after 10 years	14 (14.58%)	13 (13.54%)
	No intention to return	18 (18.75%)	-

comparatively similar. Also, from Table 2 it is evident that, in terms of occupational mobility, fully migrant youths (2.60) scored higher than partially migrant youths (2.08). This could be due to the fact that fully migrated rural youth is more perceptive to learning new skills and traveling to new places to take up the jobs as compared to partially migrated youth.

Also, it is evident from Table 2 that, for the social comprehensiveness the average mean score was comparatively higher for fully migrant youths (2.20) as compared to partially migrant youths (1.80). The fully migrant rural youths easily adjust to their new work culture and environment while the partially migrant rural youths wish to remain inside his own community of people (from their native place). For the parental and peer support, the score of fully migrant youths (02.32) was higher than partially migrant youths (02.06). Large numbers of the fully migrated rural youth have followed their friends who have migrated earlier. Also, the result depicts that for the remuneration from migration, the average mean score for fully migrant youths and partially migrant youths were similar, i.e., 02.67 and 02.60, respectively. It was understood from the replies of the respondents that remittances from migration have enhanced their living standards. The findings are supported by Anamica (2010), who stated that higher wages in urban areas are one of the biggest motivators of migration.

Push and pull factors responsible for migration of rural youths

The data presented in Table 3 shows that unsteady income from farming (92.71%) and lesser employment (90.63%) were the major reasons that pushed the rural youth to migrate. Further, regular crop failures as a result of adverse climatic conditions, peer pressure (67.61%) and small size of land holding (62.50%) were also responsible for the migration of rural youths.

The rural youth consider farming to be the last option for livelihood due to high risks from all these external factors that affects the crop production. Also, the higher educational qualifications and professional ambitions of the rural youths attract them towards building a career in private & corporate sectors. The findings are supported by Ramasubramaniam (2003) & Anamica (2010), which revealed that, inadequate revenue from farming and low employability in their native places are the primary push factors responsible for migration among rural youths.

Further, it can be concluded from table 3 that higher wages (96.35%), better jobs (93.75%), higher living standard (84.38%), work with less drudgery (78.65%) and skill acquisition (67.19%) were the primary pull factors which encouraged the migration among rural youths. The findings are similar to Kainth (2009), who revealed that, improved job prospects & relatively higher income offered in towns are the main pull factors encouraging rural youths to migrate.

Table 2. Perception indicators of migration behaviour

S.No.	Perception Indicators	Mean Score	
		FM	PM
1.	Aspiration	2.59/3.00	2.47/3.00
	To increase income	2.98	2.92
	To increase material possession	2.85	2.81
	To alter house or construct new house	2.17	1.99
	To purchase land	2.43	1.93
	To reach better social status	2.58	2.72
2.	Creativity	2.10/3.00	2.06/3.00
	Ambitious to go beyond tradition	2.41	1.91
	To take up the new task	2.49	2.31
	To revamp problems and assimilate ideas	1.88	1.89
	To work on different ideas at the same time	1.82	2.09
	To elaborate and expand the idea	1.93	2.09
3.	Occupational mobility	2.60/3.00	2.08/3.00
	I like travelling to unknown places in search of work	2.57	1.89
	I don't hesitate to take up jobs in new areas	2.43	1.84
	I don't hesitate to blend with peoples from unknown vicinity	2.82	2.21
	I easily get hold of the new traditions and customs	2.91	2.11
	I can easily learn new professional skills	2.26	2.29
4.	Migration intention	2.39/3.00	2.49/3.00
	I had a desire to relocate in past and I relocated	2.91	2.89
	I still have the desire to migrate	2.46	2.57
	I have a desire to relocate in future also	1.81	2.01
5.	Degree of social inclusiveness	2.20/3.00	1.80
	I prioritize living in the relocated place than my native village	1.89	1.61
	I feel assured of my safety in the relocated place	2.23	1.57
	I am very comfortable living with people from other communities	2.31	1.69
	I feel comfortable working with people from other communities	2.29	1.90
	I leave my family in village whenever I move to unknown places	2.27	2.21
6.	Parental and peer influences	2.32/3.00	2.06/3.00
	I migrated as my clan looked down on the farming	2.11	2.59
	I relocated as parents wanted me to leave farming	1.89	1.89
	I migrated as my friends migrated too	2.71	1.82
	I migrated as my parents want me to make earn better income like my neighbors and friends	2.15	1.81
	I migrated as families of prospective brides look down upon youths engaged in farming	2.72	2.21
7.	Remuneration	2.67/3.00	2.60/3.00
	Remuneration from migration has improved my economic status	2.79	2.81
	Remuneration from migration has made me financially independent	2.81	2.81
	Remuneration from migration has improved by ability to support the financial needs of my family	2.89	2.81

Dejong (2000) also concluded that higher wage expectancy is one of the prime reasons responsible for migration. The results are also in line with Kumari et al., (2022) who observed that male members migrate to towns in search of better jobs.

Relationship between socio-economic and psychological profile of rural youth with their migration behavior

Table 4 reveals that the independent variables viz. age, education, proximity to towns, non-farm skill, migration experience, self - reliance, self –confidence, economic motivation, risk orientation, income and comfort expectancy had significantly positive correlation with the migration behaviour, while farm size, stimulation, and affiliation expectation have significantly negative relationships with migration behaviour. The findings are in line with Anamica (2010), who stated that migration behavior is positively influenced by risk orientation & economic motivation of youths.

Dejong (2000) also stated that migrated youth has high comfort expectancy and low affiliation expectancy. The results are also supported by Sharma (2007), who revealed that migration behaviour is higher among the villages (youths) that are closer to the towns. Moreover, from the R^2 value of 0.594, it can be concluded that seventeen independent variables selected for the study accounts for 59.40 per cent deviation in behaviour of migrant youths.

CONCLUSION

Comparison of fully and partially migrated youths reveal that former tends to move to a greater distance from his native village and shows higher occupational mobility as compared to the later. In terms of factor influencing migration, unstable income, lesser employment, repeated crop failures are the primary push factors responsible for migration of rural youths whereas higher wages, better jobs and better standard of livings in cities are the major pull

Table 3. Push and pull factors responsible for migration of rural youths

S.No.	Factors Responsible	Fully Migrated (n=96)		Partially Migrated (n=96)		Total (n=192)		
		F	%	F	%	F	%	Rank
I	Push Factors							
1.	Small farm size	59	61.46	61	63.54	120	62.50	IV
2.	Unstable income	87	90.63	91	94.79	178	92.71	I
3.	Lesser employment	91	94.79	83	86.46	174	90.63	II
4.	Repeatedly crop failure due to natural calamities	51	53.13	79	82.29	130	67.71	III
5.	Humdrumness in agriculture	49	51.04	59	61.46	108	56.25	V
6.	Social discrimination	41	42.71	35	36.46	76	39.58	VII
7.	Debt	43	44.79	64	66.67	107	55.73	VI
8.	Peer pressure	79	82.29	51	53.12	130	67.71	III
9.	Lack of social amenities	29	30.21	21	21.88	50	26.04	VIII
II	Pull Factors							
1.	Availability of better jobs	91	94.79	89	92.71	180	93.75	II
2.	Higher wages	93	96.88	92	95.83	185	96.35	I
3.	Better standard of living	83	86.46	79	82.29	162	84.38	III
4.	Better infrastructure facilities	69	71.88	51	53.13	120	62.50	VI
5.	Work with less drudgery	73	76.04	78	81.25	151	78.65	IV
6.	Safety and Eco friendly environment	39	40.63	39	40.63	78	40.63	VIII
7.	Better social linkage	49	51.04	37	38.54	86	44.79	VII
8.	Skill acquisition	62	64.58	67	69.79	129	67.19	V

*Multiple responses

Table 4. Relationship between socio-economic and psychological profile of rural youth with their migration behavior

S.No.	Socioeconomic and psychological character	Fully Migrated Correlation coefficient	Partially Migrated Correlation coefficient	Total Correlation coefficient
1	Age	0.239*	0.449**	0.311**
2	Education	0.291**	0.398**	0.353**
3	Occupation	0.109 ^{NS}	0.009 ^{NS}	-0.076 ^{NS}
4	Farm size	-0.309**	0.169 ^{NS}	-0.243**
5	Farm skill	-0.671**	0.007 ^{NS}	-0.065 ^{NS}
6	Non-farm skill	0.259*	0.351**	0.289**
7	Proximity to town	0.531**	-0.097 ^{NS}	0.287**
8	Prior migration experience	0.289**	0.329**	0.331**
9	Economic motivation	0.335**	0.409**	0.430**
10	Achievement inspiration	0.140 ^{NS}	-0.004 ^{NS}	0.063 ^{NS}
11	Risk orientation	0.279*	0.290**	0.369**
12	Self-reliance	0.239**	0.569** ^S	0.396**
13	Self confidence	0.339**	0.006 ^{NS}	0.229**
14	Income expectancy	0.609**	0.599**	0.604**
15	Comfort expectancy	0.641**	0.146 ^{NS}	0.477**
16	Stimulation expectancy	-0.541**	-0.159 ^{NS}	-0.430**
17	Affiliation expectancy	-0.589**	-0.136 ^{NS}	-0.448**
R ²		0.663	0.515	0.594

factors motivating rural youths to migrate towards cities. Further, socio-economic & psychological variables such as age, education, farm size, non-farm skills, income expectancy, comfort expectancy, risk orientation, self-reliance and self-confidence show positively significant correlation with migration behaviour whereas, farm size, stimulation expectancy and affiliation expectancy have negatively significant relationship with migration behaviour. It can be implied from the study that reduced profits in agriculture and lack of employment in rural areas are responsible for this trend in migration behaviour of rural youths, where they are leaving their native places in search of a better life.

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Understanding Conservation Agriculture in terms of Knowledge, Perception and Application

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ABSTRACT

Depleting natural resources, environmental pollution and climate change are the three major factors of concern simmering up with contemporary global agriculture. Conservation agriculture (CA) is being flagged up as a sustainable adaptation mechanism. Adoption of CA depends upon ecological as well as, farmers' level of perception, knowledge acquisition, and decision-making process. The present study was taken place in West Bengal covering both the new alluvial zone (NAZ) and terai zones (TZ) following snowballing sampling method during 2018-21. A total of 65 farm households were surveyed considering 57 different social-ecological factors operating across CA farms. The study elucidated that farmers' perception of energy, climate change perception, formal education, land fragmentation, gender ratio, irrigated area, dietary diversity, and family size came up as strong determinants of their level of knowledge of CA. Understanding and measuring the complexity of social knowledge is essential for sustainable management, with consequences for problem-solving, mutual aid, and decision-making.

INTRODUCTION

Decreasing share of agriculture in productive economy and employment is taking place at different speeds and it is generating different challenges across the regions. Though spending on agriculture and technical breakthroughs are increasing crop production and yield has stagnated to an unacceptably low proportions. Food waste and losses account for a large amount of agricultural output. While, natural resource degradation is impeding the much-needed acceleration in productivity growth, the spread of transboundary pests and diseases of plants and animals, as well as the loss of biodiversity. CA has come into context as an adaptation and mitigation mechanism for safe and healthy food and environmental sustainability (FAO, 2014; Sharma et al., 2022). With CA, growers can save from 30 per cent to 40 per cent of time and

energy as compared to conventional cropping (Bharti et al., 2021). CA adoption is still stagnating in the global context (Chatterjee et al., 2021) even though farmers want to adopt more sustainable practices, and an obvious prerequisite is that they are already aware of the technology's existence (Llewellyn, 2007). D'Emden et al., (2008) found that farmers' attendance at cropping extension activities is strongly associated with the adoption of conservation tillage. Nain et al., (2019) highlighted the understanding of farmers' innovations it learning experiences for profitable farming. Gathering proper information and knowledge about sustainable farming is a highly dynamic and social process. Thus, knowledge networks and behavioural practices are to be mutually constructed to build a concrete association between people and CA technologies (Röling & Jiggins, 2007). Limitations of personal relationships with others (experts or extension agents) usually foster distrust, making local

knowledge networks highly resistant and long-lasting (Moore, 2011).

CA has been proven to be more knowledge-intensive than input-intensive, and its success is determined by the farmer's activities rather than the number of inputs used. (Saha et al., 2022). The traditional knowledge of the farmers also plays a crucial role in practising sustainable crop production (Lenka & Satpathy, 2020) also the factors of knowledge are equally important (Ravikumar et al., 2015). Even though large farmers have access to a variety of knowledge sources, this is not always the case for small farmers. Large farmers are facts and knowledge seekers in nature, seeking newer knowledge and cutting-edge technology (Wall, 2007), whereas small farmers are not well connected to outside information sources, even if they own a radio; televisions are not always common, and mobile and internet connections are lacking.

In India, Several State Agricultural Universities, ICAR institutions, and the Rice-Wheat Consortium for the Indo-Gangetic Plains have collaborated to disseminate CA technologies. Bilaiya et al., (2019) also found that CA despite being such a profitable technology, low adoption and knowledge rate is seen among farmers. Thus, the knowledge level of adopters and non-adopters of CA in the rice-wheat cropping system must be assessed. Indeed, lack of awareness has a significant role in determining whether or not farmers decide to participate (Higgins et al., 2017). Hence, the present study tried to elucidate the interaction between the farmers' level of knowledge of CA and operating social-ecological factors within the study regions.

METHODOLOGY

The study was conducted in the Haringhata (twenty respondents from five villages) and Chakdaha (twenty respondents from five villages) blocks of Nadia and Balagarh (twenty respondents from five villages) and Pandua (twenty respondents from five villages) blocks of Hooghly district from NAZ of West Bengal and Coochbehar-I (thirty respondents from six villages), Coochbehar-II (thirty respondents from six villages) and Dinhata-II (thirty respondents from six villages) blocks from Coochbehar (thirty respondents from six villages) and Alipurduar-I (thirty respondents from six villages) and Falakata (thirty respondents from six villages) blocks from Alipurduar districts of TZ of West Bengal during the period 2018-21. The purposive snowball sampling technique was adopted for the present study as CA is still not adopted rapidly in the study area (Ray & Mondal, 2014). A total of 250 farmers from the aforesaid agro-climatic zones were selected. Two agro-climatic zones, NAZ and TZ have been uniquely performing in a response to their unique socio-ecological settings. While for NAZ, it just a beginning for last five years for CA, for TZ a profile of CA practice and system have already been in operation for the last ten years. TZ is receiving an average rainfall close to 3000 mm per year, for NAZ it is hovering around 1600 mm. So that reality for socializing CA speaks differently for these two zones. The study on farmers' perception, reality, and practice of CA operationalized through two sets of variables (i) independent variables (x_1 - x_{53}) and (ii) dependent variable (y_3). Level of knowledge of CA (y_3) was measured through an attitude scale, modified and adapted to the given social ecology, as developed in

Likert's summated rating scale. A set of items on the given perceptions were developed and rated by experts as well as farmer innovators on a 4-point scale and by following summated rating scale, 25 per cent of the items were selected and subsequently, the split-half method was followed to test the reliability. Then, during the farmer's interview scoring is done over this 4- point continuum asked questions from 4 items. Finally, the quantitative values have undergone the data normalization process. Responses from the respondents were collected through a pre-tested structured interview schedule and relationships among selected variables were analyzed through quantitative methods i.e., Coefficient of Correlation, Stepwise Regression, and Scatter-plot diagram with the help of Origin Pro version 2021 and Statistical packages for social sciences (IBM-SPSS) version 24 software.

The research setting presents a dynamic, evolving, and undulating social ecology; where both the structural and functional factors are in constant interaction with the respondents in terms of operating variables. However, the present study was able to accommodate only a few selected characters for the empirical dissertation cataloguing them as dependent and independent variables. A set of x variables are found to behave with a contributor character while the same can be with a recipient behaviour, e.g., in stepwise regression analysis, the set of ' x variables' are not considered as the only source of causal variables, the rest three ' y variables' which are promoting the particular y variable under a single study have also been considered as causal variables. Hence, in case of y_3 , the rest of the y variables have to be treated like: $y_1=y_1'$; $y_2=y_2'$; $y_4=y_4'$.

RESULTS AND DISCUSSION

Predicting the significant causal variables impacting farmers' Level of knowledge of CA

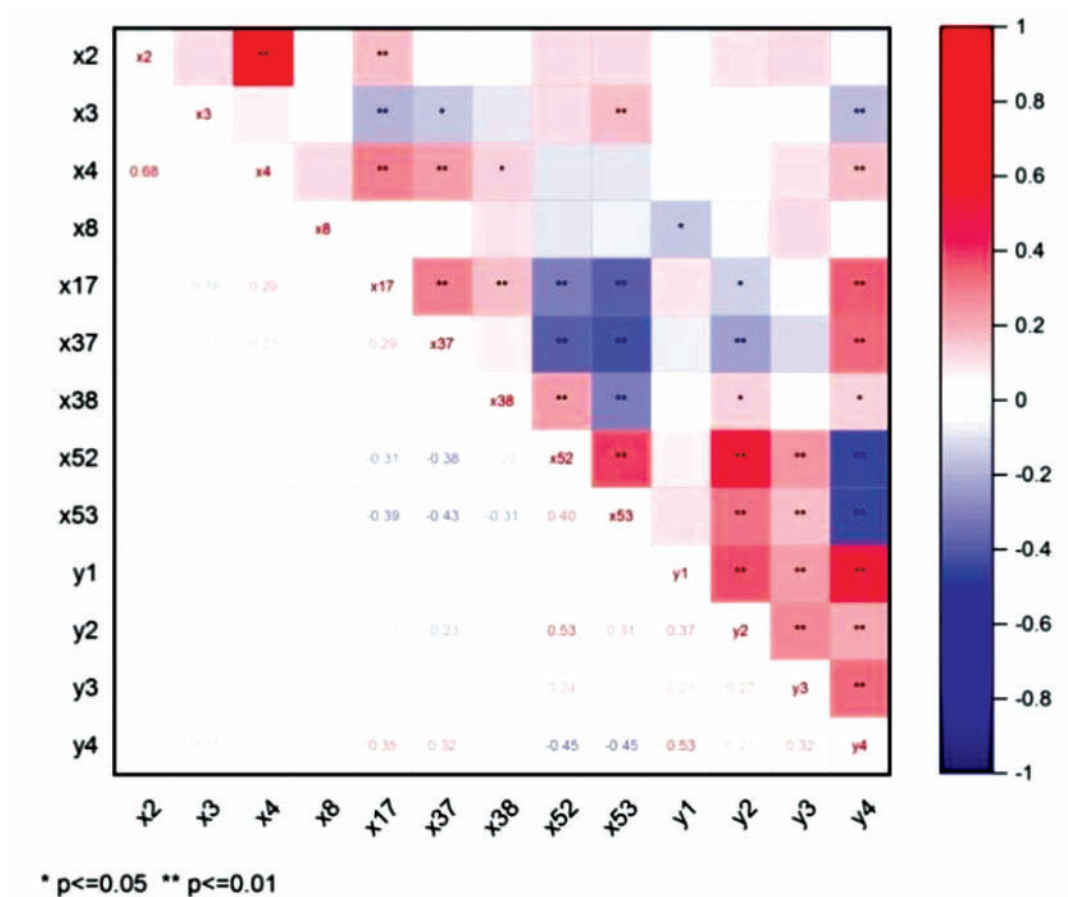
The stepwise regression was first done to get segregate the marker variables out of the total fifty-seven variables taken, then other analyses were conducted as per the steps. Table 1 presented the stepwise regression analysis which elicits those 12 causal variables viz., perception of energy management (y_2'), gender ratio (x_3), calorie intake through plant protein consumed per day (x_8), family size (x_2), amount of plant protection chemicals (x_{37}), frequency of irrigation (x_{38}), perception of climate change (y_1'), formal education (x_4), energy metabolism ratio (x_{53}), number of fragments (x_{17}), CA perceived (y_4'), total input energy equivalent (x_{52}), the regression coefficient value from the model summary table shows that have been considered as the predictor variable to have influenced level of knowledge of CA (y_3) the most. These 12 predictor variables together described 59.10 per cent of total variance out of 57 variables with a Durbin Watson value of 2.031.

Thus, when it comes to knowledge on CA acquired by the farmers, their status of formal education and their perception of CA i.e., both perception and cognition come on the list. In addition, energy components are also found to be important in the study areas as the farmers have very little perception of energy. Where plant protection chemical has been taken a consideration because farmers must know before adopting CA that in the initial years, they may have to apply weedicides because of weed problems,

Table 1. Stepwise Regression of level of knowledge of CA (y_3) vs. 56 causal variables (x_1 - x_{53} and y_1 , y_2 , y_4) (here, $y_1=y_1'$; $y_2=y_2'$; $y_4=y_4'$)

S.No.	Variables	Reg. coef. B	S.E. B	Beta	t value	R ² (In 44 th Step)	Durbin Watson Value
1	x_2	.069	.036	.115	1.906		
2	x_3	.151	.072	.091	2.099		
3	x_4	-.018	.010	-.115	-1.819		
4	x_8	4.032	.913	.189	4.415		
5	x_{17}	.036	.015	.119	2.408		
6	x_{37}	-.155	.075	-.102	-2.071	59.1%	2.031
7	x_{38}	-.026	.010	-.129	-2.606		
8	x_{52}	.083	.006	1.003	13.002		
9	x_{53}	.672	.074	.581	9.117		
10	y_4	18.857	1.207	1.434	15.627		
11	y_1	-.365	.053	-.416	-6.919		
12	y_2	-.447	.053	-.581	-8.393		

y_2 -perception of energy management, x_3 - gender ratio, x_8 -calorie intake through plant protein consumed per day, x_2 - family size, x_{37} - amount of plant protection chemicals, x_{38} - frequency of irrigation, y_1 - perception of climate change, x_4 -formal education, x_{53} - energy metabolism ratio, x_{17} - number of fragments, y_4 -CA perceived, x_{52} -total input energy equivalent.

Figure 1. Coefficient of Correlation (r) of level of knowledge of CA (y_3) vs. 56 independent variables (x_1 - x_{53} and y_1 , y_2 , y_4) (here, $y_1=y_1'$; $y_2=y_2'$; $y_4=y_4'$)

however in subsequent years when crop residues will be able to build a cover, the weed infestation gets reduced. Jat et al., (2014) reported that knowledge of the existence of CA and how to implement it (know-how), mindset (tradition, prejudice), and poor policies are considered to be major barriers to the adoption of CA techniques, for example, commodity-based subsidies, and direct farm payments, unavailability of appropriate equipment and machines, and suitable management strategies to facilitate weed and vegetation management, including mechanical, biological, and chemical options

as herbicides (especially for larger farms in low-income countries) (Jat et al., 2014; Friedrich et al., 2011; Farooq & Siddique, 2014).

Gender ratio has also come up as in both the zones women also have constituted a considerable part along with men in both family and farm decision making, thus, it must be taken into consideration before adopting CA whether it is gender-inclusive and responsive in its all the way. Nyanga (2012) found from their study that the women pulse crop farmers demonstrated that CA can improve household food security if the cover crops are utilized to

form part of local diets. CA also has the potential for increasing women's incomes. Besides, pulse crop insertion in the existing cropping system is coming up as a good predictor both for the farm family and agro-ecological health.

Relation between level of knowledge of CA (y_3) and selected socio-ecological variables

Figure 1 showed the correlation between level of knowledge of CA (y_3) and 56 independent variables. It has been found Total input energy equivalent (x_{52}), energy metabolism ratio (x_{53}), perception of climate change (y_1), and perception of energy management (y_2) have recorded positive and significant correlation with level of knowledge of CA (y_3). Two integers to CA are climate-smart and energy-smart components. Hence, when a farmer gathers knowledge or persuades on CA, he or she will be exposed to the energy-efficient and climate adaptive sides of CA at the same time. Nyanga et al., (2011) also stated that actors involved in the promotion of CA technologies have often not taken into consideration the perceptions of smallholder farmers in climate change and CA as an adaptation strategy. The perception about climate change has deeply been embaded amidst farmers cognitive domain in the form of indigenous knowledge and wisdom, which has classically been desended over decades. The Smallholder farmers' perceptions of floods and droughts were substantially correlated with the adoption of CA, according to this study. Smallholder farmers, on the other hand, had a low perception of CA as a climate change adaptation strategy. This coined out the

existence of other important reasons for practicing CA than adaptation to climate change.

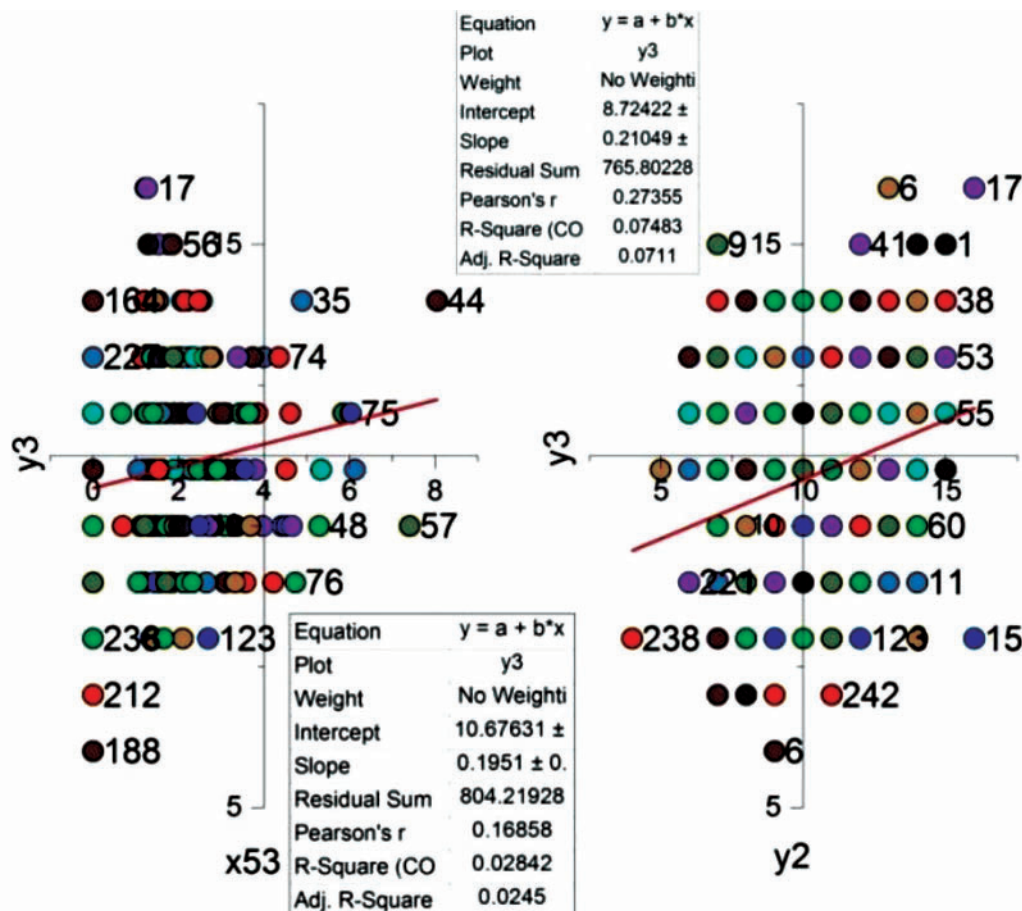
Scatter-plot diagram showing the relation of level of knowledge of CA (y_3) with Energy Metabolism Ratio (x_{53}) and perception of energy management (y_2)

Energy metabolism ratio (x_{53}) and perception of energy management (y_2) were found to be in increasing trend with level of knowledge of CA (y_3) (Figure 2 and 3). Thus, when farmers develop their knowledge on CA principles; their on-farm energy management moves in the right direction. CA is all about rationalization of tillage operation, injudicious input application and a prodical management of farms. The scatter diagram depicts that the input variable perception on energy metabolism has isochronously contributed to knowledge of CA and perception of energy management. On the other hand knowledge of CA of respondents has organically been linked with the energy management behaviour of the farmers. Acharya & Chatterjee (2019) also found that CA may help in re-building agroecology by maintaining carbon sequestration, maintaining soil health, checking soil erosion and groundwater depletion, energy balance, mitigating climate change related problems through maintaining ecosystem services.

CONCLUSION

Access to and application of proper knowledge is being simmered up as one of the prime determinants in sustainable and environmentally sound agriculture in eastern India by incubating

Figure 2 and 3. Scatter-plot diagram of level of knowledge of CA (y_3) with Energy Metabolism Ratio (x_{53}) and perception of energy management (y_2) (here, $y_1=y_1$; $y_2=y_2$; $y_4=y_4$).



scientific pursuits and perception amongst farmers operating with CA. It has found that farmers are quite aware of the ill effect of climate change on agriculture and want to mitigate it, however, did not hear the term ‘energy’. Here, CA is the best option to provide climate-smart farming technologies along with energy efficiency and sustainable livelihood within a single package. However, at every corner, a major constraint to the adoption of CA practices continues to be knowledge about the existence of CA and how to do it, mindset, lack of location-specific training, and inadequate policies are visible. Hence, proper understanding and measuring social-ecological knowledge diversity is an important part of long-term management with consequences for resolving disputes, group action, and policymaking.

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Consumers' Awareness and Opinion Towards Food Adulteration in Selected Areas of West Bengal

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ABSTRACT

Food adulteration originated several decades ago and has become more prevalent day by day. The study was conducted in Kharagpur I block of West Medinipur district of West Bengal in 2017 and 2018 among 100 respondents to measure the level of awareness of adulteration through structured interview schedule. The study found that most of respondents, both in urban and rural areas of the study faced the problems of food adulteration. They lacked appropriate knowledge, tendencies and practices relating to food adulteration. Very few of them checked proper information in the packaging before buying. Based on the research this paper suggested that, to avoid the harmful consequences of adulteration, consumers must continuously develop a habit of upgrading their awareness level, develop a habit of checking the information printed in the package and try to adopt the best buying practices in order to keep themselves away from the hazardous consequences of food adulteration.

INTRODUCTION

India is known to have a rich and various forms of food, and the diverse food habits are mainly dependent on religion, social identity, and other cultural factors, as on local farming practices (Vij & Mann, 2022). Food adulteration is one amongst the foremost current social issues that is evident in our country as well as in the world. It affects the health of consumers that are not apparent within the initial stages; however, it is a large devastating health impact to the consumers that becomes apparent within the long-term. So, the risks to consume such food will be unreal (Sapkota & Phuyal, 2016). Food adulteration is a practice of admixture one thing inferior, harmful, useless, and extra to food like stones in rice to increase weight etc. This addition will increase the amount of trade. A study shows that quality is the primary criterion of any food product that are desirable. Maintaining quality is one of the most important steps in the process of product manufacturing which assures in checking health hazards, which could occur after consuming the degraded food products (Aung et al., 2014).

Food safety, a vital international public health issue to confirm sound health, refers to addressing “all those hazards, whether chronic or acute, that may make food injurious to the health of the consumer” (FAO, 2003). Food adulteration includes varied types of practices, like admixture, subbing, concealing the standard of food by mislabelling, put up rotten or expired food, and adding toxicant substances. Awareness about several standard marks of quality marks on food items are very important in terms of health of consumers because non-standardized and fake products are sold at low price but are deteriorated in quality which harm the consumers (Karki et al., 2009). Lack of knowledge about value addition at farmers level and sub optimal input use can also be one of the reasons of food poisoning (Ram et al., 2022). Pandit et al., (2016) advocated proper education of farmers and consumers on food safety, sustainable and eco-friendly technologies. As a results, buying such food affect the consumers as they face economic loss by paying a lot for lower-quality food and also health hazards. The health hazards may end up from either addition of hurtful

substances or removal of an important element (Park, 2005). Some adulterants could even cause death (Srilakshmi, 2003).

Today's client is claimed to be king of the market. Indian client may be a victim of exploitation within the style of substandard product and services, false guarantee, usurious costs, and deceitful ways. Creation of client awareness may be a huge task in our immense country (Ramalingam, 2013). The nature of market is the mirror reflecting the buying practices of consumer. Successful buyer is the one who has all knowledge about the product good or bad. So, enriching knowledge is very important (Arefin et al., 2020). The specific objectives of the study were to describe the rural and urban consumers in respect of their buying practices and measure the awareness of the consumers about adulteration in food items.

METHODOLOGY

The research was carried out in Pashchim Medinipur district of West Bengal, where Gopali village and Kharagpur municipal town of Kharagpur-I Block were selected as a research area. The research was carried out during August of 2017 to April of 2018. Kharagpur subdivision and Kharagpur I block under this subdivision of Paschim Medinipur district were selected. Kharagpur town and Gopali village were again chosen as it falls under Kharagpur 1 block. through multistage random sampling. In Kharagpur municipal town, ward no. 34 was selected randomly, under this ward again Biren Sashmal road was selected randomly. On this road 50 families were selected randomly out of 194 families. Out of 988 houses of Gopali village, 50 were selected randomly and survey was conducted. Out of all the families selected the homemakers were chosen as respondent based on the study conducted by Pandey (2000) while working on consumers buying practice on Indian subcontinent. Simple statistical analysis such as descriptive statistical analysis, frequency distribution, percentage, cross tabulation was used. For buying practices, different variables like shop type, food choosing criteria etc were used and for awareness of adulteration, different major adulterants in selected food items were listed to collect the responses as similar methods found in studies of Ali (2010).

RESULTS AND DISCUSSION

Buying practices of consumers

From Table 1, it is clear that in urban area most of the respondents (80%) preferred to purchase goods of daily use from the daily informal shops or the local markets, 12 per cent purchased them from the nearby *Haats* or roadside vendors and only 8 per cent bought goods of daily use from the malls or other departmental stores. Whereas in rural areas, majority of the homemakers i.e., 78 per cent visited the roadside vendors and only 22 per cent visited informal daily shops. But none of them went to the malls. Both in urban and rural area of Kharagpur, 100 per cent respondents tried to properly select food items before purchase. In urban area 100 per cent respondents liked to check the colour, shape and size of the food stuff before purchase. 96 per cent of them watched the appearance, 64 per cent tried to check the expiry date, 8 per cent considered the smell and label colour and only 4 per cent checked the nutrition status as Table 1 shows. In rural area, 100 per cent of the respondents preferred to check the colour of foodstuff, followed by 92 per cent who considered both shape and size. 84 per cent

Table 1. Buying practices of respondents related to selected food products

	Urban (%) (n=50)	Rural) (%) (n=50)
Preferable market type		
Informal Shops	80	22
Road Side Vendor	8	78
Malls	12	0
Criteria before purchase of food		
Colour	100	100
Appearance	96	84
Size	100	92
Shape	100	92
Smell	8	0
Expiry Date	64	30
Label Colour	8	0
Nutrition	4	0
Experience and Identification of adulterated food by respondents		
Yes	64	68
No	36	32

considered appearance of foodstuffs. 30 per cent considered expiry date. All of them always ignored the label colour, nutrition status and smell to check. In urban area, number of respondents who experienced and identified adulterated food items are 64 per cent, whereas in rural area it was 68 per cent. Rest could not identify any adulterated food so far-similar results were found by Vijayeta (2015).

Rural and urban people's understanding of Adulteration

Both in urban and rural areas all of the respondents were aware about the term 'Adulteration.' Table 2 reveals that in urban area majority of the homemakers i.e., 54 per cent replied that adulteration as practice of adding harmful chemicals and colour to the food item. According to 34 per cent of them, adulteration was practice of adding harmful chemicals to food items and for 12 per cent of them, it was the practice of mixing any substance harmful to human health. In rural area of Kharagpur, majority of the respondents i.e., 60 per cent of the respondents considered adulteration as the practice of adding harmful chemicals to food items as Table 2 depicts. Similar results were found by-Nasreen et al., (2014).

It was also revealed that in urban area 100 per cent of the respondents knew about vegetable adulteration, 96 per cent of them were aware about fruit, 54 per cent of them knew about both meat and milk products. 50 per cent were conscious about fish adulteration. 48 per cent of them knew about cereals and its products. 40 per cent of them knew about spices, 34 per cent were aware about pulses and its products and least of them i.e., 14 per cent knew about edible oils. In case of rural areas though awareness level of most food items was more or less similar to urban, but there was no awareness about spice adulteration amongst them (Table 2).

Awareness about Adulterants used in food products

As above Table 2 depicts, respondents, aware about cereal and pulse adulteration were (24+17) i.e., 41 in urban area and (12+5)

Table 2. General idea about Adulteration

	Urban (%) (n=50)	Rural (%) (n=50)
Adulteration conception		
Mixing substance harmful to health	12	16
Adding chemical to food	34	60
Adding chemical and colour	54	24
Awareness about adulteration about some important food item		
Edible oil	14	8
Fish	50	56
Meat	54	10
Vegetable	100	100
Fruit	96	94
Spices	40	0
Cereals and products	48	24
Pulses and products	34	10
Milk and product	54	38

i.e., 17 in rural area. So, for the awareness of adulteration of cereal and pulses, the number of respondents became n=41 for urban area and n=17 for rural area. In urban area majority of the respondents i.e., 78.04 per cent were aware about stone chips followed by other adulterants as Table 3 shows. In rural area, majority i.e., 70.58 per cent were aware about both stone chips and sands followed by other adulterants, 23.58 per cent of them knew about both toxic colour and pesticide residues. The awareness about mixing of less expensive items into cereal and pulses were little bit higher in rural area, i.e., 58.82 per cent. According to Table 2, total number of respondents aware about edible oil adulteration were 12 in urban area and 4 for rural area. As Table 3 shows, in urban Kharagpur 83.33 per cent of them identified palm oil as adulterant. Whereas in rural area, majority mentioned colour and flavour. Both in urban and rural area, all of the respondents were aware about vegetable adulteration as Table 2 reveals. In urban area majority i.e., 92 per cent of the respondents were aware about toxic colours mixed in vegetables, followed by other adulterants as Table 3 depicts. Whereas in rural areas, 100 per cent of the respondents were aware about chemicals for growing vegetables bigger and faster. 92 per cent of them were aware about toxic colours. lastly none of them were aware about textile dyes. Table 2 also shows that the number of respondents aware about fruit as adulterated food item were 48 for urban and 47 for rural area. Now as per the study, in urban area majority of the respondents i.e., 75 per cent were aware about calcium carbide. Whereas in rural area 100 per cent were aware about calcium carbide and none of them were aware of wax and flavor as Table 3 shows. Table 2 also reveals that the number of respondents who identified milk as adulterated were 27 for urban and 19 for rural area. As Table 3 depicted, both in urban and rural area, 100 per cent of the respondents were aware about water as adulterant and so on as table 3 shows. None of them in rural area knew about starch. As Table 2 depicts, the number of respondents identified meat as adulterated were 27 for urban and 5 for rural area. Majority of the respondents i.e., 70.37 per cent were aware about meat of other animals as adulterant, followed by others whereas in rural Kharagpur, majority knew about rotten meat as adulterant and none of them were aware about formalin and salt and lime as Table 3

Table 3. Awareness about major adulterants of some common food items

Adulterant	Urban (%) (n=41)	Rural (%) (n=17)
Cereals and pulses		
Stone chips	78.04	70.58
Sand	73.17	70.58
Textile dye	29.26	0.00
Pesticide residue	39.02	23.52
Less expensive items	29.26	58.82
Toxic colour	48.78	23.52
Edible oil	(n=12)	(n=4)
Colour with flavor	66.66	75
Palm oil	83.33	25
Vegetables	(n=50)	(n=50)
Toxic colour	92.00	92.00
Textile dye	16.00	0.00
Pesticide residue	20.00	68.00
Chemical to grow bigger and faster	88.00	100.00
Fruits	(n=48)	(n=47)
Calcium carbide	75.00	100.00
Other chemicals	56.25	74.46
Flavour	25.00	0.00
Colour	62.50	57.57
Wax	18.75	0.00
Pesticide residue	25.00	19.14
Sugar syrup	37.50	12.76
Milk Product	(n=27)	(n=19)
Water	100.00	100.00
Starch	44.45	0.00
Detergent	51.85	47.36
Milk powder	66.67	63.15
Meat Product	(n=27)	(n=5)
Colour	44.45	40.00
Rotten meat	62.96	80.00
Salt and lime	18.51	0.00
Formalin	18.51	0.00
Meat of another animal	70.37	20.00
Fish	(n=25)	(n=24)
Formalin	24.00	0.00
Insulin	24.00	0.00
Red colour	80.00	50.00
Rotten fish	48.00	0.00
Other chemicals to grow in size	60.00	100.00
Spices	(n=20)	(n=0)
Textile dye	65.00	-
Metanil yellow	25.00	-
Brick powder	70.00	-
Talc powder	30.00	-
Saw dust	45.00	-

shows. According to Table 2, the number of respondents who identified Fish adulteration were 25 for urban and 24 for rural area. Table 3 clearly depicts that out of 25 respondents, 80 per cent mentioned red colour, followed by others. Whereas in rural area, out of 24 respondents 100 per cent were aware about use of toxic chemical to grow in size and followed by 50 per cent who knew about red colour. They were not aware about other adulterants. For

spices, in urban area out of 20 respondent's majority of them i.e., 70 per cent were aware about bricks powder, followed by other adulterants but no one were aware in rural area. Similar results were found by Pal et al., (2018).

CONCLUSION

The study concludes that the majority of the customers lack correct information, attitude, and practices regarding food adulteration. So, dietary intervention with nutrition education can be an effective tool in increasing the level of knowledge about what to eat and what not to so that different health hazards can be effectively managed. Food adulteration is a dreaded topic in West Bengal, in India and even in whole world. Each individual has to take care before they get the food product and government must appoint more food inspectors to hide each corner to forestall the food adulteration to occur once more. This study can be conducted in different areas to measure the awareness level which is important for development of targeted government interventions so that those interventions, awareness programme, proper advertisement, educational tours etc can be utilised for them to choose their healthy food and lift voices against fraud.

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Socio-economic Transformation through RKVY-RAFTAAR in Uttar Pradesh and Karnataka

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ABSTRACT

Rashtriya Krishi Vikas Yojana- Remunerative Approaches for Agriculture and Allied Sector Rejuvenation (RKVY-RAFTAAR) is aimed at augmenting agri and allied sector income. A study was conducted to analyse the socio-economic changes generated by Rashtriya Krishi Vikas Yojana rechristened as Rashtriya Krishi Vikas Yojana- Remunerative Approaches for Agriculture and Allied Sector Rejuvenation (RKVY-RAFTAAR) in the states of Uttar Pradesh and Karnataka in 2022. 160 beneficiary farmers and 80 non-beneficiary farmers from both the states were personally interviewed to elicit the socio-economic changes generated by the programme. The socio-economic transformation was higher for beneficiary farmers in terms of annual income, entrepreneurial opportunity, occupational status, crop diversification, material possession and access to the programme than non-beneficiary farmers of both the states. Comparative analysis of socio-economic transformation of beneficiary farmers of Karnataka and Uttar Pradesh revealed significant changes in the socio-economic indicators except entrepreneurial opportunity, education and access to RKVY-RAFTAAR. The changes brought about by the programme, before and after its launch revealed significantly higher socio-economic impact on beneficiary farmers.

INTRODUCTION

The National Development Council (NDC) in 2007 envisioned a special additional central assistance scheme namely RKVY be launched for holistic development of agriculture sector. The NDC resolved that agricultural development should be re-strategized to meet the needs of farmers and solicited ideas from Central and State governments to evolve a strategy to rejuvenate agriculture (GoI, 2014). The NDC reaffirmed its commitment to achieve 4 per cent annual growth in the agricultural sector during the 11th plan (Rajesh & Singh, 2021). The main objectives of this programme are, to incentivize the states to increase public investment in agriculture and allied sectors, to provide flexibility and autonomy to the states in planning and executing agriculture and allied sectors schemes, to ensure the preparation of plants for the districts and the states

based on agro-climatic conditions, availability of technology and natural resources, to ensure that the local needs/crops/priorities are better reflected, to achieve the goal of reducing the yield gaps in important crops, through focused interventions, to maximize returns to the farmers (GOI, 2019). RKVY operational Guidelines (2019) which stipulate that under the revamped scheme funds would be devolved as 50 per cent of the annual outlay will be provided for setting up infrastructure and assets, 30 per cent for value-addition linked production projects and 20 per cent of the outlay will be flexi-funds for supporting any project as per the local needs. The RKVY-RAFTAAR funds would be provided in the ratio of 60:40 to the states except for north east and Himalayan states which will get 90:10 grant. To make farming a remunerative profession, the government approved changes to ongoing central scheme Rashtriya

Krishi Vikas Yojana (RKVY) with a focus on value chain, post-harvest infrastructure and agri-entrepreneurship development, among others (ISEC, 2013). Now, the scheme has been rebranded as RKVY-Remunerative Approaches for Agriculture and Allied sector Rejuvenation (RAFTAAR) to be implemented for three years till 2019-20 with a budget allocation of Rs 15,722 crore (The Hindu, 2019). The objective of the scheme is to make farming a remunerative economic activity through strengthening the farmer's effort, risk mitigation and promoting agri-business entrepreneurship (Vijayan & Nain, 2020). By the end of 2021-22, RKVY programme had implemented 17636 projects with an expenditure of Rs. 125451 crores across all the states and union territories. The present study was conducted to analyse the socio-economic transformation brought about by the programme in the states of Uttar Pradesh and Karnataka. Debt ridden farmer, bankrupted farmer, farmers on the verge of suicides have had been believed to be the plight of a population constituting 55 per cent of the population of India. There is as such no panacea to rescue the farming community, but the efforts unleashed through several agricultural development programmes go unnoticed. This study reveals how agricultural development programmes can be a real game changer for the farming community in their total social-economic transformation. The comparative analysis of beneficiary and non-beneficiary, before and after programme launch, throw light on the minor and major positive socio-economic changes brought about by RKVY-RAFTAAR for the former. State-wise comparison enlighten oneself that, one for all approach wont yield desired results wherein core areas specific to particular region should be focused while implementing RKVY-RAFTAAR.

METHODOLOGY

The present study used the ex-post facto research design. Uttar Pradesh and Karnataka states were purposively selected. From the each selected state two districts and from each district two villages were selected randomly. From Uttar Pradesh, Gonda and Lalitpur districts were selected and from Karnataka, Kolar and Chikkaballapur were selected purposively. 40 beneficiary farmers and 20 non-beneficiary farmers were selected from each district, totaling to a sample size of 240 farmers. A detailed interview schedule was prepared to analyse the extent of utilization of benefits of RKVY-RAFTAAR. Personal interviews and focused group discussion with beneficiary and non-beneficiary farmers were conducted to elicit the data. Socio-Economic transformation incorporates the tangible and intangible positive changes on the beneficiary as a result of availing of benefits and access to agricultural development programmes. Variables namely; annual income, crop diversification, value-chain development, earning members, occupational status, material possession were chosen and analysed for economic indicators. Indicators namely; education, entrepreneurial opportunity, social participation and access to the programme were analysed for social indicators. The socio-economic indicators were chosen based on thorough review of literature and expert consultation. Socio-economic changes before and after the launch of the programme were analysed using Wilcoxon Sign rank test, while socio-economic changes between beneficiary and non-

beneficiary were analysed using Mann Whitey U test. Beneficiary farmers of Uttar Pradesh and Karnataka were also compared to project the difference in regional change in socio-economic indicators by the programme. Correlation analysis of socio-economic indicators to overall socio-economic transformation was also done.

RESULTS AND DISCUSSION

Comparison of beneficiary farmers and non-beneficiary farmers on socio economic indicators

Ten major socio-economic indicators were studied and compared among beneficiary farmers and non-beneficiary farmers and the results are presented in Table 1 and Table 2. The perusal of Table 1 indicated that there was significant difference in the annual income (mean rank=78.47), occupational status (mean rank=79.95), crop diversification (mean rank=79.44), earning members (mean rank=66.54), material possession (mean rank=80.20), entrepreneurial opportunity (77.20), value chain development (mean rank=77.88) and access to the programme (77.91) on beneficiary farmers than non-beneficiary farmers of Karnataka ($p < 0.05$). While, there was a significant difference in the annual income (mean rank=77.73), occupational status (mean rank=77.96), material possession (mean rank=77.20), earning members (mean rank=66.50), entrepreneurial opportunity (mean rank=77.88), social participation (mean rank=76.50), and access to the programme (mean rank=75.89), between beneficiaries and non-beneficiaries of Uttar Pradesh. The plausible reasons for income augmentation could be the focus of the government on promoting remunerative approaches in agriculture sector. The difference in annual income, occupational status, and material possession could be attributed to beneficiary farmers being able to accommodate agri-allied activities along with agriculture, thereby earning more income. Similar findings were reported by Vamsi et al., (2019), that RKVY interventions and technical knowledge gained from the programme had contributed in augmenting the income of the beneficiary farmers.

The access to RKVY-RAFTAAR might have synchronized with creation of entrepreneurial opportunity, practicing crop diversification and better value chain development of the products of the beneficiaries of Karnataka. Similar findings were reported by Samuel et al., (2021) that agripreneurial activities promoted by KAU through RKVY-RAFTAAR had resulted in creating enabling entrepreneurial environment for the beneficiary farmers. The data also shows significant difference in social participation and education among the beneficiaries of Uttar Pradesh. Analogous data reported by Shinoji et al., (2021) that empowering intervention had positively contributed in enhancing social participation of the beneficiaries. It was also observed that educational impact was not significant between the beneficiary farmers and non-beneficiary farmers. Being primary school educated was not an impediment in accessing the RKVY-RAFTAAR as found by Rajashekara et al., (2021). It was deduced that the increased access to RKVY-RAFTAAR in both states could be attributed to enhanced agricultural sensitization measures through social media, television and print media. Similar finding was conveyed through the information empowerment study of farmers by Vijayan et al., (2017).

Table 1. Mann-Whitney U test for analysis of social-economic transformation of beneficiary farmers vs non-beneficiary farmers of Karnataka and Uttar Pradesh (N=240)

Variables	Mean Rank		Mann Whitney	Z value	Asymp. Sig.
	Beneficiary (n ₁ =80)	Non-beneficiary (n ₂ =40)	U value		(2-tailed)
Karnataka					
Annual Income	78.47	24.55	162	-8.491	.000*
Education	69.44	62.63	1685 ^{ns}	-.507	.0518
Occupational Status	79.95	21.60	44	-9.764	.000*
Crop Diversification	79.44	20.63	80	-9.010	.000*
Earning members	66.50	48.50	1120	-3.234	.001*
Material Possession	80.20	21.10	24	-9.480	.001*
Entrepreneurial Opportunity	77.20	27.10	264	8.003	.000*
Social Participation	61.25	59.00	1540 ^{ns}	-.387	.0699
Value chain development	77.88	25.75	210	-8.275	.000*
Access to the programme	77.91	25.68	207	-8.427	.000*
Uttar Pradesh,					
Annual Income	77.73	34.04	541.50	-7.114	.000*
Education	59.44	62.63	1515 ^{ns}	-.507	.0612
Occupational Status	77.96	25.58	203.00	-8.619	.000*
Crop Diversification	79.50	22.50	80.00	-9.01	.000*
Earning members	66.50	48.50	1120.00	-3.234	.001*
Material Possession	77.20	27.10	264.00	-8.121	.000*
Entrepreneurial Opportunity	77.88	25.75	210.00	-8.275	.000*
Social Participation	76.50	28.50	320.00	-7.741	.000*
Value chain development	62.00	57.50	1480.0	-8.09	.419
Access to the programme	75.89	29.73	369.0	-7.741	.000*

*Significant at 5% level of p

Table 2. Wilcoxon Sign rank test for analysis of social-economic transformation before and after the launch of RKVY-RAFTAAR (N=160)

Variables	Z value		Asymp. Sig. (2-tailed)	
	Beneficiary farmer (Karnataka, n ₁ =80)	Beneficiary farmer (Uttar Pradesh, n ₂ =80)	Beneficiary farmer (Karnataka)	Beneficiary farmer (Uttar Pradesh)
Annual Income	-6.945 ^b	-7.563 ^b	.000*	.000*
Education	-6.140 ^b	-6.126 ^b	.000*	.000*
Occupational Status	-7.469 ^b	-6.664 ^b	.016*	.000*
Crop Diversification	-8.744 ^b	-7.961 ^b	.000*	.000*
Earning members	-4.025 ^b	-3.683 ^b	.000*	.002*
Material Possession	-8.319 ^b	-8.118 ^b	.000*	.000*
Entrepreneurial Opportunity	-8.032 ^b	-8.032 ^b	.000*	.000*
Social Participation	-7.273 ^b	-8.024 ^b	.023*	.000*
Value chain development	-7.348 ^b	-7.231 ^b	.000*	.042*
Access to the programme	-8.166 ^b	-8.020 ^b	.000*	.000*

*Significant at 5% level of p

Comparison of RKVY-RAFTAAR beneficiary status before and after the launch

Socio-economic changes generated by RKVY-RAFTAAR was also studied by analyzing before and after the programme launch with benchmark year as 2007 using Wilcoxon Sign rank test. It is deduced that all the ten socio-economic indicators were significant for beneficiary farmers of both the states after the launch of the programme ($p < 0.05$), which reiterated the fact that RKVY-RAFTAAR had created an impact on the lives of the beneficiaries. The study of Rajashekara et al., (2021); Shilpa & Rajiv (2015) support this finding, who reported that there was a positive transformation in the socio-economic status of the beneficiaries of RKVY-RAFTAAR.

Comparison between RKVY-RAFTAAR beneficiary farmers of Karnataka and Uttar Pradesh

To bring out the difference in social-economic transformation, beneficiaries of Uttar Pradesh and Karnataka were compared using Mann Whitney U test and presented in Table 3. With respect to annual income (mean rank=94.75), occupational status ((mean rank=90.00), crop diversification (mean rank=94.50), earning members (mean rank=90.50) and social participation (mean rank=86.00), Karnataka beneficiary farmers fared comparatively better, while in material possession (mean rank=92.00) and value chain development (mean rank=69.25) beneficiary farmers of Uttar Pradesh fared better. This dovetails with the findings of Rashtrarakshak et al., (2016) who claimed that components under

Table 3. Mann-Whitney U test for comparison of social-economic transformation on beneficiary farmers of Uttar Pradesh and Karnataka (N=160)

Variables	Mean Rank		Mann Whitney U value	Z value	Asymp. Sig. (2-tailed)
	Uttar Pradesh beneficiary (n ₁ =80)	Karnataka beneficiary (n ₂ =80)			
Annual Income	66.25	94.75	2060.00	-4.656	.000*
Education	80.50	80.50	3200.00 ^{ns}	.000	1.00
Occupational Status	71.50	90.00	2440.00	-3.065	.002*
Crop Diversification	66.50	94.50	2080.00	-5.284	.000*
Earning members	70.40	90.60	2392.00	-3.472	.001*
Material Possession	92.00	69.00	2280.00	-3.628	.000*
Entrepreneurial Opportunity	80.50	80.50	3200.00 ^{ns}	.000	1.00
Social Participation	75.00	86.00	2760.00	-2.019	.043*
Value chain development	69.25	52.66	2280.00	-3.632	.000*
Access to the programme	82.31	78.69	3055.50 ^{ns}	-0.555	.579

*Significant at 5% level of p

Table 4. Correlation analysis of socio-economic indicators with overall socio-economic transformation

Socio-Economic Impact Indicators	p Value			
	Karnataka		Uttar Pradesh	
	BF	NBF	BF	NBF
Annual Income	.458**	.341	.621**	.386
Education	.235	.516**	.415	.482**
Occupational Status	.644	.422	.734*	.153
Crop Diversification	.558**	.111	.718**	.025
Earning members	.774*	.306	.537*	.722
Material Possession	.652**	.427	.404*	.761
Entrepreneurial Opportunity	.747**	.127	.574**	0
Social Participation	.404	.556	.382	.788**
Value chain development	.668*	.366	.695*	.583
Access to the programme	.426**	.258	.751**	.302

*Significant at 5% level of p & **Significant at 1% level of p

RKVY-RAFTAAR projects augmented farm income and eventually overall socio-economic status of the beneficiary farmers. The difference among the beneficiaries of two states could be attributed to several factors like compounding effects of other agricultural programmes, difference in efficiency of programme implementation by department personnel (Jena et al., 2019), variation in crops, frequency of natural calamity striking the area, remunerative approaches focused by the state agricultural department, prevalence of problem soil in the area etc. While indicators like education, entrepreneurial opportunity and access to the programme didn't show any significant difference between the beneficiaries. This might be due to the fact that agripreneurship development has been gaining equally good momentum in both states; also education of the beneficiary farmers didn't contribute to getting enrolled in the programme as well as the programme has strict guidelines for beneficiary enrollment which facilitated better access to the programme. These observations are in line with the findings of Shilpa & Rajiv (2015) and Veni et al., (2018), who reported rise in socio-economic status of the beneficiary farmers.

Correlation analysis of socio-economic indicators with overall socio-economic transformation

Spearman's rank correlation analysis of socio-economic indicators to total socio-economic transformation for beneficiary and

non-beneficiary farmers of Karnataka and Uttar Pradesh are depicted in Table 4. Among ten indicators seven indicators were positively correlated to overall socio-economic transformation for Karnataka beneficiaries whereas for non-beneficiaries only education (.516) was positively correlated. At the same time eight socio-economic indicators were positively correlated in case of beneficiaries of Uttar Pradesh and reasonably education (0.482) and social participation (.788) showed positive correlation to total socio-economic transformation in case of non-beneficiaries. Albeit being educated is an added advantage, here education was not an impediment in accessing and availing the benefits of RKVY-RAFTAAR. Rajashekara et al., (2021) in his study supported the same. Social participation also didn't contribute to the overall effect as government has strict beneficiary guidelines to include farmers irrespective of their social participation.

CONCLUSION

The socio-economic transformation generated by RKVY-RAFTAAR was significantly high for beneficiary farmers than non-beneficiary farmers of both Uttar Pradesh and Karnataka. Comparison of the two states reveal difference in socio-economic transformation, which may be due to a plethora of factors like efficiency in programme implementation, protracted disbursement of benefits among the beneficiaries, non-stringent follow up activities,

delay in accessing the benefits of the programme etc. Within the state, the distinction between beneficiary farmers and non-beneficiary farmers on socio-economic indicators are conspicuous. This explains the pertinence of the programme in the holistic development of agricultural and allied sector. Especially at a time when India focuses on made in India, vocal for local and one district, one product schemes, RKVY-RAFTAAR offers immense opportunity to the farming community. The visible socio-economic changes on the beneficiaries after the programme launch should facilitate RKVY-RAFTAAR to penetrate more of each states of India to emulate such positive results.

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Training Need Assessment of Board of Directors of Farmer Producer Companies: An Application of Borich's Model

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ABSTRACT

In India, small and marginal farmers face numerous technological and institutional issues to realize the actual worth of their farm produce. To overcome such vagaries of agriculture, the collectivization of agri-producers into farmer producer companies has emerged as a potential approach to boost the bargaining power and scaling up the production process. The prime operational issues in FPCs are the result of both the limited resource availability and the capacity deficit of the governing members. Thus, a descriptive study was conducted during 2021-2022 to probe into the training needs of the Board of Directors (BoD) of FPCs in Eastern Uttar Pradesh. Three FPCs were randomly selected from each of the 28 districts of eastern Uttar Pradesh, and from each selected FPC, one BoD was interviewed. Based on Borich's need assessment model the perceived level of training need was accessed for the respondents in 34 different core training areas under 7 major domains with a standardized interview schedule. The training needs were analyzed and ranked based on the mean weighted discrepancy scores. Some of the most prioritized training areas included strategic planning for FPC activities, preparation of business plan, and financial aspects of business plan etc.

INTRODUCTION

Agriculture is considered a central pillar of the Indian economy and has a significant role in its growth, with a 17.8 per cent contribution to the country's Gross Value Added (GVA) for 2019-20 (GOI, 2021). For livelihood, over two-thirds of the country's working population is directly or indirectly engaged in agriculture and allied sectors (Census, 2011). In India, the total operational landholdings were 138.35 million hectares, with an average landholding size of 1.15 hectares. Small and marginal holdings together constituted 86.08 per cent of total land holdings (Agricultural Census, 2016). Such small and scattered landholding generates low agricultural production and marketable surplus, making agriculture a less viable profession for the farmers. The crux of the problems small and marginal farmers face can be traced back to their limited bargaining power, the lower scale of operation, poor access to credit, lack of

proper information, weak participation in the markets and the exploitation by the intermediaries in procuring inputs and marketing of their produce which ultimately leads to the inability of harnessing the benefit from economies of scale. FPOs have the capacity to reduce transactional costs (Sakthi et al., 2015). In this context, collectivization of producers, particularly small and marginal farmers, into producer organizations has emerged as one of the most effective institutional mechanism to address the various challenges of agriculture. Hence, as per the recommendation of the Y K Alagh Committee in 2002, the Government of India introduced the concept of Producers Companies (PCs) after the amendment of the Companies Act 1956 (Manaswi et al., 2018; Singh et al., 2022).

The success of the FPCs mostly depends upon the commitment of the farmers along with the quality and integrity of the leadership (Sawairam, 2014; Kumari et al., 2022). The FPC

movement in India is still in its infancy, as many of the directors are reliant on their promoters as their vision regarding FPC, business orientation, and capacities are limited due to inadequate training (Nayaji et al., 2021). Inadequate skills of office bearers, Board of Directors' lack of vision and direction, low equity base, inability to attract working capital from financial institutions, poor marketing, and value addition expertise, and no proper business plan led to the failure of most of the FPCs (NABCONS, 2019). However due to lack of awareness regarding legal issues, most of the FPCs are found to be not viable in India (Gummagolmath et al., 2021). The FPCs' ability to have a significant impact on the growth of the agri-value chain remains a constant challenge. This is the present situation that has worried the policy makers and promoters for the scaling up of FPCs across the pan India (Gorai et al., 2022). Hence the training and mentorship of the Board of Directors of FPC should be the prime focus for the promoting institutions. Training need assessment being a method of determining the training requirements by identifying the performance gaps (Skillnets, 2013), the study to assess the perceived training need of the Board of Directors of FPCs in several segments of efficient FPC management was undertaken.

METHODOLOGY

A descriptive research design along with the mixed sampling method was adopted for the present study. At the first stage of sampling, the Eastern part of Uttar Pradesh which comprises 28 districts was selected purposively as this region is having the highest number of FPCs in Uttar Pradesh as of 2021. In the second stage of sampling, three FPCs from each district of Eastern Uttar Pradesh were selected randomly and the information was collected by interviewing one Board of Director (BoD) from each selected FPC. Thus, the final sample comprised 84 BoDs drawn from 84 different FPCs (n=84).

Among various need assessment models, a discrepancy model proposed by Borich (1980) was used for this study. First of all, an intensive consultative process with experts was followed to identify the core areas for training needs followed by a thorough review of literature. As a result of the exercise, a total of 34 items related to skills and competence of BoDs on efficient FPC management were identified under 7 different domains to develop the instrument. BoDs were asked to rate the identified training areas separately with respect to how important it was perceived by them on a three-point Likert type scale with responses ranging from 1= less important, 2= important, 3= very important. The BODs were also requested to rate their self-perceived level of competency on those

training areas again by using a three-point Likert scale. Where a response of 1 indicated they were less competent, 2 indicated they were moderately competent and 3 indicated they were highly competent.

As per the Borich's need assessment model (1980), a mean weighted discrepancy score (MWDS) was computed for ranking the training areas. To determine the MWDS score, at first stage, for the discrepancy score (DS: I-C), the difference between the importance level and the competency level was calculated for each respondent in each training area. In the next step, a Weighted Discrepancy Score (WDS: $I_{\text{Mean}} (I-C)$) was computed for each respondent in each training area by multiplying the discrepancy score with the mean importance rating. At the final step, a mean weighted discrepancy score (MWDS= $\Sigma I_{\text{Mean}} (I-C) / n$) for each of the training areas was computed by taking the sum of the weighted discrepancy scores and dividing it by the number of respondents, where, 'I' denotes the Importance level, 'C' is the Competence level, I_{Mean} is the mean importance rating and n is the total number of BODs.

For each of the training area the maximum and minimum importance as well as competency score was 3 and 1 respectively. The content and face validity of the instrument were accessed by the social science experts. To ascertain the reliability of the instrument, a pilot test was administered to 20 BODs from non-sampled FPCs and the Cronbach's alpha value was found to be 0.95 which indicated proper consistency of the instrument (Olorunfemi et al., 2019).

RESULTS AND DISCUSSION

The results obtained from the analysis of the training needs of BODs on seven different domains by using Borich's need assessment model are discussed below.

Skills related to formation and compliances of FPC

Following all statutory compliance regarding the producer company emerged as the most required training area with the MWDS of 4.21 (Table 1) in this domain. Statutory compliances are the rules, policies, specifications, standards, or laws for a particular company. These compliances are mandatory to comply with the relevant regulations for avoiding any penalties. In the first year of incorporation compliances need to be followed are conducting the first Board Meeting within 30 days from the date of incorporation of FPC, issuing share certificates, conducting first Annual General Meeting (AGM) within 90 days of incorporation,

Table 1. Prioritized training needs on various skills related to formation and compliances of FPC

Skill Areas	Perceived Level of Importance (Mean)	Perceived Level of Competency (Mean)	MWDS	Perceived Rank
Following all statutory compliance about the producer company.	2.88	1.43	4.21	I
Incorporating FIGs as building blocks of FPC	2.73	1.52	3.48	II
Incorporating new members and motivating the existing members for Active Participation	2.95	1.80	3.43	III
Obtaining all licenses and approvals for FPC	2.93	1.79	3.36	IV
Understanding of various functions of FPC	3.00	1.93	3.21	V

adopting the company's Article of Association (AoA), etc. Some of the compliances need to be followed annually like filling of annual return (balance Sheet, statement of profit & loss Account), directors' report, auditors' report, income tax filing, internal auditing, etc. For following these compliances, most of the respondent BODs were dependent upon the Chief Executive Officer and Chartered Account of the company or expert from promoting agency. They had little knowledge regarding the above-mentioned compliances and most of them didn't have proper literacy levels except few educated BODs to understand the intricacies of those compliances. Incorporating Farmer Interest Groups (FIGs) as building blocks of FPC was perceived as the second most important training need area with MWDS of 3.48. As per the policy & process guidelines issued by Govt. of India for the formation of FPCs (GOI, 2013) the FIGs (a small informal groups of 15-20 members) need to be formed based on common interest and geographical location and then federate them as FPC. With the large number of shareholder farmers directly representing the General Body of an FPC, has a risk of last-mile primary producers getting marginalized as better-off amongst them may take advantage of the collective but the FIGs ensure the proper representation of the primary producer with the spirit of equity and equality. The study revealed that the majority of the selected FPCs were formed through direct membership campaigns as most of the BoDs perceived that the formation of FIGs needed a longer time and there was no monetary support for the mobilization process at the initiation stage of the FPC, but they had the awareness regarding the benefits of FIGs. Few of the NGOs promoted FPCs converted the existing farmers club, joint liability groups, or self-help groups into FIGs and federated them as FPC. The third important training need area for this particular domain (MWDS= 3.43) was incorporating new members and motivating the existing members for active participation. As per the company Act 2002, the minimum paid-up share capital for any FPC is Rs. 1 lakh which needs to be collected from the shareholders. Based on the paid-up capital, financial institutions consider the loan amount to the FPC. Normally to form an agriculture-based producer organization, about 800-1000 primary producers are of a good size (Mondal, 2016). The present study highlighted the low competence level of the BODs to incorporate the new members as most of the non-members were found to be skeptical regarding the misuse of their legal documents like Adhar details and share money paid by them. Again, BoDs also opined that many of the registered members became inactive as they were unable to derive immediate benefits from the FPC. During the mobilization drive to build the confidence of the members, the presence of the Government officials was felt imperative by the respondents as the concept of FPC was not widespread among the farming community. Obtaining all licenses and approvals for FPC was perceived as the fourth most important training need area with MWDS of 3.36. At the initial stage of formation, every FPO may avail PAN and GST registration for sales and purchases related activities, shop establishment license, fertilizer license, pesticide license and seed license to trade in agricultural inputs, mandi license for selling the primary produce of the members in bulk at regulated markets, FSSAI license for packaged and processed food products, APEDA license for import and export of vegetables and fruits, third party organic certification

for organic produce, and other few statutory licenses like fire safety license, weight, and measure license, etc. It was found that many of the BoDs availed of a few of the above-mentioned licenses for their respective FPCs with the help of promoting agencies and state agriculture department but some of the BoDs from self-promoted FPCs were struggling to avail required license due to the complex legalities as well as tiring and cumbersome paperwork required to obtain those licenses. Understanding of various functions of FPC was the least prioritized training area by the respondents from this particular domain with MWDS of 3.21 but still many of the BoDs expressed the requirement of training in this area as most of them were not fully aware of various services that FPO can offer to its members like Input supply services, procurement, and processing services, marketing services, technical services, networking services, financial services, etc.

FPC management skills

Deriving benefits from various schemes was the most prioritized area for training by the respondents with MWDS of 4.23 in this domain (Table 2). To support the promotion and strengthening of FPCs, Govt. of India has launched various schemes and policy initiatives through National Bank for Agriculture and Rural Development (NABARD), Small Farmers Agribusiness Consortium (SFAC), Department of Agriculture and Cooperation (DAC), Central ministries and state Governments. Presently NABARD is financing the FPCs at the incubation and early stages under the Producer Organization Development Fund (PODF) for capacity building, promotional support, incubation services, and market linkage. NABKISAN, a subsidiary of NABARD is also supporting the FPCs to avail term loans and working capital at a minimal interest rate. SFAC mainly offers Venture Capital Assistance, Equity Grant, and Credit Guarantee Fund Scheme to improve the availability of working capital for business expansion of the FPCs. Apart from these FPCs can avail of support from various centrally sponsored schemes like Rashtriya Krishi Vikas Yojana, Re-Vamped National Food Security Mission, National Agriculture Market Scheme, Operation Greens scheme, etc. (Khawad et al., 2019). To build a robust ecosystem for FPCs, Govt. of Uttar Pradesh launched two popular schemes i.e. Farm Machinery Bank scheme for agricultural implements with 80% subsidy and Dristi Pariyojna for seed processing unit with Rs. 60 lakhs of financial aid. It was found that most of the BoDs were unaware of the existence of most of the schemes and had no awareness regarding the procedure to extract the benefits from those schemes.

The training of human resources for effective functioning of the FPC was found to be the second most important training area for the BoDs (MWDS= 4.05). The associated staffs of every FPC need proper training as per the assigned working domain and the primary members also need to be trained based on the production planning of the FPC. Most of the respondents were ignorant about the importance of such capacity building activities which could have achieved by conducting in-house training programs by the experts or by approaching external training agencies. Imparting various technical services to the FPC members was perceived as the third

most important training area in this domain by the respondents (MWDS - 3.91). Most of the BoDs were not aware of the technical services that FPO should impart to its members like advisories on crop production, crop protection, nutrient and water management, disseminating marketing information, liaisoning with Govt. departments for soil testing, micro-irrigation, organic farming and seed production, etc. Promoting enterprise-based common service centers was perceived as the next important area for training by the respondents. (MWDS=3.00). Most of the respondents opined that they need proper training regarding the establishment of various infrastructure facilities like processing unit, warehouse for storage, grading and packaging unit, custom hiring unit, etc. which are essential for the FPC to generate earnings. Mobilizing partnerships with other FPCs and multiple stakeholders for common benefit was found to be another important training need area for BoDs (MWDS=2.89). A standalone FPC can never go far ahead as agriculture is basically to do with multi-tasking in convergence with multiple stakeholders. Lastly, appointing a Chief Executive Officer (CEO) and other officer bearers, as per AoA/Byelaws, and conducting board meetings, Annual General Body meetings, elections, and proceedings were found to be the least preferred areas for training by the respondents with MWDS of 2.82 and 1.61 respectively. According to the BoDs, appointing a full-time CEO and office bearers for monitoring day-to-day FPC activities is of utmost importance for a successful FPC. But most of the BoDs had a low competency level in appointing a CEO due to a lack of understanding regarding the selection criteria of office bearers and unavailability of funds for the remuneration of the staffs. Only a few of the FPCs, promoted by NGOs and NABARD had full-time CEO. The study also revealed that a major chunk of the respondents was competent enough to conduct board meetings with other directors and annual general meetings (AGM) with the FPC members for discussing specific issues, passing any important resolutions, etc. There should be 4 board meetings in a calendar year and the gap between two AGMs must not exceed 15 months (Ziebula et al., 2019).

Financial management skills

Financial management is an important avenue for a successful FPC. It helps in business growth along with the diversification of products and services for a profitable market. From Table No. 2 it was evident that maintaining statutory registers for the FPC was the top prioritized training area (MWDS=3.80). Accurate and updated registers denote the transparency and credibility of the FPC. It also strengthens the case of FPC to leverage loans from financial institutions. Bank cheque book, share capital register, purchase, sales, and stock register, bill books/receipt books, cash book, deposits register, expenses register, and share certificate pads are some important statutory registers. Basically, the Chief executive officer (CEO) of FPC is responsible for the keeping of these registers but the majority of the FPCs couldn't afford to appoint a full-time CEO due to a fund crisis. Hence, in absence of the CEO, the responsibility was vested with the directors and they had little competency in maintaining these registers.

The distribution of dividends among the members was found to be the second most important training area (MWDS=3.79). As per the Companies Act 2002 Part IX-A para 581, provision of 'limited return' i.e. the maximum dividend needs to be distributed among the members as specified in the article of the FPC, has been made. As per the law, the office of the director shall become vacant if he is failed to pay the dividend to the members for one year or more. Most of the respondents expressed their incompetency in dividend distribution, whereas few of the respondents were able to share the profit of the company by increasing the corpus of share amount of the members, in terms of various technical services and input supply at a discounted rate to the members. The third important training area was mobilizing partnerships with various financial institutions for funding (MWDS=3.77). Access to credit linkage from reliable and affordable sources of financing for meeting the infrastructure development needs, working capital, and other needs got a center stage. To strive for the sustainability of FPCs, the funding ecosystem should be favorable in every stage of FPC's life cycle i.e. grant support for mobilization, capacity building, and

Table 2. Prioritized training needs on FPC management and financial management skills

Skill Areas	Level of Importance (Mean)	Competency Level (Mean)	MWDS	Perceived Rank
FPC management skills				
Deriving benefits from various schemes	2.95	1.52	4.23	I
Training of human resources for effective functioning of the FPC	2.88	1.48	4.05	II
Imparting various technical services to the FPC members	2.89	1.57	3.91	III
Promoting enterprise-based common service centers.	2.84	1.80	3.00	IV
Mobilising partnerships with other FPCs and multiple stakeholders for common benefit	2.59	1.59	2.89	V
Appointing a CEO and other officer bearers, as per AoA/Byelaws	2.86	1.89	2.82	VI
Conducting board Meetings, Annual General Body meetings, elections and proceedings	3.00	2.46	1.61	VII
Financial management skills				
Maintaining statutory registers for the FPC	2.94	1.73	3.80	I
Distribution of the dividend among the members	2.60	1.25	3.79	II
Mobilizing partnership with various financial institutions for funding	2.92	1.64	3.77	III
Understanding and mobilization of share capital, authorised capital, bonus shares and general reserves	2.89	1.64	3.64	IV
Financial services for the members	2.37	1.25	3.02	V

system development at the Incubation stage, financial support for working capital and business development at Growth stage, credit support for term loans and debt capitals at Maturity stage. Without credit access, no FPC can thrive to realize its full potential. While interacting with the respondents it was found that due to lack of awareness, most of them were not competent enough to attract the required capital from formal financial institutions like NABKISAN or SAMUNNATI, which grants loans to the FPCs at a minimal interest without any collateral. Many of the BoDs were unable to access the credit facility from the commercial banks as those FPCs were perceived as high-risk clients by the banks due to the low share capital base of the FPC, absence of previous credit history, and non-availability of collateral. Understanding and mobilization of share capital, authorized capital, bonus shares, and general reserves was perceived as the fourth important training need area (MWDS= 3.64) by the BoDs. Many of the respondents had little exposure to these financial terminologies to comply with and a lack of competency was reported by them in the mobilization and allocation of funds for company activities. Financial services for the members was perceived least preferred training area by the respondents (MWDS=3.02). The FPC, duly authorized by its board through proper resolution can render financial assistance to its members like short-term working capital assistance not exceeding six months of repayment period and loans against the security as mentioned in articles. Most of the BoDs had no clue regarding such provision of financial lending by the FPCs to the members. They considered it as least important area due to the low financial reserve of the FPC and uncertainty of loan repayment by the loaner members in a stipulated time frame.

Business skills

The findings obtained from Table 3 reveal the perceived level of importance as well as competency level of respondents attached to various business skills. Based on the mean weighted discrepancy scores ranking, the prominent areas of training need regarding business skills were 'Preparation of business plan' (MWDS=4.43), 'Financial aspects of business plan' (MWDS=4.36), 'Business opportunity identification in local area' (MWDS=3.80), and 'Facilitating Forward and backward linkages' (MWDS=3.78). The business plan of an FPC is the consolidated blueprint of activities including production, trading, and services for one to three years. The key financial aspects to be considered for a business plan are

budgeting, capital requirements, sources of funding, etc. Business opportunity identification is an important factor to be considered for preparing a business plan. BoDs of FPC need to be vigilant enough to identify the opportunities for business operation based on the local demand and the production of FPC with due consideration of the external business environment and SWOT analysis of the business idea. Lastly facilitating forward and backward linkages for the proposed business is very important as the forward linkage is essential for the production, processing, and marketing of the produce while backward linkage is for input procurement at a reasonable price for the proposed business. It was found that many of the respondents were competent in identifying the business opportunities but had a little competency in proper formulation and execution of business ideas due to a lack of knowledge regarding financial aspects of business, facilitating forward and backward linkages, etc.

Marketing skills

From the results obtained from Table 3, the rank wise prioritized areas of training need regarding marketing skills were 'Value chain management for produce' (MWDS=3.91), 'Pricing strategy of products' (MWDS=3.70), 'Marketing Strategy' (MWDS=3.62) and 'Market analysis' (MWDS=3.54). Knowledge of the value chain can help the BoDs in identifying the existing supporting actors, chain actors, and policy environment associated with the business for better price realization. Whereas, competency of BoDs in pricing strategy of agricultural produce and agricultural inputs is essential for harnessing maximum benefit from the business. The proper marketing strategy will help the BoDs in the appropriate promotion and distribution of the product of FPC. Before starting any business of FPC, the BoDs must undergo market analysis for identifying the targeted market and customers for uninterrupted supply chain activity. Most of the respondents never followed such systemic marketing approaches before starting their business activity due to insufficient knowledge and after a certain period, the supply chain was broken.

Soft Skills for FPC's organizational development

The soft skills of BoDs play a major role in the proper governance of the FPC. The results obtained from Table 4 revealed the prioritized training need areas by the respondent regarding the Soft Skills required for FPC's Organizational Development. Strategic

Table 3. Prioritized training needs on business skills and marketing skills

Skill Areas	Level of Importance (Mean)	Competency Level (Mean)	MWDS	Perceived Rank
Business skills				
Preparation of business plan	2.76	1.21	4.43	I
Financial aspects of business plan	2.64	1.07	4.36	II
Business opportunity identification	2.96	1.70	3.80	III
Facilitating Forward and backward linkages	2.88	1.57	3.78	IV
Marketing skills				
Value chain management for produce	2.80	1.45	3.91	I
Pricing strategy of products	3.00	1.55	3.70	II
Marketing Strategy	2.82	1.55	3.62	III
Market analysis	2.89	1.70	3.54	IV

planning for FPC activities was found to be the most needful training area among various soft skills (MWDS= 4.61). Strategic planning helps in deciding the logical course of action to achieve the goals of the FPC. It includes step by step breakdown of a large task in subtasks, the development of a systematic approach for activities while considering the alternatives, etc. Creativity and problem-solving skill was considered the second important training need area (MWDS= 4.02) which is a critical competency for a BoD of FPC. It helps in overcoming the barriers of FPC with feasible approaches and to manage the day-to-day affairs of FPC smoothly. Leadership development, teamwork, and conflict resolution (MWDS= 3.38) was the third important training need area. Leadership skills help to convince, motivate and direct the members to actively take part in company activities. On the other hand teamwork and conflict resolution helps to maintain the integrity and cohesiveness among the members for striving unitedly to achieve a common goal. Interpersonal skills, persuasion, and use of influence strategies was the fourth important training need area (MWDS= 2.84). Interpersonal skills are vital as they determine how BoDs interact and communicate with the members effectively. It helps in working as a team for reaching the shared goal. Some of the interpersonal skills are active listening, empathy, patience, negotiation, positivity, reliability, flexibility, etc. Persuasion and use of influence strategies also help the BoDs to persuade the members to act in a desired manner. To convince the members, BoDs can produce evidence for the business potential of the FPC, proper action plan, networking strategies, etc. Commitment to works contract and self-confidence (MWDS= 1.88) was the least important area of training need as perceived by the BoDs. The majority of the directors opined that after becoming the director, the respondents were never exposed to any formal training regarding soft skills development. Most of them had a high degree of opinion leadership and held a prestigious positions in their locality which helped them to influence the members to believe in the ideology of FPC.

Skills on digital technology

The perusal of Table 4 depicts the various training need areas perceived by the BoDs about various digital technology-related skills. Based on the WMDS score the rank wise prioritized training areas were 'Participation in digital markets like e-Nam'

(MWDS=3.82), 'Connecting members on social media platform' (MWDS= 3.64), 'Digitalization of company records' (MWDS=3.14), and 'Availing online Financial services' (MWDS=3.05). In today's digital era online marketing can help the farmers to reach a large number of customers in a very short time for better price realization of produce. National Agricultural Market (eNAM) is an online trading platform that intends to provide farmers with improved marketing options by allowing them to sell their products at a fair and transparent price. Farmers will be able to promote their goods through local marketplaces, while merchants will be able to quote prices from anywhere using the eNAM platform. The BoDs can decide to sell the product of FPC in bulk through eNAM for an efficient supply chain with enhanced market accessibility. But due to a lack of awareness, none of the respondents were able to harness the benefit of eNAM. The use of social media platforms is important for the timeless dissemination of various information among the members. The respondents opined that most of the time it was very difficult for them to reach out to the large member base of FPC separately for the invitation of AGMs, to disseminate procurement, marketing, agriculture-related information, etc. Hence there was a felt need to connect the members in a common digital social platform. Maintaining various records of FPC digitally was also found as an important training area by the respondents as it enables quick and easy access to documents. Digital recordkeeping assures the safety and security of the information than physical storage as paper records can get accidentally damaged. Keeping all office records digitally comes under the work domain of the CEO or office staff of the FPC but in their absence, the BoDs need to take this responsibility. It was found that unavailability of computers due to fund crunch and lack of computer operating knowledge were the prime reasons for the low competency level of the respondents in maintain digital database of the FPC. Lastly, poor competency level was observed in availing online financial services like online fund transfer, checking bank account statements online, etc. by most of the BoDs due to lack of digital financial literacy.

CONCLUSION

The present study provided an empirical analysis of the training needs of the Board of Directors in several areas for efficient FPC management. It can be concluded that though the BoDs rated

Table 4. Prioritized training needs on soft skills for organizational development and skills on digital technology

Skill Areas	Level of Importance (Mean)	Competency Level (Mean)	MWDS	Perceived Rank
Soft skills for FPC's organizational development				
Strategic planning for FPC activities	3.00	1.46	4.61	I
Creativity and problem solving skill	2.95	1.60	4.02	II
Leadership development, team work and conflict resolution	2.93	1.80	3.38	III
Interpersonal skills, persuasion and use of influence strategies	2.91	1.95	2.84	IV
Commitment to works contract and self confidence	2.88	2.25	1.88	V
Skills on digital technology				
Participation in digital markets like e-Nam	2.39	1.00	3.82	I
Connecting members on social media platform	2.75	1.48	3.64	II
Digitalization of company records	2.87	1.79	3.14	III
Availing online financial services	2.87	1.86	3.05	IV

most of the training areas as highly important, their competency level was quite low in those areas as per the results. Though, many of the identified skill areas come under the work domain of the CEO, but in every aspect, the BoDs must set the policies, plans, and strategic directions for implementation. Again, in absence of the CEO and other office staff, BoDs need to take care of all these affairs. The study, therefore suggested that to promote sustainable FPCs with full operational potential, capacity building and training of BoDs at the nascent stage is very crucial. Training institutions may devise certification courses in FPC management to empower the BoDs as, without professional handholding support and technical guidance, the journey from a primary producer to an FPC director is very arduous.

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Adoption of Sustainable Dairy Management Practices among Peri-urban Dairy Farmers in Odisha

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ABSTRACT

The research was based on a survey done in 2019 across Odisha's eastern and southern coastal plain zones to assess sustainability among dairy farms based on various scientific management practices adopted by the farmers. The sustainability index was constructed using primary data acquired through a random sampling approach from 120 dairy households. The results reveal that 61 per cent of the farms belonged to the low sustainable category. The study area's peri-urban dairy farms had inadequate shelter management, feeding, and animal health practices, as seen by their mean sustainable scores. Space constraints, dung disposal, lack of expertise in planned systematic breeding, paucity of green fodder, lack of refrigerated storage, and timely vaccination were all issues that farmers in the study area faced. These problems can be solved by organizing various capacity building training programmes, creating awareness about the benefits of following various scientific management practices, finding alternative supplements of green fodder as well as encouraging farmers to cultivate green fodder at a commercial level.

INTRODUCTION

Indian dairy sector has undergone several changes since the advent of the white revolution and becoming a world front-runner in terms of milk production and the dairy sector is providing employment opportunities to a massive population (Aski & Hirevenkanagoudar, 2010; Das et al., 2020; Mandi et al., 2022). Despite largest producer of milk, the low productivity of dairy animals attributed to low adoption of scientific management practices by the farmers (Singh et al., 2015; Parihar et al., 2020). In this respect, ensuring domestic demand and enduring top most position in the world, India needs to produce 300-400 million tonnes of milk by 2050 (Vision 2050, 2015). For achieving this target a sustainable balance between dairy management practices, sustainable livelihood and environmental practices are need of the hour (Alvez et al., 2013).

Now a day's peri-urban dairy farming has become widespread as a consequence of the high price of milk in urban centres and insufficient milk marketing infrastructure which raises the demand for milk in urban areas (Gillah et al., 2012). Peri-urban dairies are mostly situated in and around cities for meeting the high demand for milk in urban areas (National dairy report, 2017). An easily accessible market is one of the major advantages of these farms to increase their sale and making a profit (Bohra et al., 2004). The scarcity of land in urban areas makes peri-urban dairy farms zero-grazing type and farms are protected by a fence which restrict free movement of dairy animals (Tumutegyeize et al., 1999). Considering these things practicing scientific dairy management practices has become much more important for increasing productivity and assuring the sustainability of these dairy farms. Peri-urban dairy farms in Odisha now gaining importance due to

the rising urban population and increasing milk demand for making traditional sweets. Currently, milk production in Odisha was 23.11 metric tonnes and per capita availability of milk was 145 gm/day which is far below the national average (NDDB, 2018-19). Despite increase in milk production over the year, the dairy development potential of the state is count to be among the lowest (Kale et al., 2016). There is a decrease in cattle population by 15.01 per cent in the state during the inter census period between 2012 to 2019 (20th livestock census report, 2019). Considering these facts sustainability of existing dairy farms is of prime importance for meeting the future demands of milk in the state which should be in line with the most widely accepted definition of sustainability i.e., “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland, 1987). Although the meaning of sustainability differs from context and its applicability by various persons (Shearman, 1990; Kelly, 1998). Therefore, sustainability in dairy farming should be measured in such a way that it considers all the activities performed by dairy farmers (Bosshard, 2000). Here, an index of sustainability was developed to identify sustainability among dairy farms and the adoption rate of various dairy management practices also calculated.

METHODOLOGY

The research was based on a survey done in 2019 across Odisha's eastern and southern coastal plain agro climatic zones. Based on availability of dairy farms two urban areas namely, Cuttack town (Cuttack district) and Bhubaneswar town (Khordha district) were selected for the study. Primary data was collected by using a pre-structured questionnaire from 120 peri-urban dairy farms (60 dairy farms from each urban area). Following complete enumeration, these dairy farms were divided into three categories using the cumulative square root frequency method: small (up to 18 milch animals), medium (18-24 milch animals), and large (above 24 milch animals) (above 24 milch animals).

At first, potential sustainable dairy management practices were identified through extensive literature review and consultation with experts. However, it was difficult to assess the sustainability status of different dairy management practices at the farm level as it was hard to derive an absolute measure of compliance (Calder, 2000). As a result, an index of sustainable dairy management practices was developed based on the weighted scores of different components of dairy management practices to make a comparative assessment. The 58 practices used by dairy farmers were divided into five categories: shelter management, breeding, nutrition, milking management, and animal health, with weights of 0.14, 0.20, 0.32, 0.12, and 0.22 assigned to each, depending on their relative relevance in guaranteeing sustainability. These differential weights were

determined in collaboration with the scientists who worked on these issues. Following the preparation of the index, data on farming techniques was collected from the farmers. Following Kumar et al., (2011), the number of practices followed in each category were multiplied by the relevant weight and then totaled across all categories to generate a weighted score. Accordingly, each farm got scores based on the practices they were following. So, the sustainable dairy management practices index (SDMPI) was calculated by

$$\text{SDMPI} = \frac{\text{Obtained weighted Score}}{\text{Maximum Obtainable Score}} \times 100$$

Following the computation of sustainability ratings for each dairy farm, experts grouped the farms into three groups of sustainability levels: low (below 50 percentiles), medium (50 to 80 percentiles), and high (above 80 percentile). In order to see the association of different categories sustainable score in different herd size categories Chi-square test was used. Adoption rate of different dairy management practices was also calculated using the formula

$$\text{Adoption Rate (AR)} = \frac{\text{No. of respondents adopted a particular practice}}{\text{Total number of respondent}} \times 100$$

RESULTS AND DISCUSSION

In the study area, there were two types of peri-urban dairy farms: cattle farms and mixed farms. Cattle farms had solely crossbred cows, whereas mixed farms included both buffalo and cows. Table 1 reveals that about 25.83 per cent farms were pure cattle farms while 74.16 per cent farms were mixed farms. Number of crossbred cows was found to be more than that of buffaloes in the study area because cow milk (mostly jersey) is mostly preferred for traditional sweets preparation.

Assessing sustainability

Sustainability scores were obtained for each sample peri-urban dairy farms. Maximum obtainable score for given index was 300. Scores obtained out of 300 was converted into percentage. This percentage was used for classification of farms. Dairy farms were divided into 3 categories. The majority of the farms in the research region fall into the low-sustainability group, accounting for 61 per cent of all farms. About 38 per cent of farms were in the medium sustainable category. It shows that there is a very low level of adoption sustainable dairy management practices which represents very poor status of development of peri-urban dairy in Odisha. Only 8 per cent farms were found to be highly sustainable i.e., practices recommended by scientists were followed in these farms.

Dairy farms were distributed based on sustainability index among different herd size categories. It was observed (Table 2) that

Table 1. Distribution of peri-urban dairy farms according to type of animal and herd composition

Farm type	Small	Medium	Large	Overall
Cattle farms	23(46.93)	8(19.51)	0(0.00)	31(25.83)
Mixed farms (CB + Buffalo)	26(53.06)	33(80.48)	30(100)	89(74.16)
Total	49	41	30	120

Figures in parentheses indicate percentage of column total, CB-Crossbred Cow

Table 2. Distribution of dairy farms among herd size categories based on sustainability index

Farm Categories	Low	Medium	High	Total number of farms
Small	35(71.42)	14(28.58)	0(0)	49
Medium	14(34.14)	27(65.86)	0(0)	41
Large	12(40.00)	10(33.33)	8(26.66)	30
Chi-square Value 39.11*				120

Figures in parentheses indicate percentage of row total, * signifies 1 per cent level of significance

71.42 per cent of the small farms were belongs to low sustainable categories and rest of the small farms belongs to medium sustainable category. In the case of medium farms 34.14 per cent of the farms were fall in low sustainable category while 65.86 per cent of the farms were in medium sustainable categories. None of the small and medium farms were found to be highly sustainable which indicates low adoption of sustainable dairy management practices in these farms. Chi-square test was used to see whether there was any effect of sustainability index on distribution of farms in different herd size categories. As the value of chi-square test is significant, it depicts the association between the peri-urban dairy farm size and level of sustainability on the basis of sustainability index.

Mean sustainable scores of dairy management practices across different herd size categories have been presented in Table 3. In the case of shelter management practices overall average score was 50.27 per cent. Large dairy farms were found to be better at shelter management practices with an average 65.63 per cent. Dairy farms in the study area were found to be better a performing breeding practices with an overall mean score of 67.75 per cent. Overall mean sustainable score was found to be lowest in case of nutrition i.e., 42.9 per cent. Small farms were found to have a lowest score of 42.27 per cent followed by medium (42.27%) and large farms (51.73%). It indicates that peri-urban dairy farms in the study area were very poor performance in animal nutrition which may account for low productivity of dairy animals. In the case of milking management practices overall mean score was 62.08 per cent. We can observe that farms among different herd size categories were performing well in terms of milk management practices. Overall mean score obtained in case of animal health was 51.26 per cent. Large farms (55.50%) were found to be good at performing animal health practices followed by medium (50.99%) and small farms (48.88%).

Adoption of various dairy management practices

The rate of adoption of desired scientific management practices have been presented in Table 4. It was observed that in the case of shelter management practices 20.83 per cent of the farmers were having location of shed separate from the dwelling house while rest of them have cattle shed close to dwelling house. Similar, findings

were observed by Srivastav & Promila (1983) where only 18 per cent farmers have cattle shed separated from the dwelling house. It may be due to unavailability of cheap land and to save the additional construction cost for cattle shed near city (Sabapara et al., 2010). Most of the farms do not have facilities for manger feeding and a separate house for calving animals. Only 63.33 per cent farms were utilizing cow dung for various purposes like vermicomposting, bio-gas plant, farm yard manure etc. while other simply disposed it. It shows that 39.16 per cent of the farmers were following a planned systematic breeding practice. Most of the farmers (85.83%) were following artificial insemination with supporting results Ashwar et al., (2017). Quality germplasm from various government and private sources were available with 79 per cent of the farmers. Milk yield and various phenotypic characteristics were the important parameter for choosing semen for artificial insemination. Only 49.16 percent of farmers were aware of heat detection techniques such as bellowing, mucus discharge, frequent urination, mounting, and so on. Unawareness about various heat detection techniques increases the number of services per animals. Only 65.83 per cent of the farmers informed that their cow is served within 60-90 days after calving and 22.50 per cent reported a 12-month calving interval.

Dairy animals require a high-quality balanced diet, which is often unavailable, resulting in delayed maturity, protracted dry period, and a low conception rate. Peri-urban dairy farms in Odisha practices mainly stall feeding of animal, only 27.50 per cent reported both stall feeding and grazing of animal. It was observed that only 15 per cent of the farmer feed green fodder to the animal which means there is unavailability of green fodder in the study area as also reported by Hodshil et al., (2007). All the farms fed dry fodder, mostly paddy straw to the animals. It reveals that most of the dairy farms fed unchaffed fodder to the animals, only 6.66 per cent farmers do have chaffing machine. Similar findings reported by Sabapara et al., (2010). Mostly the farmers fed compound concentrate mixture to the animals while only 35.83 per cent of the farmers have the knowledge of feeding concentrate with proper nutrient proportion. It was found that 31.66 per cent of the farmers fed mineral mixture to the animal while 49.16 per cent of the farmer fed common salt to the animal. Colostrum feeding to newly born calf just after birth performed by 54.16 per cent of the farmer and

Table 3. Mean sustainability scores (%) of dairy management practices followed by the dairy farmer

Dairy management practices	Shelter management	Breeding	Nutrition	Milking management	Animal Health
Small Farm	41.44	65.34	38.03	58.04	48.88
Medium Farm	49.59	65.73	42.27	63.48	50.99
Large Farm	65.63	74.44	51.73	66.75	55.50
Overall	50.27	67.75	42.90	62.08	51.26

Table 4. Adoption Rate (AR) of dairy management practices by the farmer

S. No	Shelter management practices	AR	S. No	Breeding	AR	S. No	Nutrition	AR	S. No	Milking management	AR	S. No	Animal health	AR
1.	Location of shed separate from dwelling house	20.83	1.	Planned systematic breeding	39.16	1.	Both stall feeding and grazing of animals	27.50	1.	Full hand milking	19.16	1.	Consulting veterinary doctors for treatment of sick animals	45.00
2.	Loose housing as per BIS standard	23.33	2.	Artificial insemination	85.83	2.	Feeding green fodder to animals	15.00	2.	Calf is allowed to suckle before and after milking	22.50	2.	Purchasing veterinary aids from veterinary hospital	65.00
3.	Tie barn with adequate area and rope length	23.33	3.	Using Quality germplasm	79.16	3.	Feeding dry fodder to animals	100.0	3.	Stripping at the end of milking	50.00	3.	Following deworming measures	60.00
4.	Kutcha floor with proper drainage.	22.50	4.	Selection of breeding bull considering its milk yield and phenotypic characteristics	70.00	4.	Feeding chaffed fodder	6.66	4.	Milking at a separate and dry place	20.00	4.	Tik control	16.66
5.	Height of the roof shade 15ft. at the ridge and 8 ft. at side.	34.16	5.	Animal coming to heat within 90-120 days after parturition	33.33	5.	Feeding concentrate to the animals	76.66	5.	Cleaning udder and teats, washing hands with antiseptic solution	90.83	5.	Isolating sick animals from healthy ones	46.66
6.	Proper and permanent roof.	70.83	6.	Proper heat detection by visualizing animal behaviors	49.16	6.	Concentrate feeding to lactating cow both at milking and mix with fodder	35.83	6.	Practicing drying off of animals	65.83	6.	Daily cleaning of animal shed water trough and mangers	71.66
7.	Manger feeding.	5.83	7.	Insemination during mid heat	34.16	7.	Pretreatment of concentrate mixture like soaking and boiling the animals	25.00	7.	Leaving animals to stand for sometimes after milking	40.83	7.	Daily cleaning of animals	50.00
8.	Proper ventilation.	18.33	8.	Insemination within 12 hours after heat detection	26.66	8.	Feeding mineral mixture to the animals	31.66	8.	Cleaning utensils & milk storage area with cleaning agent and water	75.83	8.	Practicing vaccination timely and regularly against contagious disease	15.83
9.	Separate housing of calving animal.	35.00	9.	Insemination performed by Veterinary officers	32.50	9.	Feeding common salt to the animals	49.16	9.	Keeping milk harvested from sick animals separate from milk of healthy animals	25.83	9.	Vaccination by government agencies	15.00
10.	Proper utilization of cow dung without wasting.	63.33	10.	Cow served within 60-90 days after calving	65.83	10.	Colostrum feeding to newly born calf just after birth	54.16	10.	Availability of refrigerated storage	21.66	10.	Diseased animal carcass gets properly treated with disinfectant before disposal and making provision to remain unapproachable for stray dog/jackal etc.	
11.	Availability of hygienic water	91.66	11.	12 month calving interval	22.50	11.	Consultation with scientist/ veterinary officers about nutrient management	14.16	11.	Change in feed during rainy days	29.16	11.		
			12.	Conservation of fodder as hay/silage	12.50	12.	Practicing conservation of fodder as hay/silage	12.50						
			13.	Own feed and fodder production	0.00	13.	Own feed and fodder production	0.00						

only 14.16 per cent of the farmer consult scientists/veterinary officers about nutrient management of the animals. About 40 per cent of farmers have enough fodder throughout the year, while others suffer due to a lack of storage facilities, and only 12.50 per cent reported conserving fodder as hay/silage. These findings are similar to Kumar et al., (2006) & Nagalakshmi et al., (2007). Farmers do not have their own production so they have to purchase feed and fodder from outside which is adding extra cost to the farmer.

Effective milking management procedures aid in the production of clean milk. Farmers were found to be using full hand milking 19.16 per cent of the time, while others were using a faulty approach called knuckling and stripping. Due to space constraint most of the farmers do not have a separate dry place for milking, only 20 per cent farmer did milking at a separate and dry place. The majority of farmers (90.83%) found it necessary to clean the animal's udder and teats before and after milking, as well as to wash their hands with antiseptic solution. About 65 per cent of the farmer practices gradual drying off of animals rather than instantly stopping milking. Leaving animals to stand for sometimes after milking helpful in preventing mastitis known by 40.83 per cent of the farmers. Daily cleaning utensils & milk storage area with cleaning agent and water for maintaining hygienic condition practiced by 75.83 per cent farmers. It was observed that only 25.83 per cent of the farmer separated milk from healthy animals and sick animals. Only 21.66 per cent farmers were having refrigerated storage while other forced to dispose milk on the same day of harvesting otherwise it will be waste.

Socio-economic status of the farmers mainly responsible for their decision regarding animal health services (Kumar & Meena, 2021). It was observed that only 45 per cent of the farmer consulting veterinary doctors for treatment of sick animals while others are consulting quacks, stockman etc. It was found that various measures like deworming and tik control were performed by 60 per cent of the farmers. Only 16.66 per cent of the farmers were able to isolate sick animals from healthy one while others were not due to space constraint. About 46 per cent of farmers clean their animal sheds, water troughs, and mangers on a daily basis, whereas 71.66 percent clean their animals on a daily basis. Half of the sampled farmers were well aware about various contagious diseases of dairy animals and performing vaccination timely and regularly against contagious diseases. Diseased animal carcass gets properly treated with disinfectant before disposal and making provision to remain unapproachable for stray dog/jackal etc. performed by 15 per cent of the farmer while others leave it as such at a distant place for decay.

CONCLUSION

The study pronounced sustainability of peri-urban dairy farms on the basis of scientific dairy management practices. Results reveal that 61 per cent of the farm belonged to low sustainable category, 32 per cent belong to medium sustainable category while only 8 per cent farms found to be highly sustainable. The overall mean score results show that peri-urban dairy farms have a low performance in shelter management, nutrition and animal health management practices. Especially peri-urban dairy farms in the study area have challenges in space constraint, unawareness about

planned systemic breeding practices, unavailability of green fodder, unavailability of refrigerated storage, problems in dung disposal and timely vaccination of animals. Therefore, farmers should be educated about the benefits of following various dairy management practices through various training programmes and government should make various policies for removing such barriers in peri-urban areas.

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Determinants of Adaptation during COVID-19 Pandemic by Rural Households in Cooch Behar District of West Bengal

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ABSTRACT

The COVID-19 pandemic has led to loss of human life and presented an unprecedented challenge to public health and food systems. The study was conducted to assess the factors in terms of livelihood profile determining awareness and adaptation level. Using random sampling procedure, data were collected from 80 farmers from four villages under two blocks of Coochbehar district in 2021. Altogether eleven variables i.e., age, education, information availability, social participation, quality of common facilities services, mean distance of common facility services, economic status, expenditure during pandemic, net landholding, number of migrants in family and duration of migration explain 46.9 per cent of variance in awareness level and six variables i.e., personal cosmopolite sources use, social recognition, annual family income before and during pandemic and expenditure before and during pandemic explain 63.7 per cent variance of adaptation level. Rural people should be encouraged to participate in different extension activities. Findings would serve as a valid reference for researchers and policy makers concerning pandemic issues.

INTRODUCTION

The Covid pandemic has been considered as the most crucial global health calamity of the century. The outbreak of novel coronavirus disease, caused by a novel coronavirus SARS-Cov-2 has left no sectors untouched. (Saadat et al., 2020). According to FAO (2020), COVID-19 is impacting global food systems, disrupting regional agricultural value chains, and posing risks to household food security. It is estimated that the global gross domestic product (GDP) of the developing economies will contract by 2.5 per cent in 2020 (World Bank, 2020). This could potentially result in an increase in global poverty pushing 60 to 100 million people into poverty (Lakner et al., 2020). India is the second most populous country having 68.84 per cent of rural population out of which 56.6 per cent of workers depend on agriculture and ailed activities (Census, 2011). According to statistical data available, the share of agriculture in India's total workforce was 43.21 per cent in 2019 (World Bank, 2020). Of the total agricultural workforce in

India, 45.1 per cent are cultivators (farmers with land or self-employed in agriculture) and the rest 54.9 per cent agricultural labourer. (Directorate of Economics & Statistics, 2017). Severe lockdown has resulted in large scale economic distress and food insecurity as large sections of the population subsist on daily earnings without any savings. (Ray & Subramanian, 2020). It will hit the most vulnerable sections of the population (e.g., migrant laborers, daily wage workers, and street vendors) the hardest, with reduced employment opportunities and lower earnings and disruptions to the supply chain which, in-turn, threatens to worsen the food insecurity (Gettleman & Raj, 2020). There is also scarce culturally and linguistically accessible information about COVID-19 and how to protect self and others, that further increases the risks to refugees and migrants as well as host population (WHO, 2020).

West Bengal is the fourth most populous state in India with a population of over 90 million. The pandemic has led to a devastating

impact on adaptation behaviour besides their health. As a result of the pandemic, many people have avoided large gatherings, encouraged physical distancing, and quarantined citizens (Mckinsey & Company, 2020). Farmers are exploring alternate channels to directly sell to consumers through farmer producer companies or linking directly to retailers and wholesalers in urban centres (Reddy & Devi, 2020). Cooch Behar district of West Bengal, was one of the hardest hits during pandemic in northern region of the state. When the total COVID-19 cases per 1000 households was compared, the top five districts were Kolkata, Darjeeling, North 24 Parganas, Howrah and Cooch Behar. COVID-19 cases per 1000 households were 123, 52, 51, 33, and 29. Similarly, when COVID-19 cases per One Million population was analysed, the top five districts were Kolkata, North 24 Parganas, Darjeeling, Howrah and Cooch Behar with 2811, 1199, 1100, 726 and 690 COVID-19 cases per one billion population (Biswas et al., 2021). On this backdrop present study was conducted to measure the adaptation mechanism undertaken by rural households and factors effecting it during pandemic.

METHODOLOGY

Agriculture of Cooch Behar district shows a special feature of agro-ecology for its geographical location (Terai Zone). Agriculture is the main source of livelihood and employment for rural people. Out of 12 development blocks of Cooch Behar two blocks i.e., Cooch Behar-I and Cooch Behar-II blocks were purposively selected due to its highest number of households among all other blocks. Two villages under each block were randomly selected. A sample of 20 rural households were selected for present study. Thus, a total of 80 respondents were chosen. Based on the literature review of the secondary data, 25 statements were initially developed and the relevancy of each item was measured on 3-point continuum i.e., most relevant, relevant and least relevant by experts representing Uttar banga Krishi visvavidyalaya, KVK and state line departments. Twelve items which mean score were greater than 1.5 were kept in the schedule which was pretested in non-sampling area and thereafter the final schedule was formed and administered with the sample respondents. The responses whether the people were aware of it or not and whether it was adopted by them or not

were recorded accordingly. Correlation and multiple regression analysis were done to reveal the factors in term of attributes determining livelihood profile of rural households which have influenced the awareness level of rural household on different coping strategies and their adaptation during the COVID-19 pandemic.

The attributes determining livelihood profile of rural households were, viz., age, education, personal localite information sources use, personal cosmopolite sources use, mass media use, ICTs use, social media use, information accessibility/ availability, participation in extension activities, social participation, extent of cohesiveness, social recognition (household status), quality of common facilities services, mean distance of common facilities services, level of physical assets holding, economic status, annual family income, monthly family expenditure, credit behaviour, financial awareness, financial safety, net land holding, net cultivated area, livestock holding, number of migrants in family, duration of migration, perceived level of financial constraints, perceived level of marketing constraints, perceived level of production & labour constraints, perceived level of personal & general constraints.

RESULTS AND DISCUSSION

Table 1 shows the distribution of respondents according to the adaptation mechanisms. All the respondents were aware of the maintenance of social distance in public places. Singh et al., (2021) also revealed that 64 per cent of respondents had moderate knowledge about the characteristics of COVID19. Bhati et al., (2020) in their study reported that majority of the respondents felt necessity of wearing mask and sanitizing hands. Julie Howard (2020) stated that the pandemic will creates an opportunity to accelerate the use of digital technologies in smallholder agriculture, not only for extension advice but to crowdsource information about COVID-19 impacts. Digital logistics, both in rural and urban areas, can play crucial services in reducing the impacts of COVID-19 on whole transport, aggregation, and retail systems (Maji et al., 2020). Majority of the respondents were not aware about different digital technologies however Arogya Setu mobile app was a well-known name to majority, about 88.75 per cent were aware of use of Arogya Setu mobile app and 61.92 per cent came to know about this app through mass media. Most of the respondents have adopted it

Table 1. Distribution of respondents according to the adaptation mechanisms

S.No.	Strategies	% of farmers (N=80)									
		Awareness		Sources of Information				Adapted		Found it useful	
		Yes	No	PL	PC	MM	SM	Yes	No	Yes	No
1.	Social distance maintenance in public places	100.0	-	17.5	-	67	16.25	100	-	100	-
2.	Proper farm sanitation	77.5	22.5	75.0	-	11.7	13.4	45.0	55.0	37.5	62.5
3.	SHG or farmer club meetings through WhatsApp	35.0	65.0	67.8	-	-	32.14	31.25	68.75	28.75	71.25
4.	Use of post office linkage model for input services	7.5	92.5	16.7	-	16.7	66.7	-	100	-	100
5.	Use of e-farm advisory	13.75	86.25	9.09	-	-	90.9	-	100	-	100
6.	Use of Arogya Setu mobile app	88.75	11.25	21.12	-	61.92	17	68.75	31.25	35	65
7.	Use of FSC start-up linkage	8.75	91.25	-	-	-	100	-	100	-	100
8.	Regular visit of the veterinary & human health team	71.25	23.75	43.8	50.8	-	3.5	32.5	67.5	32.5	67.5
9.	Use of KCC	65.0	35.0	59.6	-	-	40.3	42.5	57.5	33.75	66.25
10.	Imparting education through online platform	70.0	30.0	8.92	92.8	-	-	45.0	55.0	38.75	61.25
11.	Doorstep services for different inputs	47.5	52.5	76.3	-	-	23.6	21.25	78.75	17.5	82.5
12.	Cultivation of short duration variety	32.5	67.5	-	-	19.2	80.7	8.75	91.3	8.75	91.25

(68.75%) and only 35 per cent have found it useful. Only 13.75 per cent of respondents were aware about the use of e farm advisory. However, Slathia et al., (2012) stressed that to maintain trust among the farming community requires induction of professionally qualified personnel and their regular trainings. Three fourth respondents feels that even the education system cannot afford lock down (Bhati et al., 2020). About 70 per cent of respondents were aware about imparting education through online platform and 45 per cent had adapted it.

Table 2 shows that there were significant associations between the awareness level and respondent's attributes like social participation, annual family income during pandemic as evident from significant correlation coefficient values. While attributes like mean distance of common facility services and number of a migrants in family showed significant negative relation with the awareness level.

Adaptation level of the respondent was having significant associations with the personal cosmopolite sources use, participation in extension activities during pandemic, social recognition (household status) and livestock holding with the significant correlation coefficient values of each while attributes like mean distance of common facility services, number of migrants in

family and duration of migration showed significant negative relationship with the adaptation level.

Table 3 shows the multiple regression (backward elimination) between the attributes, awareness and adaptation of respondents on different coping strategies. Accordingly, eleven variables namely age, education, information availability, social participation, quality of common facilities services, mean distance of common facility services, economic status, expenditure during pandemic, net landholding, number of migrants in family and duration of migration found having significant regression coefficient at 0.9, 1.5, 6.8, 0.4, 6, 4.7, 9, 0.5, 7.1, 0.9 and 3.3 per cent level of significance respectively. Altogether these eleven variables explain 46.9 per cent of variance in awareness level. Patel & Palandurkar (2020) described that there is a lack of awareness among the people and often they confuse common cold with COVID19. Additionally, these communities live in small, overcrowded spaces and expose a lot many people to the infection if they are the carrier. For adaptation level, accordingly six variables namely personal cosmopolite sources use, social recognition (household status) annual family income before and during pandemic and expenditure before and during pandemic found having significant regression coefficient at 1.2, 1,

Table 2. Correlation analysis between the attributes and awareness level of respondents

S.No.	Attributes	Correlation coefficient (r)	
		Awareness	Adaptation
1.	Age	0.061	0.075
2.	Education	0.157	0.140
3.	Personal localite information sources use	0.013	0.078
4.	Personal cosmopolite sources use	0.150	.225(*)
5.	Mass media use	0.083	0.191
6.	ICT use	0.014	0.068
7.	Social media use	0.037	0.021
8.	Information availability	-0.004	-0.071
9.	Participation in Extension activities before pandemic	0.141	0.202
10.	Participation in Extension activities during pandemic	0.150	.244(*)
11.	Social participation	.314(**)	0.177
12.	Extent of social cohesiveness	0.116	0.006
13.	Social recognition (household status)	0.195	.274(*)
14.	Quality of common facilities services	0.174	0.126
15.	Mean distance of common facilities services	-.266(*)	-.292(**)
16.	Number of physical assets	-0.033	-0.033
17.	Economic status	0.123	0.041
18.	Annual family income before pandemic	0.092	-0.160
19.	Annual family income during pandemic	.259(*)	0.154
20.	Expenditure before pandemic	0.197	0.032
21.	Expenditure during pandemic	0.201	-0.041
22.	Credit behaviour	0.097	0.134
23.	Financial awareness	0.076	0.072
24.	Financial safety	0.098	0.077
25.	Net land holding	0.002	-0.032
26.	Livestock holding	0.204	.225(*)
27.	Number of migrants in family	-.310(**)	-.296(**)
28.	Duration of migration	-0.208	-.242(*)
29.	Perceived level of financial constraints	-0.149	-0.028
30.	Perceived level of marketing constraints	-0.057	-0.005
31.	Perceived level of production & Labour Constraints	-0.145	-0.213
32.	Perceived level of personal & general Constraints	-0.063	-0.011
Awareness			.684(**)

** significant at 1% level of significance * significant at 5% level of significance

Table 3. Multiple Regression (Backward Elimination) between the attributes, awareness and adaptation level of respondents

S.No.	Coefficients	Unstandardized	Standardized	T	Sig.
		Coefficients	Coefficients		
		Std. Error	Beta		
FOR AWARENESS LEVEL					
	(Constant)	27.719	(22.365)	0.807	0.423
1.	Age	0.157	0.341	2.674	0.009
2.	Education	0.447	0.316	2.498	0.015
3.	Information availability	0.605	-0.189	-1.856	0.068
4.	Social participation	1.995	0.303	2.998	0.004
5.	Quality of common facilities services	0.452	0.190	1.909	0.060
6.	Mean distance of common facilities services	0.107	-0.225	-2.020	0.047
7.	Economic status	3.360	0.184	1.720	0.090
8.	Expenditure during pandemic	0.000	0.301	2.932	0.005
9.	Net land holding	1.288	-0.200	-1.834	0.071
10.	Number of migrants in family	2.696	-0.266	-2.702	0.009
11.	Duration of migration	1.536	-0.213	-2.175	0.033
R = 0.685; R ² = 0.469; F statistic = 1.918					
FOR ADAPTATION LEVEL					
	(Constant)	5.210	(-0.118)		
1.	Personal cosmopolite sources use	2.010	0.196	2.570	0.012
2.	Social recognition (household status)	1.800	0.206	2.635	0.010
3.	Annual family income before pandemic	0.000	-0.320	-3.020	0.003
4.	Annual family income during pandemic	0.000	0.196	1.915	0.060
5.	Expenditure before pandemic	0.001	0.516	2.385	0.020
6.	Expenditure during pandemic	0.001	-0.578	-2.620	0.011
7.	Awareness level	0.066	0.607	7.810	0.000
R = 0.798; R ² = 0.637; F statistic = 3.590					

0.3, 6, 2 and 1.1 per cent level of significance respectively altogether these six variables explain 63.7 per cent variance of adaptation level.

CONCLUSION

The respondent's attributes like social participation, annual family income during pandemic showed a positive significant relationship with the awareness level. While adaptation level of the respondent was having significant associations with the personal cosmopolite sources use, participation in extension activities during pandemic, social recognition (household status) and livestock holding. The attributes like mean distance of common facility services and number of a migrants in family showed significant negative relation with both the awareness and adaptation level. Thus, respondents should be encouraged to participate in different social initiatives and extension activities while maintaining safety precautions due to pandemic. They should be encouraged to use different emerging digital and ICT technologies.

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Extent of Information Utilization Behaviour of Vegetable Growers Regarding Integrated Pest Management Practices

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ABSTRACT

The study was undertaken in the Jaipur district of Rajasthan. Chomu and Amber tehsil were selected for the research purpose as Chomu and Amber have the maximum number of vegetable growers in the Jaipur district. List of villages in the selected tehsils were prepared, out of which, eight villages had the maximum number of vegetable growers from the two identified Tehsils. From each selected villages a sample of 15 respondents was selected randomly making a total of 120 respondents. It is evident from the study that the highest level of utilization was found in respect of the application of *Cultural practices* as summer ploughing followed by crop rotation. In *Mechanical/ physical practices* mass trapping of pests followed by use of pheromone traps was majorly utilized. Among *Biological practices*, use of predators followed by use of beneficial insects and among *Chemical practices*, uses of pesticides followed by safe application of pesticides were the major practices utilized.

INTRODUCTION

A number of factors, including pests, pose a challenge to achieving the goal of increasing food production. In terms of accelerated crop production, pests and diseases are the most significant restraining factor (Wilson, 2001). In the global agriculture sector, pests cause the loss of 32.1 per cent of global crop production annually (Dhawan et al., 2010). Pests are responsible for the majority of the crop losses in Africa (Bonabana-Wabbi et al., 2006). In Bangladesh, estimates that annually, 25 per cent of vegetables, 20 per cent sugarcane, 16 per cent rice, 15 per cent jute and 11 per cent wheat are lost to pest infestations (MoA, 2010; Kabir & Rainis, 2013a).

The loss is presumed to be higher than those caused by various natural disasters, such as floods, droughts, cyclones, although there is no formal record (Kabir & Rainis, 2013b). In spite of the fact

that pesticides are a remarkable innovation for modern agriculture and are needed to minimize crop losses due to pest infestation, their frequent use results in resistant pests that appear as new pests. Furthermore, the frequent use of pesticides pollutes the environment by contaminating soil, groundwater and surface water (Kabir & Rainis, 2012). Additionally, the way and how pesticides are applied in developing countries causes several diseases (Cuyno, 1999). Due to these issues, it is assumed that a certain approach is needed to increase food production without harming the environment and the health of people. Pests can be controlled by organic farming without using chemicals. Hence, this system is better in social (health) and environmental aspects, but has limitations as it relates to productivity (Rattanasuteerakul, 2009). A system of integrated pest management emphasizes non-chemical approaches to control pests, and chemicals are only used if no other

means are available (Kabir & Rainis, 2013c). IPM is preferred to conventional and organic agriculture in countries that need to increase food production sustainably (DAE, 2012).

Research into vegetable production is moving fast, as evidenced by the current state of vegetable technology, which has resulted in an increase in vegetable production to a remarkable extent through research carried out in the country. Despite rapid advances in knowledge, research findings have little practical application. It depends on the source and channel of information whether farmers respond differently. Research has shown that the variability in the knowledge acquired by the farmers through different sources and channels is a function of their age, education, family background, and farming experience. Integrated pest management (IPM) is a strategy that uses a variety of techniques such as biological control, habitat manipulation, modification of agronomic practices, and the use of resistant varieties to solve pest problems over the long term. Various aspects of IPM stand reported by Wason et al., (2009); Hooda et al., (2009); George et al., (2010); Ghanghas et al., (2017); Gupta et al., (2020). A single tactic for controlling a particular organism is not sufficient to constitute IPM, even if that tactic is an integral part of the system. It is most likely to sustain long-term crop protection when multiple pest suppression methods are integrated. Monitoring and scouting are needed to determine if pesticides are necessary to prevent economic damage from the organism before use.

METHODOLOGY

The study was undertaken in the Jaipur district of Rajasthan. Chomu and Amber tehsil were selected having the maximum number of vegetable growers in the Jaipur district. Out of which, eight villages with the maximum number of vegetable growers from the two identified Tehsils were selected. From the selected village a sample of 15 respondents was selected randomly from each village. Thus, a total 120 respondents were selected for the study. The data was collected through personal interview method with the help of pre-tested interview schedule. The data gathered were analysed for statistical treatments in the light of objectives. Mean score was obtained by total scores of each item divided by total number of respondents. The correlation coefficient ("r" value) was used to measure the relationship between dependent and independent variables.

RESULTS AND DISCUSSION

The component-wise extent of utilization of integrated pest management practices by the farmers is presented in Table 1 and Figure 1. There were 17 components of integrated pest management practices and the farmers were categorized into three categories viz, (low, medium, and high) as per the utilization of a particular component using mean $\pm$ standard deviation method.

It is evident that the highest mean per cent score of utilization was found in the case of application of summer ploughing followed by Crop rotation. The highest mean per cent score of utilization was found in case of application Mass trapping of pests was found in case of application use of Pheromone traps followed by Destruction of crop residues. The highest mean per cent score of utilization was found in case of application Use of beneficial insects.

Table 1. Component-wise utilization of different IPM practices

S.No.	Component	MPS	Rank
1.	Cultural practices		
i.	Summer ploughing	83.61	I
ii.	Crop rotation	79.72	II
iii.	Trap crop	66.39	VIII
iv.	Clean cultivation	76.39	III
v.	Weed management	74.44	V
vi.	Timely sowing	75.63	IV
vii.	Proper water management	74.01	VI
viii.	Seed treatment	67.22	VII
	Over all MPS	74.44	
2.	Mechanical/Physical practices		
i.	Destruction of crop residues	71.39	III
ii.	Mass trapping of pests	74.44	I
iii.	Use of Pheromone traps	71.67	II
	Over all MPS	72.5	
3	Biological practices		
i.	Use of predators	64.44	I
ii.	Use of parasitoids	58.05	IV
iii.	Conservation of natural enemies	61.38	III
iv.	Use of beneficial insects	62.00	II
	Over all MPS	61.46	
4	Chemical practices		
i.	Use of pesticides	83.33	I
ii.	Safe application of pesticides	82.5	II
	Over all MPS	82.91	

The highest mean per cent score of utilization was found in the case of Use of pesticides, followed by application Safe application of pesticides.

After going through the practice-wise and aspect-wise utilization of various IPM practices, the utilization scores of all the 30 traditional practices were computed. The maximum and minimum possible scores of IPM practices could be obtained 35.9 and 41.9 scores, respectively. From the utilization scores obtained by all the IPM practices, the mean score and standard deviation were calculated to classify these practices into three different levels of utilization namely "High utilization practices" "Medium utilization practices" and "low utilization practices" as follows: The integrated pest management practices which obtained utilization scores of more than 41.9 score were classified as "High utilization practices" by the farmers. The integrated pest management practices which obtained the utilization scores from 35.9 to 41.9 score to were categorized as "Medium utilization practices by the farmers. The integrated pest management practices which obtained utilization scores below 35.9 scores were classified as "low utilization practice" by the farmers. The statistical data regarding the levels of utilization of integrated pest management practices by the farmers.

It is evident from the Figure 2 that 80.00 per cent of integrated pest management practices were moderately utilized by the farmers, whereas 11.67 per cent IPM practices were high information utilized practices by the farmers. Only 8.33 per cent were low utilized by the farmers. The findings are in conformity with the findings of Rathod & Chauhan (2012) that the majority of the respondents adopted cultural, mechanical and biological practices for pest control. Due to the adoption of IPM in cotton, the data regarding

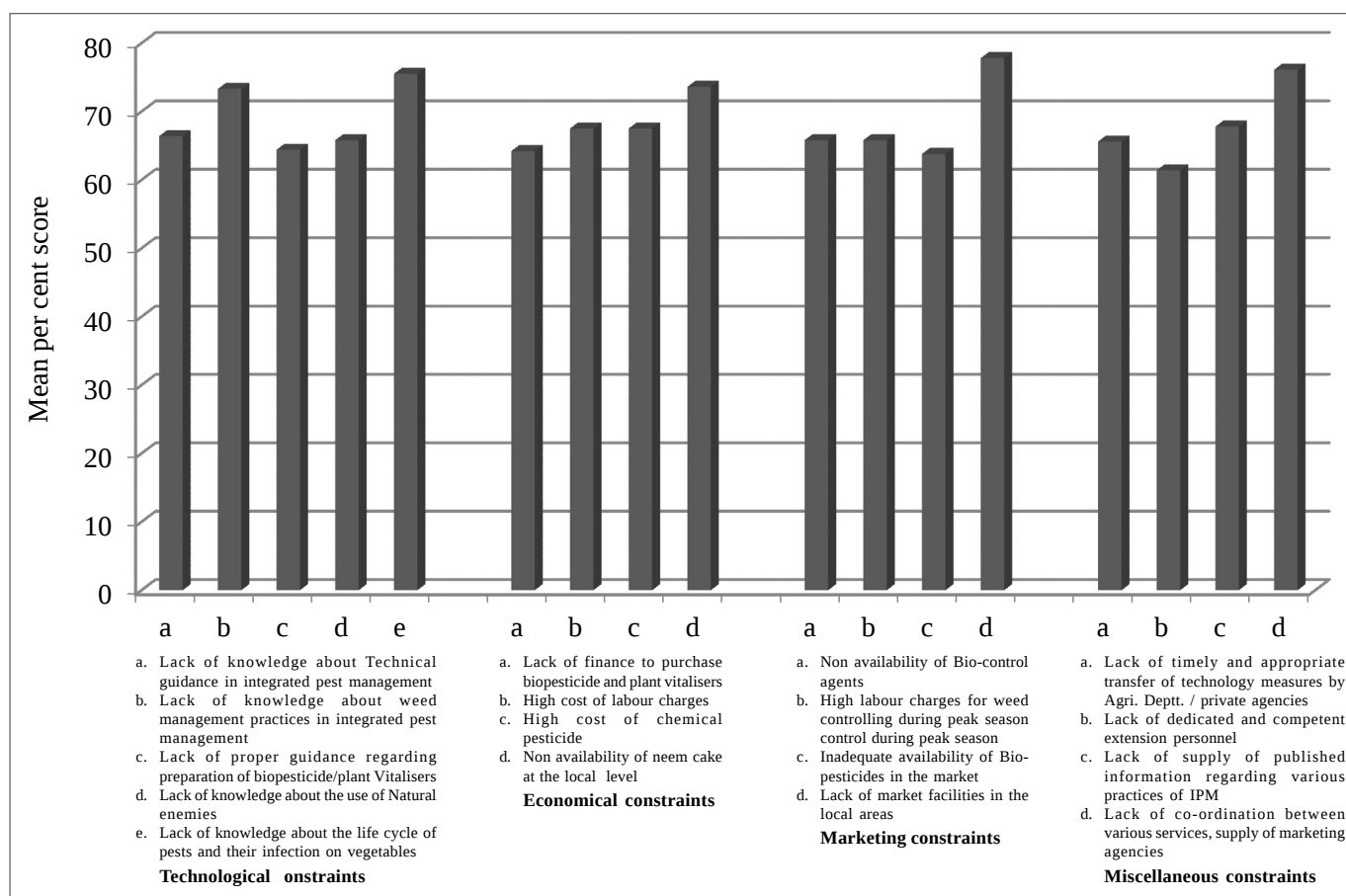


Figure 1. Distribution of farmers according to their component wise extent of utilization of different IPM practices

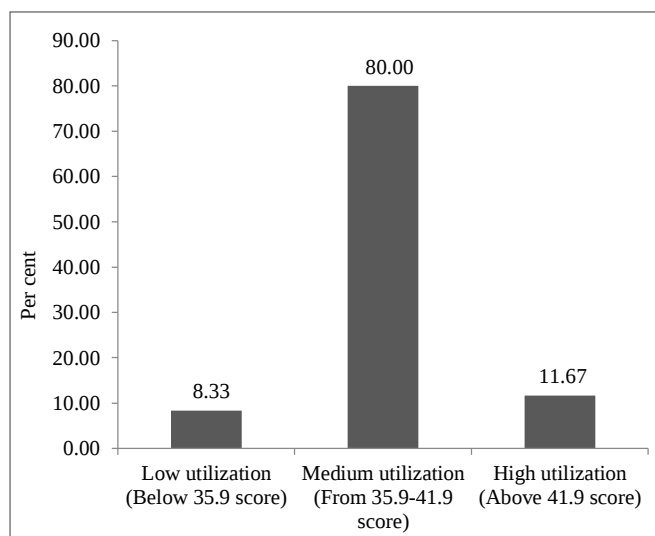


Figure 2. Distribution of respondents into different levels of utilization behaviour regarding IPM

comparison of economics between conventional and IPM technology indicated that the 63 per cent reduction in the cost of plant protection in IPM as compared with conventional methods of pest control and (Ram et al., 2012) reported that majority of the respondents had medium level of adoption of IPM practices, while equal per cent of respondents (20%) had high and low level

of adoption. With regard to cultural practices, the majority of farmers had adopted the practice of transplanting of the recommended number of seedlings per hill. As mechanical control measures, the use of bamboo-cage-cum-perchers to control pest in cole crops had been adopted by (70%) of farmers (Singh et al., 2018). In respect to biological control measures, use of neem products / neem-based pesticides was also noticed in the case of 40 per cent of farmers. The application of chemical control measures was in significant among the farmers. Among the cultural, mechanical, biological and chemical measures of integrated pest management, respondents mainly followed cultural and mechanical methods for management of pests of cabbage and cauliflower crops.

The results of the multinomial logit model presented in Table 3, indicates that 2 out of 8 variables in the model were statistically significant at the 0.05 and 0.01 levels. Nagelkerke's R square is 0.249, indicating that the explanatory variables explain about 25 per cent of the variation in utilization behaviour regarding IPM. The age of the farmers had a significant and negative effect on their utilization behaviour regarding IPM at the 1 per cent level of significance. It might be possible that the elderly age of farmers is not interesting in increasing their knowledge. They believe in their traditional knowledge to prevent their crop. It is another possibility that the sampled farmers have a secondary occupation to maintain their livelihood. (Mubushar et al., 2019) have also conducted a similar study. The result shows that farming experience has a significant and positive effect on their utilization behaviour regarding

Table 2. Logit regression model of utilization behaviour regarding IPM (dependent variables)

Explanatory Variable	β	S.E.	Wald
Age	-0.118**	0.039	8.940
Caste	0.437 ^{NS}	0.253	2.987
Occupation	0.444 ^{NS}	0.330	1.806
Education	0.327 ^{NS}	0.196	2.776
Landholding	0.375 ^{NS}	0.303	1.532
Social participation	-0.010 ^{NS}	0.219	0.002
Farming experience	0.106*	0.053	4.083
Income	-0.098 ^{NS}	0.331	0.087
Constant	-2.460 ^{NS}	2.491	0.975

Dependent variable: Total utilization behaviour regarding IPM; 1 = acceptable (above the mean), 0 = low (below the mean), -2 Log likelihood: 141.054, Nagelkerke R Square: 0.249, Level of significance: ** (P < 0.01); * (P < 0.05), NS = not significant.

Table 3. Correlation between utilization behaviour regarding IPM and various socioeconomic parameters

Socioeconomic parameters	Utilization behaviour regarding IPM
Age	-0.150 ^{NS}
Caste	0.127 ^{NS}
Occupation	0.259**
Education	0.204*
Landholding	0.221*
Social participation	0.232*
Farming experience	0.036 ^{NS}
Income	0.209*

Level of significance: ** (P < 0.01); * (P < 0.05), NS = not significant

IPM 5 per cent level of significance. It can be understood that the professional type of farmers who are gaining experience year to year and observing the better practice as utilization behaviour regarding IPM. Chandran & Podikunju (2021) to measure the constraints faced by the respondents in vegetable production, a suitable schedule was developed and the constraints were ranked accordingly based on the total score obtained by summing up the total score for each constraint. A similar type of study has been conducted by (Sharifzadeh et al., 2018) & (Deguine et al., 2021).

It could be seen from the Table 3 that the characteristics of respondents namely, occupation, education, landholding, social participation, and annual income were positive and significantly related to their information utilization of integrated pest management. While, the characteristics of respondents namely age, caste, and farming experience were found to be non-significantly related to extent of information utilization of IPM practices by vegetable growers.

CONCLUSION

The study reveals that the highest level of utilization was found highest in respect of the application of summer ploughing, mass trapping of pests, use of predators and use of pesticides in their major categories. The highest and lowest percentage was been found in terms of IPM practices and varied from medium to low utilization. Age and farming experience have been found to influence information utilization of IPM practices. The socio-economic

factors i.e. occupation, education, landholding, social participation, and annual income were positive and significantly correlated to their information utilization of IPM. It is, therefore, suggested to great opportunity to extend the study in other part of state with more sample size, other sampling procedure and more possible way to find gap between technology recommended and its utilization.

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Farmers' Acuity on Climate Change in the Central Dry Zone of Karnataka

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ABSTRACT

To counteract the vulnerability results from climate change, it is critical to understand farmers' viewpoints. In Karnataka, farmers' perspectives, implications, adaptive measures, and barriers were investigated during 2021 by collecting the data from farmers using multi-stage random sample technique. Farmers witnessed significant changes in temperature, rainfall distribution, emergence of new plant pests and infirmity over time as a result of the introduction of new cultivars/crops, and the occurrence of drought/flood, according to the data. Crop harvests were inconsistent, depleted common property resources, and costs had risen as a result. Cultivation of stress-tolerant cultivars, drilling bore wells, novel plant protection molecules, changing sowing/harvesting dates, and water-saving techniques were among the adaptation strategies. Climate adaptation challenges in the region included high-cost farm inputs for climate-smart agriculture, labour scarcity, lack of shared water resources, and knowledge gaps. For the best results, adaptation strategies should be implemented "collectively" rather than "individually". Weather based Crop insurance must be marketed with assured indemnity.

INTRODUCTION

Climate change is impacting India's agricultural economy. Temperatures would rise by 1.7 to 4.78 degrees Celsius by 2030-2080, with precipitation increasing by 1.2 to 11.3 per cent, affecting the agricultural and water sectors (Vijayabhinandana et al., 2022). Since the twentieth century, climate change has been a major concern that threatens the livelihoods of humans and other living organisms (Kowshika et al., 2021). Future climate change projections for India indicate distinct rise in temperature and increased variability in rainfall (Sandeep et al., 2018). Climate change has a variety of effects on agriculture, including decreased crop productivity, incidence of pest and diseases and change in cropping pattern. When production decreases, availability of goods also decreases and hits the poor most. Climate change has about 4-9

per cent impact on agriculture each year. As agriculture contributes 15 per cent to Indian Gross Domestic Product (GDP), climate change presumably cause about 1.5 per cent loss in GDP (Subhojit, 2017). Numerous studies on climate change and variability have been conducted at the international, national, and state levels (Anonymous, 2017; Chand et al., 2011).

Farmers are facing a new challenge in the form of climate change. Apart from the losses incurred as a result of changing weather conditions, it also has an impact on farmers' decision-making abilities due to a lack of awareness and expertise. Farmers' readiness to adapt is influenced by their perceptions and attitudes about climate change. Adaptation to climate change requires long-term planning of alternative agricultural management strategies in response to changing weather conditions (Rachit et al., 2021). The impact of climate change is particularly visible in India's semi-arid

region, where geo-ecological fragility is reflected by low and erratic rainfall patterns, poor soil fertility, and inherent socio-economic instabilities (Bantilan et al., 2006; Singh et al., 2012). Because of agro-climatic conditions, land pattern, cropping systems, cropping pattern, and resource availability differs by region, key findings from macro-level research may not be applicable to the micro level, such as individual districts (Kumar et al., 2011; Jangra & Singh, 2011). The regional study of climate parameters and their impact on agriculture is urgently needed. Normal agricultural and allied sector activities rely heavily on rainfall and the number of rainy days per year. Any deviation from the normal mean in climatic parameters puts a strain on rural livelihoods and economies. As a result of rural agriculture's distress, the state's agrarian crisis has worsened over time (Sagar et al., 2018). Between 2030 and 2050, climate change is expected to cause approximately 2,50,000 additional death per year from malnutrition, malaria, diarrhea and heat stress. The cardiopulmonary and digestive systems of humans are particularly vulnerable to the negative effects of global warming. Furthermore, climate change has an impact on some infectious human diseases and their animal vectors (Massimo & Pier, 2015).

Farmers' perceptions of climate change and the risks associated with it, on the other hand, are a necessary prerequisite for developing appropriate adaptations strategies. As a result, the purpose of this study is to elicit grassroot perspectives on climate change impacts, adaptation measures implemented to cope with climate change, and barriers to effective adaptation in Karnataka's Chitradurga district.

METHODOLOGY

Chitradurga district was selected purposively as it is one of the most historically drought-prone districts in Karnataka. The district is experiencing insufficient water availability, owing to the depletion of the groundwater table. Such risk will be exacerbated by climatic variations, posing an imminent threat to the region's food and livelihood sustainability. Furthermore, the majority of studies assessing the vulnerability of Indian agriculture to climate

change have designated Chitradurga as a highly vulnerable district (Anonymous, 2018).

Information from both primary and secondary sources were used. To select sample households, a multistage sampling technique was used, with the first stage focusing on three taluks: *Holalkere*, *Hiriyuru*, and *Challakere*. In the second stage, two villages from each taluk i.e., Chikkajajuru and Raamagiri from Holalkere taluk, Aadivaala and Maarikanive from Hiriyuru taluk, Kurudihalli and Saanikere from Challakere taluk were chosen. Finally, a total of 150 households i.e., 25 respondents from each village was chosen randomly to investigate grass-roots perceptions and adaptation measures to climate change during 2021. Furthermore, individual primary surveys and Focus Group Discussions (FGDs) with farmers were conducted, during which they were asked open-ended questions about their perceptions of climate change, socio-economic hardships experienced, and obstacles encountered in dealing with climatic uncertainty. Moreover, concerns were raised about the steps that farmers were taking in response to changing climatic conditions. Farmers' perceptions of climate change were validated further by observing variation in rainfall and temperature from their long-term averages using data on climate variables from 1951 to 2020.

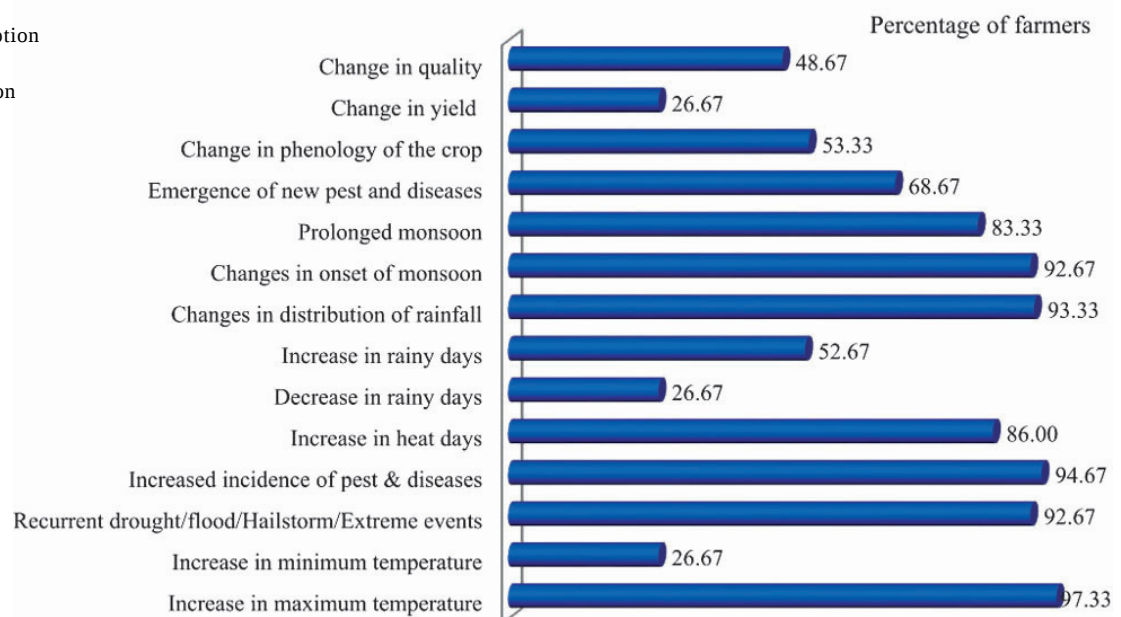
RESULTS AND DISCUSSION

Farmers' perceptions on climate change

According to surveys and focus group discussions conducted in selected villages of Chitradurga district, the vast majority of farmers (97.33%) reported an increase in maximum temperature (Figure 1). A sizable proportion of respondents (94.67%) stated that pest and disease incidence had increased. Similarly, many farmers (93.33%) believe that unpredictable rainfall distribution has increased, with 92.67 per cent citing changes in monsoon arrival and the recurrence of extreme occurrences. Every year, the nakshatra-based rainfall is unpredictable, as perceived by majority of farmers. This result is supported by study conducted by Chinchorkar et al., (2019) and Swamy (2018). The study area

Figure 1. Farmers' perception on climate change

Source: Author's estimation based on Field Survey data, 2021



farmers reported an 86 per cent increase in the number of hot days and 83.33 per cent increase in the length of the monsoon. Almost 69 per cent of respondents predicted the emergence of new pests and sickness over the years. Surprisingly, roughly 54 and 53 per cent of farmers reported that changes in crop Phenology (growth stages) and increased rainy days in the region have made agriculture unpredictable over time. Concerns about changes in the quality of their produce were expressed by approximately 49 per cent of farmers. Farmers also reported a change in crop yield by 26.67 per cent, fewer rainy days, and a higher minimum temperature. Farmers' education, use of the media, and source of meteorological information all played a role in their impression of climate change (Bharat et al., 2022).

Temperature and rainfall patterns of Chitradurga district

From 1951 to 2020, the long-term variation and trends in climate variables were studied. Figures 2 and 3 indicate rainfall and temperature anomalies calculated by subtracting the current value from the long-term average. Maximum temperatures, according to farmers' perceptions, have been rising at a rate of 0.019°C per year.

Singh et al., (2021) reported similar increase in maximum temperature in Rajasthan and Ganesh (2020) also found out similar outcome in Gujarat. However, the increase in minimum temperature was insignificant when compared to the increase in maximum temperature in the district. Significant changes in the amount of annual rainfall was observed in the study area, indicating that farmers perceive rising oscillations in precipitation.

Impact of Climate Change in Chitradurga district

Climate-related risks have a negative impact on the socio-economic stability of rural households. Figure 4 shows that 98.67 per cent of farmers believe that changing climatic conditions have increased the cost of farming in recent years due to crop loss, while, 93.33 per cent believe that common property resources (wells, ponds, lakes, and so on) in their village have declined due to unpredictable rainfall. Farmers they all agreed that climate change has reduced the cultivation of conventional varieties, which has increased crop yield uncertainty. A large majority of respondents (82.67%) agreed that soil fertility has declined over time, and 85.33 per cent said pest and disease infestation has increased on a regular

Figure 2. Rainfall deviation in Chitradurga district, Karnataka during 1951-2020

Source: Author's estimation based on secondary data obtained from ICAR-CRIDA, Hyderabad

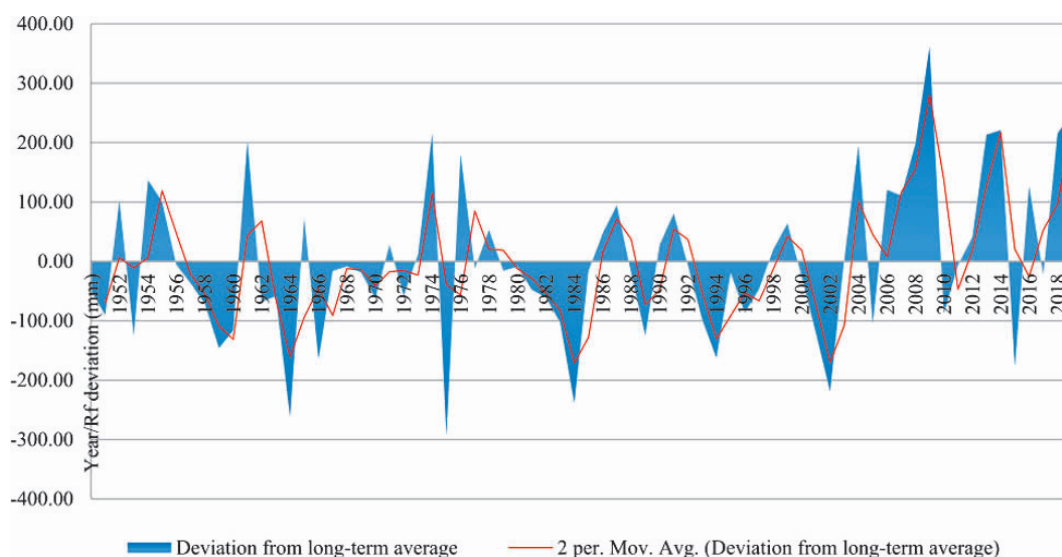
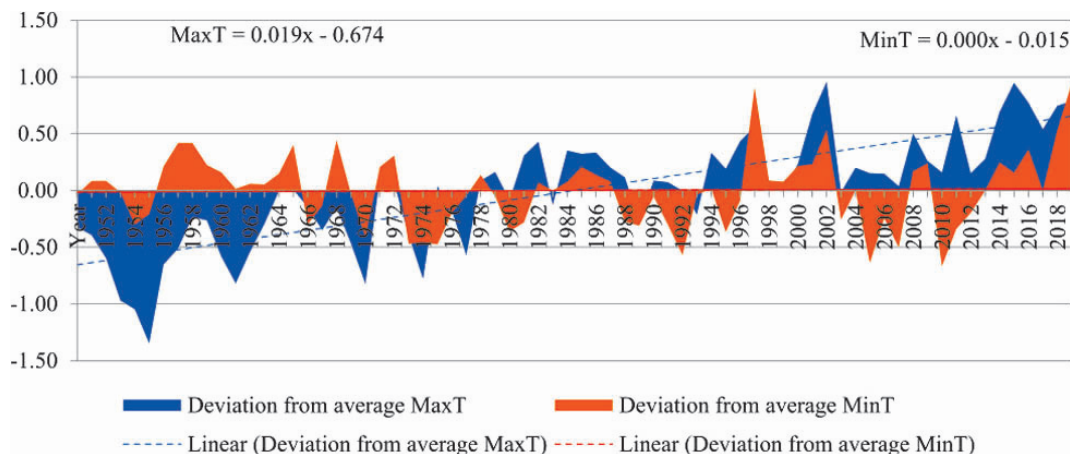


Figure 3. Maximum and minimum temperature anomalies and linear trend for Chitradurga district, Karnataka during 1951-2020.

Source: Author's estimation based on secondary data obtained from ICAR-CRIDA, Hyderabad



basis. As a result, crop yield and quality were both questioned (81.33%). The findings of Sreenivas et al., (2021) back up this conclusion. More than half (53.33%) of respondents were satisfied with the percentage of net revenue earned. Around 47 per cent of each group wish to stop farming and believes that climate change has hampered crop growth and affected the farm income. A significant proportion of the farming community (34.67%) has abandoned agriculture as a primary source of income. Surprisingly, 32.67 per cent of farmers have shifted to new crops (i.e., arecanut and pomegranate, which were not there in the district before two decades). Changes in soil health and mortgage/sale of precious metals for income generation are also expressed by 33.33 and 46.67 per cent of farmers, respectively. Furthermore, only 5.33 per cent of farmers have made investments in climate-smart technologies such as protected structures (poly and shade house). In Meghalaya, Singh & Feroze (2020) support a similar finding on asset sales due to climate change.

Adaptation strategies for climate change

Farmers' awareness, technical competence, and financial ability all play a role in climate change adaptation efforts in the district. It

is crucial to note that adaptation strategy selections are not mutually exclusive, and farmers have reported using more than one technique at a given time. As shown in Figure 5, the majority of farmers (86.67%) in the selected villages chose to dig a borewell to ensure continued irrigation after the district experienced several years of drought and to provide adequate irrigation to new crops such as arecanut and pomegranate. Approximately, 86 percentage of respondents reported using new chemical compounds to combat persistent plant pests and illnesses in hybrids and high-yielding varieties, while 57.33 per cent reported using drip and sprinkler watering. Farmers were also found to be making proper modifications in terms of planting and harvesting stages (54.67%), which is critical because crop production is mainly influenced by climatic condition. To adapt to climate change, a sizable proportion of farmers (53.33%) were able to find new crops or change their cropping patterns. Furthermore, 34.67 per cent of respondents used adaptive techniques such as cultivar selection for biotic and abiotic stress tolerance (drought tolerant, pest and disease resistant varieties). Few farmers (25.33%) were able to use soil and water conservation methods to combat climate change, which were among the other possible strategies employed. Besides, only 8.67 per cent

Figure 4. Perceived impact of climate change

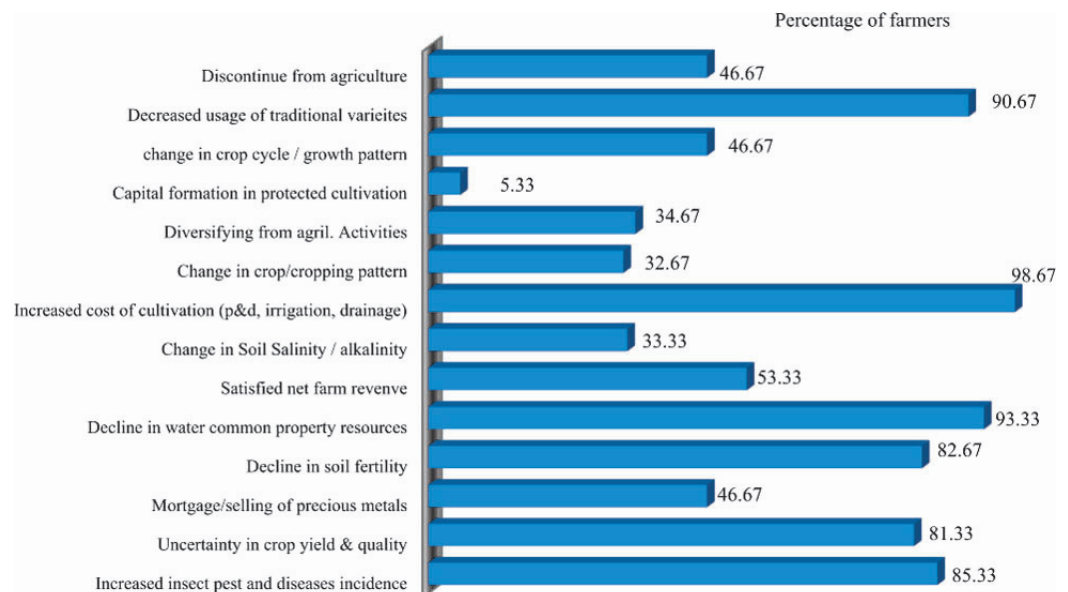


Figure 5. Adoption to climate change

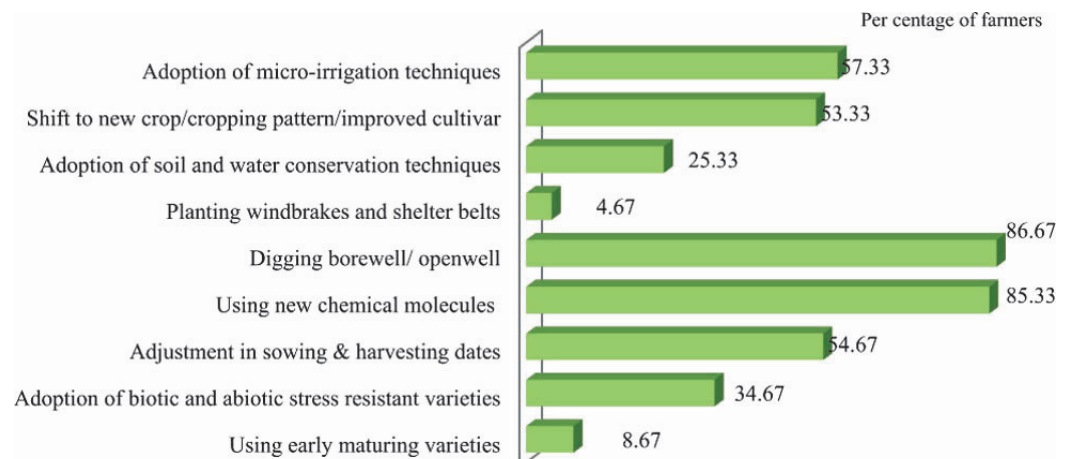
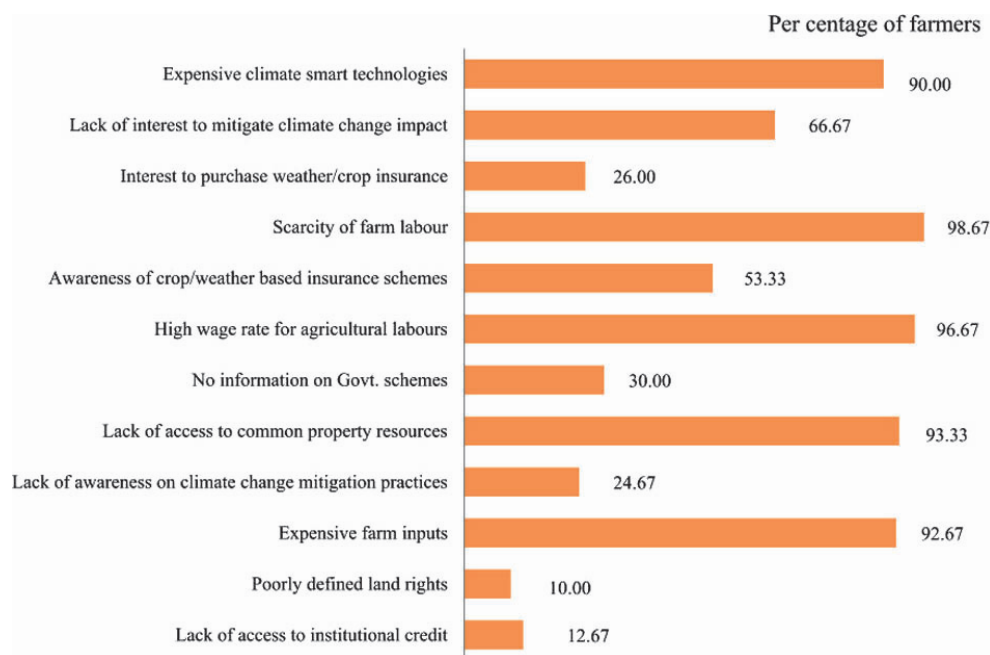


Figure 6. Barriers to climate change adaptation
 Source: Author's estimation based on Field Survey data, 2021



of farmers used early maturing cultivars as an adaptation strategy. A negligible proportion of tree species were used for windbreaks and shelter belts (4.67%) as there is misconception of reduced yield due to shade. Sujit et al., (2022) reported similar adaptation strategies in climate smart village in West Bengal.

Climate adaptation roadblocks

Farmers' ability to adapt to climate change is hampered by a variety of issues. These include institutional, economic, technological, social, and informational factors, all of which contribute to a lack of coping capacity. Farmers' perceptions of barriers must be evaluated to determine the relative importance of the factors influencing their adaptation decisions. The majority of farmers in the research areas stated that the biggest deterrents to adaptation were lack of farm labour availability (98.67%) and high wage rates of agricultural labourers (96.67%) (Figure 6). Farmers also cited a lack of access to common property resources (93.33%), expensive farm inputs (92.67%), and expensive climate smart technologies (90%) as major barriers to adaptation. Despite the fact that it is a task that requires people's participation, 66.67 per cent of farmers in our grass-roots survey reported a lack of interest in mitigating climate change. About 53 per cent of respondents were unaware of crop/weather-based insurance programmes, and only 26 per cent were interested, because respondents believe that prompt indemnity is not guaranteed every year. Furthermore, 30.00, 24.67, and 12.67 per cent of farmers saw a lack of information about government programmes, lack of awareness about climate change mitigation methods, and lack of access to institutional loans as significant impediments, respectively. Surprisingly, 10 per cent of those polled believe that lack of clearly defined land rights prevents them from implementing climate change mitigation measures.

CONCLUSION

As a result of the introduction of new cultivars/crops owing to climate change, farmers in the Chitradurga area of Karnataka are

witnessing major differences in temperature, rainfall distribution, the advent of new plant pests and diseases, and the occurrence of drought/flood over time. Crop yields are uneven, resulting in fewer common property resources and higher costs. Stress-tolerant cultivars, borehole drilling, innovative plant protection molecules, shifting sowing/harvesting time, and water-saving techniques were among the adaptation options. High-cost farm inputs for climate-smart agriculture, labour scarcity, a lack of shared water resources, and knowledge gaps are among the region's climate adaption issues. To achieve the optimum results, "collective" adaption strategies should be used rather than "individual." Crop insurance dependent on weather must contain a regular indemnity guarantee.

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Impact of *Meghdoot* Mobile App - A Weather-based Agro-advisory Service in Cold arid Ladakh

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ABSTRACT

The study was conducted to evaluate the impact of the *Meghdoot* mobile application-a weather-based agro-advisory service in cold arid Ladakh during 2020-21. A random sample of 100 registered farmers was selected which included 25 farmers each from Stok and Stakna villages and 50 farmers from Bazgoo village of Leh district. The data indicated that farmers of Leh district were very belittling of newspapers followed by radio. Almost, 70 per cent of registered farmers have followed information for agriculture practices through the *Meghdoot* application of agro-meteorology advisory services but non-registered farmers used to follow their traditional methods for agricultural practice due to a lack of knowledge of this application of agromet-advisory services. More than 50 per cent of farmers agreed that this application provided weather information in the local language with a mean score of 0.55. Similarly, in the case of wheat, an average yield superiority of 16.71 per cent was recorded in the case of registered farmers over non-registered farmers during 2020. The mobile application provided benefits to the registered farmers in comparison to non-registered farmers of district Leh, Ladakh.

INTRODUCTION

With the growing population of India, it is aimed to produce and support Indian agriculture for more food with more precision and correctness by weakening the impacts of extreme events. In view of this, weather information integrated with agro-advisories might support and bring economically viable sustainability for more agricultural production. Sharing knowledge through advisories as effective tools for proper understanding of user priorities needs to work in partnership with meteorological services to promote more environmentally friendly and sustainable development in Indian agriculture, especially in a country like India that has wealthy biodiversity and experiences extreme weather variability, crop failure, cloud burst, etc. India's Integrated Agrometeorological

Advisory Service (AAS) drive is the largest agro-meteorology information advisory program in the world by the Indian Meteorological Department based on weather-based services for farmers by radio broadcasting system since 1945. In 1976, IMD integrated its work involving state governments to help farmers by issuing forecast-based advisories, and in 1988 piloted by the National Centre for Medium-Range Weather Forecasting. In 2008, IMD launched the district-level Agrometeorological Advisory Service (DAAS). Ministry of Earth Sciences mobile App *Meghdoot* launched in August 2019 and covered 68 districts including the Leh district. Later the service was available in 150 districts across the country (Bijlwan, 2020). *Meghdoot* or Cloud Messenger, a joint initiative of the Indian Meteorological Department (IMD), Indian Institute of Tropical Meteorology (IITM), and Indian Council of

Agricultural Research (ICAR) aims to deliver critical information to farmers through a simple and easy to use mobile application for example. After installing, the app displays information like targeted weather parameters such as temperature, precipitation, etc. It also give information on major crops viz., cereals, vegetables fruit crops, and livestock grown in a particular location (Saini, 2019), also, provide crops and livestock advisories for specific locations every Tuesday and Friday in location-based languages. Also bear features by tracking past weather patterns in the selected region for the past seven days. The application seamlessly aggregates contextualized district and crop-wise advisories issued by Agro-Met Field Units (AMFU) every Tuesday and Friday with the forecast and historic weather information to the fingertips of the farmers (Vartika, 2019). This App is very useful in a region like Ladakh where all biotic and abiotic extremes have been noted in past. The advisories are also issued in vernacular wherever available. *MEGHDOOT* mobile application used in different organizations of Ladakh such as high mountain arid agriculture research institute (HMAARI), Stakna-Leh, SKUAST-Kashmir, and IMD centre-Leh for valuable information dissemination to the farmers through scientific expert advisories and essential need of motivating to more and more farmers for engagement with *Meghdoot* application of Agro-met Advisories Services (AAS). Hence, it emphasizes the need to study the psychological perception of farmers' *Meghdoot* mobile application of Agro-advisories in the cold arid region of Ladakh.

METHODOLOGY

The study was conducted in the purposively selected Leh district of the Union Territory of Ladakh in 2021. There are 16 blocks and 119 villages in the Leh district. Two blocks namely Kharu and Chuchot were selected on the basis of having a maximum number of farmers being registered under Agro-Meteorology Field Unit (AMFU) centered at SKUAST (K) HMAARI, Stakna, Leh. Three villages namely Stakna, Stok, and Bazgoo were identified from Kharu and Chuchot blocks on the basis of having a maximum number of farmers who have been registered under the agro meteorology field unit (AMFU). Random sampling for 100 farmers was carried out that included 25 farmers each from Stok and Stakna villages and 50 farmers from Bazgoo village. Perception of farming on information acquired through *Meghdoot* application of agro advisories on agriculture and weather which was measured on the basis of Follow vs Unfollow with a score of 2 and 1, respectively. The impact of farmers about the *Meghdoot* application has been assigned marks and one mark each was assigned for 'Yes' correct reply and zero scores each for 'No' reply, respectively. The descriptive statistics such as the percentage, mean score and average superiority yield of barley and wheat crops obtained by the registered farmers who used the *Meghdoot* application and non-registered farmers who did not use the *Meghdoot* application from 2019 to 2020 in Ladakh, were used. Tabular analysis was employed to assess the source of information, perception of farmers about agriculture and weather, psychological perceptions of farmers for *Meghdoot* mobile application and yield variation of crops (Barley and Wheat).

RESULTS AND DISCUSSION

The majority of farming communities belonged to small as well as marginal levels with limited resources and access to the latest

technologies and if not equipped with this type of advisories experience huge food deficits under extreme weather challenges under changing climate. Ladakh has been very keen and profound of radio information where all the information through All India Radio is broadcasted. Every household still relies on Radio news as compared to TV News. In interviews about the broadcasting of news, they are of the opinion that these are more accurate as compared to television. In addition to this, every house has at least a minimum of 5 people and 80 per cent maintains mobile. The source of information at high altitudes and remote regions like Ladakh where mobile apps have been found very effective in communication as well as apps specially developed for agricultural purposes. Almost cent per cent is the agrarian population in Ladakh where commodities like barley, wheat along with vegetables are the lifeline in this high mountain region which is locked from all directions for seven months during the winter season. Under such situations and natural disaster locations, these mobile apps bring together the Ladakhi people in an effective manner.

Table 1. Existing source of information for Farmers

Source of Information	Percentage
Radio	26
Television	28
Newspaper	05
Friends/Relatives	23
Mobile	18

The survey indicated (Table 1) that the dissemination of information at the farmers' level was found very effective through various modes of communication like radio, television, newspapers, friends/ relatives, and especially Mobile apps. The major source of information for farmers of Leh ranged between 25-28 per cent through television, radio, and in the present scenario the Mobile apps. And mobile is gaining much popularity as compared to television. Mutual interaction of exchange of information is between friends/ relatives. This mode of mutual exchange either from friends or mobile was recorded during the cloud-burst situation in 2010 when no casualties were recorded. The newspaper was the least and lowest source of information for the farmers of Leh i.e., 5% as this mode of information was always delayed 3 days due to its remote location. Thus, the data also indicated that the source of information has a major role in farmers' progress. All the modes besides newspapers are still working very effectively and they benefitted with increased income and increased marketing opportunities by accessing marketing information from these modes of communication. Similar findings were observed by Rahman et al., (2016) & Rahman et al., (2020) studied the source of information for farmers of different areas of agricultural practices. Likewise, it was observed that in mountain regions, radio and television are the major source for communicating with farmers on how to protect and stimulate agricultural development. This impact as seeing is believing and doing is learning if these media are working effectively.

Information of agriculture disseminated to farmers through the *Meghdoot* application of agro-advisory Services (Table 2) indicated that 80 per cent of registered farmers followed advisories about snowfall/ temperature/ rainfall through *Meghdoot* App through AAS

Table 2. Perception of the farming community on information acquired through *Meghdoot* mobile application of agro-advisories on agriculture and Weather

Information acquired by <i>Meghdoot</i> mobile application on Agriculture and Weather	Response category	Mean score of farmers
Snowfall/ temperature/ rainfall	Follow	0.80
	Not follow	0.20
Ploughing	Follow	0.74
	Not follow	0.26
Seedling/ Sowing/ Seeds/ varieties/ input on crops	Follow	0.70
	Not follow	0.30
Manurial application	Follow	0.66
	Not follow	0.34
Irrigation/ Availability of water	Follow	0.69
	Not follow	0.31
Intercultural operations (Weeding etc.)	Follow	0.64
	Not follow	0.36
Harvesting	Follow	0.69
	Not follow	0.31
Polyhouse related (winter) fertigation, preventive measures from pests	Follow	0.75
	Not follow	0.25
Advisories related to season change- time and stages of agriculture (shift from monocropping approaching winter activities)	Follow	0.86
	Not follow	0.14
Others (agricultural and environmental advisories)	Follow	0.71
	Not follow	0.29

and only 20 per cent of registered farmers did not follow about this aspect through AAS. Registered farmer respondents revealed that 74 per cent followed about ploughing through Agromet advisory services and 26 per cent of registered farmers had not followed about this aspect. Farming community registered followed to the tune of 70 per cent about advisories regarding seedlings/ sowing/ seeds/ varieties/ inputs on crops through AAS and 30 per cent of registered farmers had not followed about this aspect through AAS. Manurial application has been followed by 66 per cent of registered respondent farmers through AAS, whereas 34 per cent of registered farmers have not followed it. Further, 69 per cent of registered farming communities followed irrigation/ availability of water through AAS and 31 per cent of farmers had not followed this aspect. Intercultural operations practices had been followed by 64 per cent of registered farmers, whereas 36 per cent of farmers had not followed it. Registered farmers (69 per cent) followed about harvesting through and 31 per cent of had not followed. 75 per cent of registered farming communities followed polyhouse-related fertigation, and preventive measures against pests through AAS,

whereas 25 per cent of farmers had not followed this aspect. Further, 86 per cent of registered respondent farmers followed advisories related to season change-time and stages of agriculture through agro-advisory services. Finally, 71 per cent of registered farmers followed others (agricultural and environmental advisories) through AAS. On average basis, the majority of registered under the *Meghdoot* application of Agro-meteorology advisory services farmers (70%) followed agricultural practices but non-registered farmers used to follow their traditional methods for agricultural practice due to a lack of knowledge of this application of agromet-advisory services. IMD and SKUAST-Kashmir established more agro-meteorology field unit (AMFU) centers provided for the Ladakh region for the benefit of the farming community through the *Meghdoot* application. The results were in agreement with the findings of Sindhu (2017); Jiyawan (2010), and Kaur and Anand (2021) who studied the perception of different aspects in different regions.

The data indicated (Table 3) that more than 50 per cent of farmers agreed for motivation to others farmers registration in

Table 3. Perceptions of farmers about *Meghdoot* mobile app. of agro-advisories

Perception items	Percentage
Have you motivated other farmers to register in the <i>Meghdoot</i> mobile app	55
Have you been aware of being motivated by the farmers to register in the <i>Meghdoot</i> application	50
Do you think the <i>Meghdoot</i> app. provides valuable information for the cultivation of agriculture and climatic conditions to the farmers	60
Do you feel after registering <i>Meghdoot</i> mobile application provide help us	65
Do you feel about <i>Meghdoot</i> application is not good for the farmers	29
Do you think about <i>Meghdoot</i> application is good for the farmers	70
It helps to solve the constraints of agriculture farming	60
It helps to improve their agriculture yield	63
Does it give a stress-free life to the farmers?	54
It provides the helpful information to the farmers after post-disaster	51
It helps to provide important information spread to the farmers regarding the Covid-19 pandemic	62
Do you think about <i>Meghdoot</i> application is the mode of communication	52
It provides weather information in local/regional language	55

Meghdoot application with a mean score of 0.55. 50 per cent of farmers agreed for awareness to other similar farmers in this application of AAS. More than 60 per cent of farmers agreed for the *Meghdoot* application provided valuable information for the cultivation of agriculture and climatic conditions, 65 per cent of farmers agreed that *Meghdoot* mobile application provide help. Although, 29 per cent minimum farmers reported that *Meghdoot* application is not good but 70 per cent agreed for *Meghdoot* application is good for them. 60 per cent of the farmers agreed to undergo to solve the problems of agriculture farming through *Meghdoot* application whereas 60 per cent of farmers agreed to improve their socio-economic status with the help of it. half of farmers agreed to live a stress-free life with the help of it and 62 per cent of respondents agreed that it helps to provide helpful information to the farmers post-disaster whereas 60 per cent of farmer respondents agreed that it helps to provide important information spread to the farmers regarding COVID-19 pandemic. More than half of farmers agreed for the *Meghdoot* mobile application is a mode of communication. More than half of farmers agreed that this application provides weather information in the local language. Similar results were observed by Diaz et al., (2021), Krumpel (2019) & Kumbhare et al., (2019) who studied the psychological impact of a mobile application on the farmers from different regions.

The economic impact of the *Meghdoot* application was observed in terms of the yield performance of barley and wheat in the case of registered and non-registered farmers. The results (Table 4) revealed that during 2019 an average yield superiority of 12.13 per cent was recorded in the case of barley among the registered farmers over non-registered farmers. Similarly, in the case of wheat, an average yield superiority of 16.71 per cent was recorded in the case of registered farmers over non-registered farmers during 2020. As a result of this, this app provided benefits to the registered farmers in comparison to the non-registered farmers of Ladakh. This table also indicated the positive increase over the previous year in terms of respondents registering the App. While it just decreased

under non-registered and added to the App and showed the attraction towards the utility of this App for yield gain in crops.

The data in Table 5 revealed that the villages and farmers using the *Meghdoot* App were at different altitudes and distances and obtained higher yields significantly when the community utilized the mobile App '*Meghdoot*'. It is clear from the table that there is a significant gain over after registering with the App. It indicated that the utilization of App by the farming community was found very effective in the parameters for crop output. The Indian Meteorological Department since 1945 is broadcasting weather services by radio for the farmers and its Integrated Agrometeorological Advisory Service (AAS) is the largest agrometeorological information program in the world (Venkatasubramanian et al., 2014). All agrometeorological information directly benefits the livelihood of farmers for agricultural production. This App directly impacts the quality and quantity of produce and lastly income enhancement (Chattopadhyay & Chandras, 2018).

CONCLUSION

The government of India is regularly trying to promote innovative technology-based agriculture among the farmers. The respondent farmers of Leh were very less using newspaper. 70 per cent of registered farmers followed information for agriculture practices through the *Meghdoot* mobile application of agrometeorology advisory services but non-registered farmers used to follow their traditional methods for agricultural practice due to a lack of knowledge of this application of agromet-advisory services. More than 70 per cent farmers opined that the *Meghdoot* application is good for them. The district administration disseminates this mobile application on the large scale to the farmers of Ladakh with the help of SKUAST-Kashmir, IMD, and other N.G. O's. In overall, the mobile application provides benefits to the registered farmers in comparison to the non-registered farmers in terms of yield advantage which indirectly motivated the farmers to register for the App.

Table 4. Yield variation due to application of MEGHDOOT in Leh district

Crops	Registered farmers under <i>Meghdoot</i> mobile app		Non-registered Farmers		Average yield (q/ha) under				Percent gain over non- registered	
					Registered category		Non-registered category			
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
Barley	53	65	50	35	18	19	16	17	12.5	11.76
Wheat	55	50	50	45	20	22	17	19	17.64	15.78

Table 5. Validation of *Meghdoot* App in villages of different altitude in Leh-Ladakh

Villages	Farmer's name	Name of crops	Area (Kanal)	Yield of crop (kg/kanal)		RemarksElevation (m)
				Without the <i>Meghdoot</i> app.	With the <i>Meghdoot</i> app.	
Stakna	Tsering Sandup	Barley	03 kanal	180	196	3287m, 33.9955°, 77.6851°
Stakna	Tsewang Chorol	Barley	06 kanal	363	382	3287m, 33.9955°, 77.6851°
Bazgoo	Tsering Youdol	Vegetables*	05 kanal	63	72	3292m, 34.1244°, 77.1741°
Stok	Stanzin Dorge	Wheat	05 kanal	316	371	3364m, 34.0644°, 77.5533°

(Note: 20 kanals= 1 hectare); * Cabbage, cauliflower, knol-khol, tomato, spinach, other leafy vegetables

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Effect of Personal Characteristics of Respondents on their Perception towards Over-exploitation of Water Resources

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ABSTRACT

The study was carried out in the purposively selected five districts of Haryana state due to intensive agricultural practices followed in these districts. Mainly rice-wheat cropping pattern was followed in selected districts along with sugarcane and maize. The objective of this study was to know the relationship of personal characteristics of respondents with perception towards the over-exploitation of water resources. The data were collected from 150 respondents comprising 15 respondents from randomly selected ten villages through a well-prepared interview schedule. Age, education, land holding, mass media exposure, and extension contact were significantly correlated with the perception of respondents. Age was negatively correlated while, education, land holding, mass media exposure, and extension contact were positively correlated with perception of respondents and the independent variables in the regression equation jointly explained the variation of 22.70 percent. There is a need to organize awareness campaign and trainings to develop the favorable perception towards over-exploitation of water resources.

INTRODUCTION

Agriculture plays an important role in India's political and social economy. India is one of the world's top producers of agricultural products, so the long-term viability of its agricultural sector is crucial. While the majority of India's agricultural production chains are small-scale, they account for around 20 per cent of the India's GDP and employ the majority of work force of country (GOI 2014 & FAO, 2015). In the early 1960s, India was dependent on imports from foreign countries to fulfil local food requirements, so India could no longer depend on the foreign assistance and imports which were required to ensure the food security of the nation. That was backed more by the green revolution in India that resulted in a decision to the introduction of high-yielding varieties, disease-resistant varieties, and improved agricultural tools and techniques to raise productivity. During the green revolution, farmers had adopted rice and wheat cultivation mainly due to its

profitability but it resulted in excessive use of groundwater resources. In 1966s, Haryana had about 1.92 lakh hectares of area under paddy cultivation, which was increased to 14.47 lakh hectares by the end of 2020 which leads to drastic decreases in water availability (GOI, 2020).

Perception is the process through which an individual becomes aware of the objects and events taking place around him/her or the way in which sensory information is organized, analysed and experienced which involves both bottom up and top-down planning. In bottom up, the sensory inputs are used to develop perceptions and in top-down planning, our prior information, experiences, and thoughts affect how we interpret those sensations (Lumen learning). A person's perception determined by him or her awareness about any ideas or object, as well as their acceptance, adoption, and rejection. Perception has also association with all other criteria related to idea or object. The psychological object can be a symbol, statement, slogan, individual, organization, theory, idea or invention

towards which people may have different view on whether it has a positive or negative impact (Kumar et al., 2021).

Water scarcity has become a major worldwide problem, particularly for rural areas that are dependent on rainfall for agriculture. Irrigation water resources over-exploitation has resulted into drastic declines of groundwater levels and putting water resources out of reach for a large number of small and marginal farmers (Kumar et al., 2021). According to U.P. Singh, Secretary, Ministry of Water Resources states that “if remedial steps are not taken, the great scarcity of water availability may capture many parts of country in upcoming years.” Many blocks in Haryana may completely run out of water, not just for irrigation, but even for drinking purposes in the next 15 to 20 years. So, keeping in view the main facts and their relevance, the present study was taken into account to know the relationship between socio-personal characteristics of respondents with their perception towards over exploitation of water resources.

METHODOLOGY

The study was conducted in five districts of Haryana namely; Ambala, Kaithal, Karnal, Kurukshetra, and Yamunanagar which were selected purposively due to intensive agricultural practices followed in these districts in the year 2020-2021. One block each from each district viz; Ambala-I, Dhand, Nilokheri, Thanesar, and Jagadhri was purposively selected. Further, two villages were selected from each block randomly. In Ambala district, Jansui and Niharsi from Ambala-I block whereas, in Kaithal district, Kaul and Chandlana were selected from Dhand block. In Karnal district, Raison and Karsa from Nilokheri block meanwhile in Kurukshetra district, Kirmich and Hathira from Thanesar block. In Yamunanagar district, Damla and Aurangabad were selected from Jagdhari block. To study the perception of respondents, 15 respondents from each village were selected randomly. As a result, a total of 150 respondents were selected for the study. The data were collected through the personal interview method with the help of a structured interview schedule constructed and then analyzed using Statistical Package for Social Sciences (SPSS) version 23, for computing total score, weighted mean score, correlation, and regression analysis. For assessing the profile of respondents, twelve variables were selected viz; age, education, family type, family size, occupation, land holding, cropping pattern, irrigation facilities, irrigation methods, water conservation structures, mass media exposure, and extension contact. The scores were given for all twelve independent variables to know their relationship with the perception of respondents. To measure the farmers' perception towards over-exploitation of water resources, they were given 30 statement interview schedule and the responses were obtained on a three-point continuum (Likert-type) scale representing agree, undecided, and disagree. So, a score was given against each statement and aggregated total score was calculated, then weighted mean score was calculated accordingly.

RESULTS AND DISCUSSION

Perception of respondents towards over-exploitation of water resources

The results portrayed in Table 1 revealed that most of respondents (71.34%) were having high level of perception towards

Table 1. Perception towards over-exploitation towards of water resources

S.No.	Category	Percentage
1	High	71.34
2	Medium	14.66
3	Low	14.00

over-exploitation of water resources followed by 14.66 per cent respondents with medium level of perception towards over-exploitation of water resources. While, only 14.00 per cent respondents had low level of perception towards over-exploitation of water resources.

Item wise analysis of perception of respondents towards over-exploitation of water resources revealed that respondents generally perceive change in ground water availability, mostly farmers stick with rice-wheat cropping pattern and more dependency on ground water. This might explain that most of respondents perceived that there is over-exploitation of water resources in Haryana. Similar results were found by Ankit (2018) during his study in the region of Punjab that most of the respondents were highly perceived with over-exploitation of water resources. The results also revealed that respondents had perceived that water resources are being depleted in Haryana and they also know the major reason of the same. Similar findings were reported by Mohammadi et al., (2013); Sharma et al., (2016); Rezaei et al., (2017); Bharat et al., (2022) who found that most of respondents were having high level of perception towards over-exploitation of water resources in their respective regions. The respondents were skeptical about water conservation practices and perceived them as waste of time, labor, and money, long distance between canal and field also major factor of exploitation of water, water conservation awareness programs help to stop the over-exploitation of water resources. This might explain that only few of respondents perceived that there is over-exploitation of water resources in Haryana. Similar results were found partially supported by Ankit (2018) where it was reported that only a few numbers of the respondents perceived over-exploitation of water resources. The results also revealed that respondents had perceived that there is no over-exploitation of water resources in Haryana and they also do not know the main cause of regarding the same. Similar findings were reported by Parveen et al., (2012); Malik et al., (2014); Rahman & Bulbul (2015); Kumar et al., (2021) who found that few of respondents were having low level of perception towards over-exploitation of water resources in their respective findings.

Relationship of socio personal traits with the perception of respondents towards over-exploitation of water resources

The independent variables viz; education, land holding, mass media exposure and extension contact were significant and positively correlated with respondents' perception towards over-exploitation of water resources while, age is significant and negatively correlated with perception of respondents (at 0.05 level of significance). The other variables such as family type, family size, occupation, cropping pattern, irrigation facilities, irrigation method, and water conservation structure had no significant relationship with perception of respondents towards over-exploitation of water

Table 2. Perception of respondents towards over-exploitation of water resources

S.No.	Item	WMS
1	Change in ground water availability	3.00
2	Ground water table goes down	3.00
3	Quality of water decreasing day by day	2.53
4	Less rainfall due to climate change	2.79
5	More dependency on ground water	2.87
6	No change in irrigation practices	2.50
7	Flood irrigation requires more water to irrigate the field	2.59
8	Uneven topography needs more water for irrigation	2.83
9	Small landholdings increase the number of borewell/ Tubewell	2.78
10	Rice Wheat cropping pattern leads to over exploitation of water	2.86
11	Intensive cropping pattern increases the requirement of irrigation	2.55
12	Mostly farmers stick with rice wheat cropping pattern	2.89
13	Early crop sowing requires more water for irrigation	2.48
14	Long distance between canal and field also major factor of exploitation of water	1.93
15	Supply of canal water is not sufficient for crop production	2.61
16	No or less alternative irrigation practices	2.55
17	Water conservation practices are waste of time, labor, and money	1.27
18	Farmers should adopt water conservation technology for judicious use of resources	2.87
19	Change in cropping patterns helps in water conservation	2.65
20	Farmers should irrigate field as per recommendations	2.85
21	Proper soil management is a key to conserve water	2.76
22	Avoiding mitigating runoff of rain water	2.75
23	Farmers should use ITKs for water conservation	2.54
24	Scientists should develop more efficient irrigation system	2.69
25	Farmers should adopt organic farming for more water conservation	2.17
26	Water conservation awareness programs helps to stop the over exploitation of water resources	2.15
27	Policies regarding water conservation should be at grass root level	2.75
28	Timely provision new tubewell /borewell connection	2.61
29	Crop diversification helps in water conservation	2.69
30	<i>Mera Pani Meri Virasat</i> scheme help to overcome exploitation of water	1.83

*WMS=Weighted mean score

resources. In case of positively correlated variable like education, land holding, mass media exposure and extension contact this could be due to the fact that as education, land holding, mass media exposure and extension contact increases, the respondents become more aware of the benefits of water resources, able to access valid information on water extraction, its judicious use and their scarcity in nature and thus to perceive the over-exploitation of water resources and might be due to fact that people become able to understand the phenomenon of over-exploitation of water resources as well as they become highly perceived towards over-exploitation of water resources. While in case of negatively correlated variable like age, this could be because older responders adhered to their old beliefs and did not employ new or effective irrigation technologies. This finding is well supported by Mohammadi et al., (2013); Ravikumar et al., (2015); Gupta et al., (2021). The regression analysis gave value of R^2 as 0.227 which shows that 12 independent variables in the study generated a total of 22.70 per cent variation in the perception of over-exploitation of water resources, when other factors were held constant. This indicates that just 22.70 per cent of the variation in the dependent variable was due to these 12 independent variables and other variables account for the remaining 77.30 per cent of variations. These findings were found to be partially supported by reports of Ankit (2018) where extension contacts, extension participation, mass media exposure and total earnings had positive and significant relation with perception of

respondents towards over-exploitation of water resources. Habiba et al., (2012) in his study too revealed that education, mass media exposure and extension contact had significant and positive correlation with perception of respondents towards over-exploitation of water resources. Similarly, Kaur & Kalra (2016), observed that age showed negative and significant relationship while,

Table 3. Relationship of socio personal traits with the perception of respondents towards over-exploitation of water resources

S.No.	Variable	Correlation Coefficient ('r' value)	Regression Coefficient (B value)
1	Age	-0.341*	-7.431
2	Education	0.232*	-1.602
3	Family type	-0.142 ^{NS}	-1.814
4	Family Size	-0.144 ^{NS}	1.886
5	Occupation	0.043 ^{NS}	0.227
6	Land holding	0.218*	3.787
7	Cropping pattern	-0.034 ^{NS}	-1.844
8	Irrigation facilities	0.152 ^{NS}	4.728
9	Irrigation method	0.00	0.00
10	Water conservation structure	0.092 ^{NS}	-1.854
11	Mass media exposure	0.318*	0.899
12	Extension contact	0.255*	1.254

$R^2 = 0.227$, Constant = 58.844, *Correlation is significant, NS – not significant

education showed positive and significant relationship with perception of respondents regarding over-exploitation of water resources. Furthermore, findings of Kaur & Kumar (2014); Sarkar & Padaria (2015) partially supported that extension contacts, mass media exposure, total earnings and total land holding had positive and significant relationship with perception of respondents towards over-exploitation of water resources.

CONCLUSION

It was found that most respondents highly perceived change in ground water availability, ground water table going down and mostly farmers sticking with rice wheat cropping pattern. Further, most of the respondents lowly perceived that water conservation practices are waste of time, labor, and money, *Mera Pani Meri Virasat* scheme helped to overcome exploitation of water, long distance between canal and field also a major factor of exploitation of water. Age (negatively), education, land holding, mass media exposure, and extension contact were significantly correlated with the perception of farmers. It was possible to conclude that independent variables under study were found to be responsible for only 22.70 percent of the variation in the dependent variable. Proper education, awareness campaign, trainings, result and method demonstrations should be organized to develop the positive perception of people about the over exploitation of water resources and to make proper utilization of this finite resource.

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Job Satisfaction of Teachers of Orissa University of Agriculture and Technology, Bhubaneswar, Odisha

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ABSTRACT

The study was conducted in three campuses of Orissa University of Agriculture and Technology, Bhubaneswar viz. Bhubaneswar, Chiplima and Bhawanipatna in 2019 to measure the job satisfaction of teachers working in the University. Ninety respondents from these three campuses were selected for the study using a random sampling procedure. Data was collected from the respondents by implementing personal interview method. Job satisfaction of teachers was measured with the help of a scale with slight modifications. Majority of teachers possessed medium level of overall job satisfaction while working in the University. Majority of the variables were found to have a significant positive association to the dependent variable. In addition, variables such as level of aspiration, achievement motivation, perceived workload, mass media exposure, job stress, awards and recognition along with awards and recognition were found to show significantly positively contributing to as well as explaining about sixty three percent variation of the dependent variable.

INTRODUCTION

University is regarded as the ultimate source of knowledge generation and wisdom creation for the purpose of training the manpower needed different sets of society and life (Khalid et al., 2012). University is a centre of culture and academic excellence. It is a unique institution engaged in exploring, generating, and transmitting knowledge. In all probability, it calls for taking more responsibility for students than they have ever taken before. (Johal et al., 2010). Considering university as an organization, it is of inevitable requisite of a responsive and dynamic climate for the job satisfaction of the working faculties. The fundamental goal of an organization is to bring forth adequate ventures and facilities to employees for their efficient job performance. The improper official communication is most severe factor as perceived by the respondents leading to credibility loss and ultimately the job satisfaction (Slathia et al., 2012). Therefore, an effective human

resource management leads to success of the concerned organization that can be analyzed in the improved levels of job performance of the employees (Mohanlal, 2016). The state agricultural university possess a distinctive system of functioning owing to the diversity in their roles and responsibilities. The faculty moves beyond playing a singular role of a teacher, a scientist or an extension worker (Borah, 2019). Thus, the stability of agri-education imparted by the State Agricultural Universities (SAUs) banks on the working rigours of the teachers and that is why it becomes inevitable not to be ignorant towards the content and satisfaction derived from executing their roles assigned to their job, which forms an important component under human resource management of the concerned university as an organization.

The spirit of job satisfaction has great impact on job performance of any individual and thus conceptualized to describe how an individual is contended with their job. It is determined by the comparison between their expectations and reality (Garbyal,

2018). Happy contented employees does make up a better healthy organizations advancing over any ordeals they face because in such organizations, the employees itself values its responsibility and thus encharged to carry out the duties assigned to them with sheer dedication and act as prominent cogwheels in the productivity of the organization (Ramannanavar, 2018). The job satisfaction in the organization provides support to the duty of administrators to a great extent because it helps to evolve and develop conditions desirable for the all-round growth and development of the concerned organization (Mishra, 2005). Wright et al., (2007) reported that a worker's satisfaction does influence his job behaviour and job satisfaction is associated with high employee performance. In this context, a comprehensive study was undertaken with an objective to measure the job satisfaction of the teachers of Orissa University of Agriculture and Technology, Bhubaneswar, Odisha. The result of this study will be helpful in policy advocations for improving the job satisfaction of the teachers of the University.

METHODOLOGY

The study was conducted in the three campuses of Bhubaneswar, Chiplima and Bhawanipatna of the Orissa University of Agriculture and Technology. The teaching personnel employed by the University were taken as respondents for the study. A total of 90 respondents were taken by selecting 30 respondents in each of the three campuses by following disproportionate random sampling method.

Job satisfaction was operationally defined as the individual's contentedness with their job in terms of their likeliness towards the job or its individual facets such as its nature, structure, and functioning. The job satisfaction of Teachers was evaluated by using the scale developed by Fazely (2016) with slight modifications in the present investigation. The scale comprises of six dimensions with 25 items. The response of the respondents was appraised on five-point continuum namely, Very Much Satisfied (VMS), Satisfied (S), Partially Satisfied (PS), Dissatisfied (DS) and Very Much

Dissatisfied (VMDS) respectively. The job satisfaction scores for all the statements were added to get the satisfaction scores of Teachers. The possible scores varied from 25 (lowest) to 125 (highest) which was normalized later. The classification of respondents into low, medium and high levels of job satisfaction was done by following *cumulative square root frequency method*. Personal interview method was implemented for the purpose of data collection from the respondents. The variables selected were found to be relevant for the study owing to the result of an extensive review of literatures accompanied with experts' consultancy and guidance. Chi-square analysis was employed to measure the relationship between the independent variables and job satisfaction of the teachers of the University, followed by multiple linear regression and stepwise regression to determine the relative contribution of the selected independent variables and their combined effect on the dependent variable, 'job satisfaction'.

RESULTS AND DISCUSSION

Item wise analysis of Job Satisfaction of teachers of the University

The result provided in Table 1 presents the item-wise analysis of job satisfaction of the teachers of the University. The activities that opined to be in terms of highest satisfaction by the teachers were 'Status and prestige as an employee in the University' of "Esteem" with the mean score of 3.689. The second position is jointly held by 'Help, guidance and encouragement from superiors' of "Environment" dimension and 'With regard to the library facilities available in the University' of "Facilities" dimension with their corresponding mean score of 3.533. The teachers are highly satisfied with the prestige status attached with the job and guidance received from the superiors like senior cadre teachers and head of the departments which motivates them to push hard against obstacles while performing their daily given assignments both at the classroom level as well as office level. They are also satisfied

Table 1. Item wise analysis of job satisfaction of teachers in the University

S.No.	Statements	VMS (%)	S (%)	PS (%)	DS (%)	VMDS (%)	Mean score
I.	Environment						
a.	Help, guidance and encouragement from superiors	17.78	41.11	24.44	10.00	6.67	3.533
b.	The policies and procedures of the University in relation to the job.	14.44	38.89	27.78	13.33	5.56	3.433
c.	With respect to the posting to the place of liking.	10.00	42.22	37.78	10.00	0.00	3.478
II.	Opportunity						
a.	The scope and opportunity available for self-development.	14.44	32.22	33.33	14.44	2.22	3.356
b.	Opportunities to express the professional developmental needs.	11.11	36.67	31.11	13.33	7.78	3.322
c.	With respect to opportunities created to do higher studies in India and abroad.	13.33	23.33	36.67	22.22	4.44	3.189
d.	The promotional opportunities provided in the present job.	14.44	35.56	32.22	15.56	2.22	3.444
III.	Facilities						
a.	With regard to the library facilities available in the University.	16.67	42.22	24.44	11.11	5.56	3.533
b.	Provision of equipment, vehicle and other infrastructural resources necessary to execute the responsibilities	18.89	34.44	26.67	13.33	6.67	3.456
c.	Regarding education facilities available for the children.	13.33	35.56	32.22	12.22	6.67	3.367
d.	Medical facilities provided by the university	15.56	32.22	27.78	21.11	7.78	3.200
e.	The residential facilities provided by the university.	14.44	31.11	27.78	14.44	12.22	3.211
f.	With respect to transport, facilities provided at the university.	23.33	23.33	32.22	12.22	7.78	3.400

Table 1 contd...

S.No.	Statements	VMS (%)	S (%)	PS (%)	DS (%)	VMDS (%)	Mean score
IV.	Esteem						
a.	Status and prestige as an employee in the university.	24.44	37.78	24.44	8.88	4.44	3.689
b.	Scope to prove the merit and excellence in the university.	15.56	36.67	26.67	15.56	8.88	3.344
c.	The recognition given by the students and colleagues	17.78	34.44	27.78	10.00	14.44	3.344
d.	The rewards, recognition and incentives provided by the University for good work.	16.67	26.67	33.33	12.22	11.11	3.256
V.	Job						
a.	The description of job and responsibilities as a teacher.	15.56	27.78	30.00	22.22	4.44	3.278
b.	The present salary commensurate with the work	15.56	31.11	27.78	15.56	10.00	3.267
c.	Encouragement to participate in seminars, symposia / conferences in India and abroad.	17.78	21.11	35.56	17.78	7.78	3.233
d.	Freedom for flexibility in work provided by the university.	14.44	34.44	31.11	12.22	7.78	3.356
e.	Provision of equipment, vehicle and other resources necessary to execute the responsibilities.	11.11	35.56	30.00	12.22	11.11	3.233
VI	Training						
a.	The budget provided to organize educational activities.	14.44	28.89	28.89	18.89	8.88	3.211
b.	The pre service training given at the time of joining the post.	18.89	26.67	28.89	12.22	13.33	3.256
c.	Appropriate in-service programmes leading to promotions are available.	16.67	32.22	26.67	16.67	7.78	3.333

with the existing library system, which also supports them in acquiring the requisite technical knowledge with the changing times keeping them updated with newer discoveries occurring in the field of agriculture and allied sciences.

The activities that fall under the category of least satisfaction of teachers were 'With respect to opportunities created to do higher studies in India and abroad' of "Opportunity" dimension followed by 'the residential facilities provided by the University' of "Facilities" dimension with their mean scores of job satisfaction by 3.189 and 3.211, respectively. There is lacunae in the provision of residential quarters by University for staying which led to additional expenses of paying rents thus adding burden on family expenditure on availing basic amenities while living in towns and cities. There is also the absence of scope and avenues for seeking higher educational opportunities that has deprived them from increasing their exposure and paving the way for their self-development.

Overall Job satisfaction of the teachers of the University

The complete information on the overall job satisfaction of teachers being classified in to different levels/ strata as displayed by the Figure 1. According to this table, 40 per cent of the teachers appertained to the strata of medium level of job satisfaction while the portion of teachers falling under the strata of low and high level of job satisfaction yields to 24.44 per cent and 35.56 per cent, respectively. From it, the mean score of job satisfaction of all Teachers was 83.502 with the standard deviation of 14.253. The findings were quite analogous to that of Meena (2009); Patel & Dhodia (2015); Fazely (2016); Bhat (2017); Kusumalatha (2018); Kumar (2020).

The classification of teachers into the different levels of job satisfaction viz. low, medium and high based on the obtained values of mean and standard deviation of the job satisfaction scores of teachers. This was also depicted the fact that the major portion of teachers appertained to medium level and the causal factors for this

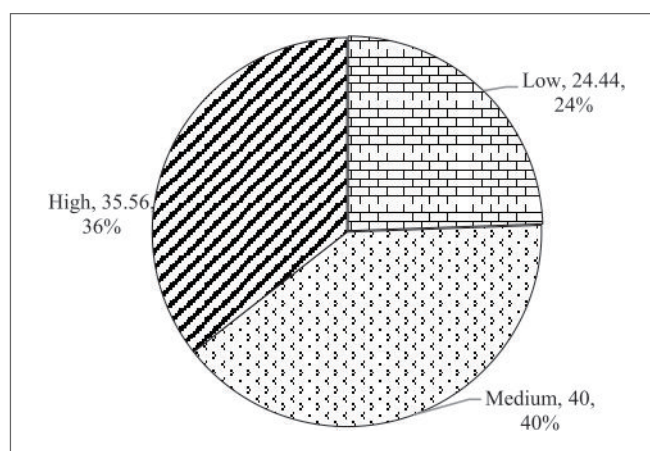


Figure 1. Job satisfaction level of University teachers

owes to the dissatisfaction of teachers about the prevailing conditions of the job, strict adherence to rules and pressure of finishing the course curriculum with limited time and resources thus blocking them to develop and acquire new innovative approaches while performing their job.

Association between independent variables and job satisfaction of the University teachers

The relationship between selected independent variables with job satisfaction of teachers of the University was measured with the help of chi-square analysis, followed by multiple linear regression analysis. From the chi-square analysis as depicted in the Table 2, it was conferred that the independent variables like age, educational qualifications, achievement motivation, perceived workload, organizational climate, e-literacy, mass media exposure, commitment to work and participation in seminars and conferences concurred to have significant association at five per cent level of significance with the job satisfaction of teachers whereas the ones

Table 2. Relation between independent variables and job satisfaction of the teachers of the University

S.No.	Profile Characteristics	Contingency Coefficient	Chi-square value
1.	Age	0.336	11.458*
2.	Gender	0.264	4.782 ^{NS}
3.	Family size	0.167	2.583 ^{NS}
4.	Rural-Urban Background	0.199	3.743 ^{NS}
5.	Educational Qualifications	0.323	10.489*
6.	Job Experience	0.276	7.445 ^{NS}
7.	Job Stress	0.377	14.912**
8.	Level of Aspiration	0.386	15.787**
9.	Achievement Motivation	0.311	9.689*
10.	Perceived Workload	0.349	12.486*
11.	Health	0.223	4.721 ^{NS}
12.	Organizational Climate	0.318	10.167*
13.	e-Literacy	0.337	11.581*
14.	Training Received	0.371	14.372**
15.	Mass Media Exposure	0.321	10.366*
16.	Commitment to work	0.365	13.851*
17.	Interpersonal Contact	0.230	5.069 ^{NS}
18.	Self-reliance	0.261	6.624 ^{NS}
19.	Number of Publications	0.199	3.726 ^{NS}
20.	Global Exposure	0.379	15.172**
21.	Participation in seminars and conferences	0.335	11.451*
22.	Awards and Recognition	0.389	16.118**
23.	Research Projects Handled	0.197	3.653 ^{NS}

**Significant at 1%; *Significant at 5%; NS=Non-significant

like job stress, level of aspiration, training received, global exposure along with awards and recognition displayed significant association with the concerned dependent variable at one per cent level of significance.

Since age and educational background found to be in significant association, it does put highlight on the fact that acquiring knowledge along with facing different types of situation in their lifetime eventually makes the individual more capable and confident of doing the assigned work in more efficient manner which tends to derive more satisfaction from the job. These results were in similarity to that of findings of Raut (2006); Kusumalatha (2018). An individual's innate desire to achieve more by constantly improving themselves to hone their skillset and trying day by day in reaching the perfection to avoid uncertainties and overcoming the failures in performing their job ultimately paves for deriving more of satisfaction from job which can be inferred from the existence of significant association of achievement motivation as well as level of aspiration. With this, it also improves their dedication that needs to be provided to the job concerned which act as fuel to their loyalty towards their job responsibilities, the fact which is well depicted by the result of significance displayed in the relation between commitment to work and job satisfaction. These results were in concurrence with the findings of Gopika (2014); Ramannanavar & Nagnur (2018).

Even though with prominent educational background, innate desire to progress with profound aspirations and dedication, still there are things which, yet being external to the concerned individual, has prominent effect on the satisfaction. Being teacher

whose primary responsibility is to ensure proper educational development of the students on the lines of agri-professionalism coping up with changing scenarios of the agricultural science, the students' nature in the face of limited resources and that too under restricted boundaries of classroom teaching and practical sessions either at field or laboratory conditions, it does put up a heavy toll on the teachers in terms of workload and in times of inability to perform their duty does put up a negative strain on themselves which does hamper in deriving satisfaction from job. That is why, perceived workload and job stress has significant relation with the job satisfaction. With today's changing world of scientific innovations and technological enhancements in the field of education has changed the picture of classroom teaching whereby the arrival of instructional aids in form of audio video lectures, slideshow presentation, online classroom teaching, video-conferencing, webinars, project reports, pdf notes, etc which helps in efficient consumption of information by almost all senses at the students' end ensuring proper dissemination and adoption of knowledge in their college life. That's why the proficiency in handling these new gadgets and forums for the above said scenario does put up in effective execution of job duties of the teacher and so justifies the significance of association of satisfaction from e-literacy and mass media exposure.

Following chi-square analysis, multiple linear regression analysis was carried out to measure the relative contribution of all independent variables to the dependent variable, i.e., the job satisfaction of teachers. In this context, a regression equation was fitted, keeping the score of job satisfaction of teachers as dependent variables with twenty-three independent variables. Table 3 shows the results of the multiple linear regression analysis carried out. The R^2 value in the regression model says that 63.80 per cent of variation in the job satisfaction of teachers could be explained by the selected all independent variables in which level of aspiration, perceived workload, mass media exposure, awards and recognition and commitment to work found to contribute significantly to the dependent variable at five per cent level of significance. Only one independent variable, level of aspiration found to be significantly contributing at one per cent level of significance.

Since it was concluded that a major number of independent variables were found not to be significantly contributing to the dependent variable, the method of stepwise regression in backward mode was employed in which after loading of all the variables into the model, each time a variable was removed to test its relative significance on the overall result of contribution to dependent variable. As described in Table 4, with R^2 value of 0.598, the independent variables like job stress, aspiration, perceived workload and mass media exposure were found to have significantly contributing to the dependent variable and thus explaining 59.8 per cent of the variation occurring in the dependent variable.

Therefore, these variables were very much crucial to explain the importance of job satisfaction of the teachers of the University. It is an inevitable fact that the aspirations act as driving force for the teachers to set up targets with aims and objectives followed by devising a plan and constantly strive for to achieve it in order to improve and become a better teachers than before they were. In the modern world dominated by the technological advancements

Table 3. Linear multiple regression analysis of independent variables with job satisfaction of teachers of the University

S.No.	Variables	Regression coefficient (b)	Standard error	t-value
1.	Age	0.182	0.152	1.196 ^{NS}
2.	Gender	3.926	2.845	1.380 ^{NS}
3.	Family size	0.644	0.827	0.778 ^{NS}
4.	Rural-Urban Background	-0.176	0.378	-0.465 ^{NS}
5.	Educational Qualifications	3.051	3.107	0.982 ^{NS}
6.	Job Experience	0.222	0.198	1.122 ^{NS}
7.	Job Stress	-0.144	0.289	-0.497 ^{NS}
8.	Level of Aspiration	1.076	0.381	2.824 ^{**}
9.	Achievement Motivation	0.331	0.286	1.158 ^{NS}
10.	Perceived Workload	-0.610	0.300	-2.036 [*]
11.	Health	-0.237	0.676	-0.350 ^{NS}
12.	Organizational Climate	-0.134	0.279	-0.483 ^{NS}
13.	e-Literacy	0.526	0.570	0.923 ^{NS}
14.	Training Received	-0.109	0.648	-0.169 ^{NS}
15.	Mass Media Exposure	1.374	0.649	2.116 [*]
16.	Commitment to work	2.357	0.929	2.538 [*]
17.	Interpersonal Contact	-0.003	0.232	-0.013 ^{NS}
18.	Self-reliance	0.135	1.270	0.106 ^{NS}
19.	Number of Publications	-0.081	0.059	-1.360 ^{NS}
20.	Global Exposure	-0.398	1.430	-0.278 ^{NS}
21.	Participation in seminars and conferences	0.385	0.610	0.631 ^{NS}
22.	Awards and Recognition	0.464	0.746	2.326 [*]
23.	Research Projects Handled	-0.418	0.661	-0.633 ^{NS}

R²=0.638; ** Significant at 1%; * Significant at 5%; NS=Non-significant

Table 4. Stepwise regression analysis of independent variables with job satisfaction of teachers of the University (n=90)

S.No.	Variables	Regression coefficient (b)	Standard error	t-value
1	Job Stress	-0.977	0.243	-4.025 ^{**}
2	Level of aspiration	0.394	0.786	2.121 [*]
3	Perceived Workload	3.558	1.254	2.837 ^{**}
4	Mass media exposure	1.971	0.526	3.750 ^{**}

R² = 0.598; ** Significant at 1%; * Significant at 5%; NS=Non-significant

and constant need of real-time information to keep pace changing needs in the agri-education sector as well as the nature of the upcoming next generation of students, the compatibility and constant touch with the mass media aids play a vital role in the satisfactory performance of the teachers. But with these arrives new ordeals and challenges of these changing times in the view of restricted boundaries of university campus and limited resources, their perception of workload also determines their capability to draw satisfaction which is also psychological phenomena varying from individual to individual.

CONCLUSION

The efficiency of the University depends on the job satisfaction of the teachers. Majority of the respondents state that they derive maximum satisfaction from the prestige and status associated with their job along with cooperation from the senior cadres and head of the departments. Majority of the respondents opines to fall in the strata of medium level of overall job satisfaction. Most of the profile characteristics are significantly associated with their job satisfaction. Factors like level of aspiration, awards and recognition, achievement motivation, perceived workload, mass media exposure and commitment to work significantly contributed

to the variation of the dependent variable, thus deserving due importance. The consequences of the study would be supportive to the policy formulations for the betterment of the teachers. Further studies on the job satisfaction of teachers working in different universities are encouraged to obtain a generalized picture of the job satisfaction of the teachers of the University.

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Performance of Groundwater Irrigation System as Perceived by Farmers in West Bengal

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ABSTRACT

In spite of being the most fundamental stakeholder, farmers often receive least attention for assessment of irrigation performance. Present study assessed the performance of groundwater irrigation systems being managed by water user associations (WUAs) in Burdwan (East) district of West Bengal from the perspectives of farmers during the year 2019. A random sample of 120 farmers under four groundwater irrigation systems perceived that most of the parameters of irrigation performance in term of irrigation service utility at a higher level with mean perception score ≥ 4.0 except for the certainty of water delivery (2.67) leading to overall mean perception score 4.12 in kharif season. Farmers perceived similarly in rabi season with overall mean perception score 4.15; however, the overall perception of farmers regarding irrigation in summer season was relatively low (3.78). Overall irrigation performances under the jurisdiction of WUAs was perceived very good by all the farmers for all three seasons with index values more than 93 per cent. The farmers' participation in irrigation management has helped in better water management that advocates for promoting participatory irrigation management through WUAs in all the minor irrigation systems to overcome low irrigation efficiency and other management constraints being faced in irrigated areas.

INTRODUCTION

Irrigation has played a crucial role to bring green revolution and self-sufficiency in food production in India (Chambers, 1988). The large production gains were a result of agricultural intensification in which irrigation played a critical role (Madramootoo & Fyles, 2010). With the rapidly growing population and expanding agriculture, water resources for agricultural purposes are becoming scarcer in most parts of India. Therefore, the importance of groundwater development is increasing rapidly on account of inherent weaknesses (maintenance and operational inefficiencies) in the canal (surface water) irrigation system (Ghosh et al., 2019). Even though the irrigation has made profound impacts on agrarian dynamism, the same has yet to be visible in eastern India, where it is needed having abundant water

resources to sustain intensive irrigation. Performance of irrigation and agriculture has been better in Northern region of India, while eastern region has been lagging behind in spite of rich water resources and average annual rainfall of more than 1000 mm (Srivastava et al., 2014).

In spite of being the most fundamental stakeholder, the farmers often receive the least attention for assessment of performance of water delivery system. A set of criteria for constraints and performance evaluation of irrigation system needs to be considered from farmers' point of view (Chambers, 1998). The bottleneck for good performance of any irrigation scheme is often found in the water delivery system. In most of the cases evaluation of performance of irrigation water delivery system is done on the basis quantitative (flow data) at various levels and points of the irrigation

system. It is important to consider irrigation as a service provided to farmers (Naik et al., 2019).

Of the eastern Indian states, West Bengal has a relatively better irrigation situation (Ghosh et al., 2017). West Bengal is endowed with 7.5 per cent of the water resources of the country and is relatively rich in water resources among the eastern Indian states. Rainfall is the main source of water in West Bengal with an annual average of about 1700 mm. Out of this 76 per cent falls in four months during the monsoon and the rest in the non-monsoon period. During the 12th Five-Year Plan (2012–2017), an initiative has been taken up by the government of West Bengal to include the concept of participatory irrigation management (PIM) through implementation of the West Bengal Accelerated Development of Minor Irrigation Project, leading to a formation of around additional 848 WUAs covering 25,499 ha command area and 50,265 beneficiaries by the end of July 2015 with the aim of improving the irrigation and agricultural scenario in the minor irrigation commands of the state. On this backdrop, present study was undertaken to evaluate the performance of groundwater irrigation systems being managed by WUAs from the perspectives of farmers.

METHODOLOGY

The study was conducted in randomly selected Burdwan district of West Bengal. Out of 23 blocks in Burdwan (East) district, two blocks i.e., Ausgram I and Ausgram II were randomly selected, where from four groundwater irrigation systems, two each from each block were selected. Random samples of 30 farmers represented from each groundwater lift irrigation command areas were chosen. Thus, overall, 120 farmers were selected as respondents in present study.

The irrigation service utility was measured based on 10 dimensions, viz., sufficiency of water, duration of supply of irrigation water, condition of point of delivery of water, frequency of water supply, certainty of delivery of water, stream size of water, timeliness of water supply, equity of water supply, functioning of irrigation system below the outlet level, and irrigation performance under the jurisdiction of WUA. Farmers' responses on each of the above-mentioned dimensions were taken on a 5-point continuum scale (very poor: 1, poor: 2, average: 3, good: 4 and very good: 5) with the help of a structured interview schedule.

Thereafter, mean scores of the 10 dimensions were calculated to derive overall perception of each farmer on irrigation service utility followed by mean of all sampled farmers to arrive at overall irrigation service utility scores separately for kharif, rabi and summer seasons. The irrigation service utility in terms of afore-said dimensions were further reduced to three categories, viz., tractability, convenience and predictability. Tractability refers to the ease with which farmers can control and satisfactorily apply water to their land. It was measured by quantity of water supply/ adequacy/ sufficiency (no. of irrigations requested and those actually received), point of water delivery (distance of field from the outlet), stream size, and control mechanism to regulate the flow in outlet. Convenience refers to the timing of water delivery as preferred by farmers to enable them to plan their activities. It was determined through timeliness of irrigation (no. of irrigations requested and those received on time), duration of water supply, and frequency of getting water (interval between two irrigations). Predictability relates to the farmer's degree of confidence with respect to water supply service, or how much information is available to farmers about the water delivery schedule and the degree of uncertainty associated with this information. Predictability was measured on the basis of certainty of water availability, equity of water supply, and irrigation performance under aegis of WUA (having knowledge of water supply roster/ advance water supply roster, management decisions/ farming operations influenced by water supply). Index values of each dimension were calculated as ratio of farmers' mean perception score (1 to 5) and maximum possible score expressed in percentage.

RESULTS AND DISCUSSION

Groundwater lift irrigation service utility from the farmers' perspectives was assessed for all three seasons, viz., kharif, rabi and summer, respectively. Evidently from Table 1, farmers in groundwater irrigation command area perceived most of the parameters highly favourable with mean perception score ≥ 4.0 except the certainty of water delivery (2.67) leading to overall mean perception score 4.12 in the kharif season. Farmers perceived most of the parameters similarly for rabi season resulted to overall mean perception score 4.15. However, the overall perception of farmers regarding groundwater irrigation service in summer was relatively

Table 1. Irrigation performance as perceived by the farmers in groundwater irrigation command area

S.No.	Particulars	Kharif Mean (SD)	Rabi Mean (SD)	Summer Mean (SD)
1.	Sufficiency of water	4.08 (0.60)	4.02 (0.52)	3.43 (0.57)
2.	Duration of supply of irrigation water	4.08 (0.56)	3.96 (0.49)	3.44 (0.57)
3.	Condition of point of water delivery	4.04 (0.52)	3.97 (0.45)	3.44 (0.55)
4.	Frequency of water supply	4.09 (0.37)	4.98 (0.16)	4.98 (0.16)
5.	Certainty of delivery of water	2.67 (1.06)	2.48 (0.84)	2.81 (0.61)
6.	Stream size of water	4.00 (0.53)	3.93 (0.50)	3.43 (0.61)
7.	Timeliness of water supply	4.80 (0.46)	4.78 (0.47)	4.11 (0.71)
8.	Equity of water supply	4.54 (0.52)	4.53 (0.52)	4.01 (0.58)
9.	Functioning of irrigation system below outlet level	4.08 (0.50)	4.02 (0.43)	3.48 (0.57)
10.	Irrigation performance under jurisdiction of WUA	4.82 (0.39)	4.81 (0.40)	4.67 (0.50)
	Overall Performance	4.12 (0.37)	4.15 (0.30)	3.78 (0.34)
	Irrigation Performance Index	82.42%	82.92%	75.63%

low (3.78) as five parameters like sufficiency of water, duration of water supply, condition of point of water delivery, stream size of water and functioning of irrigation system below the outlet level were perceived relatively low with mean perception score less than 3.50. The perception of the farmers on certainty of water supply was poor with mean score of 2.81. This parameter was perceived poorly by most of the farmers in all three seasons. Therefore, overall groundwater irrigation was found best in rabi season followed by kharif and summer season with irrigation performance index value of about 83, 82 and 76 per cent, respectively.

It is noted from Figure 1 that tractability in terms of sufficiency of water, point of water delivery, stream size and functioning of irrigation below the outlet was perceived better (>80%) in kharif season followed by rabi and summer season. Water was perceived sufficient by farmers both in kharif and rabi season (index value 81.67% and 80.33%). Rice was a predominant and main crop in kharif season, while potato and mustard were major crops in rabi season. Water was more needed for rice crop rather than other crops. That's why farmers under WUA could easily cultivate rice crop due to sufficient amount of water in kharif season. However, in kharif season, rainwater used to take a vital role in rice cultivation apart from irrigation water. Contrastingly, potato and mustard crops were grown with groundwater irrigation only. In summer season, water was not sufficient (index value 68.64%) in comparison to that in kharif and rabi season; however, it was sufficient for 67.5 per cent farmers to grow *boro* rice in selected groundwater irrigation command areas. The condition of point of delivery in command area was perceived very good in kharif season

(index 80.83%) and rabi season (index 79.33%); however, it was relatively low in summer season (index 68.89%). It is revealed that stream size of water in groundwater irrigated area was very much sufficient in kharif season (index 80%) followed by rabi season (index 78.67%). But in summer season stream size of water was perceived relatively less (index 68.64%) in groundwater irrigation as perceived by the farmers cultivating in the command areas. Irrigation system below the output level in irrigated area was perceived favourably in kharif (index 81.67%) and rabi season (index 80.33%) but in summer season index value of 69.63 per cent indicated lower perception of the farmers regarding functioning of groundwater irrigation system below the outlet level.

Contrasting to the tractability, overall convenience of water supply is better in rabi season followed by kharif and summer season (Figure 2). Farmers used to get water at the time of need for irrigating the crops both in kharif (index 96%) and rabi (index 95.67%) season. But in summer season timeliness of water supply (index 82.22%) was relatively lowly perceived by the farmers as compared to kharif and rabi season due to problem of irregular electric supply. It is observed that duration of water supply in groundwater command area was perceived much better in kharif season (index 81.67%) followed by rabi season (index 79.17%). But in summer season duration of water supply (index 69.89%) was relatively low due to electricity problem of these areas as revealed by the farmers during interview. Frequency of water supply in groundwater command area was perceived high in summer season (index 99.51%) and rabi season (index 99.50%). But in kharif season frequency was relatively less that may be attributed to the fact of

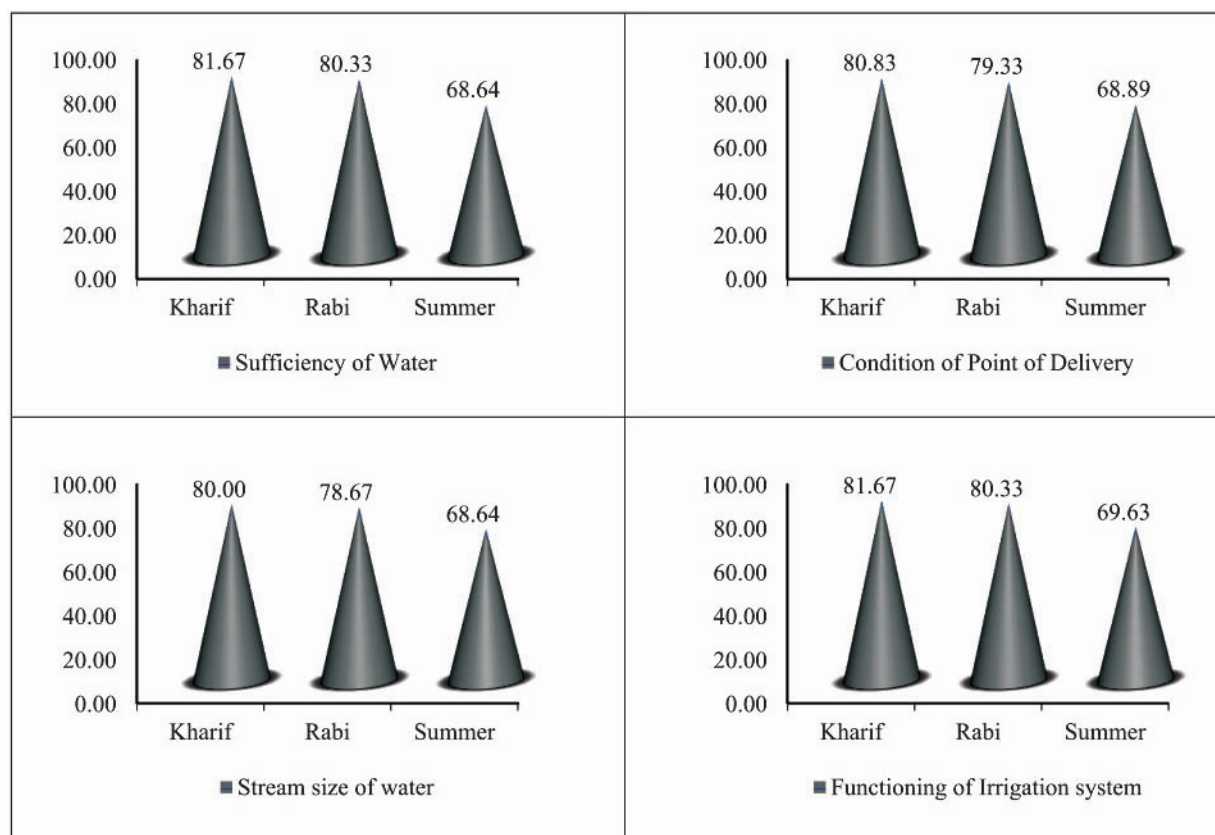


Figure 1. Tractability of water supply as perceived by farmers in groundwater irrigated area

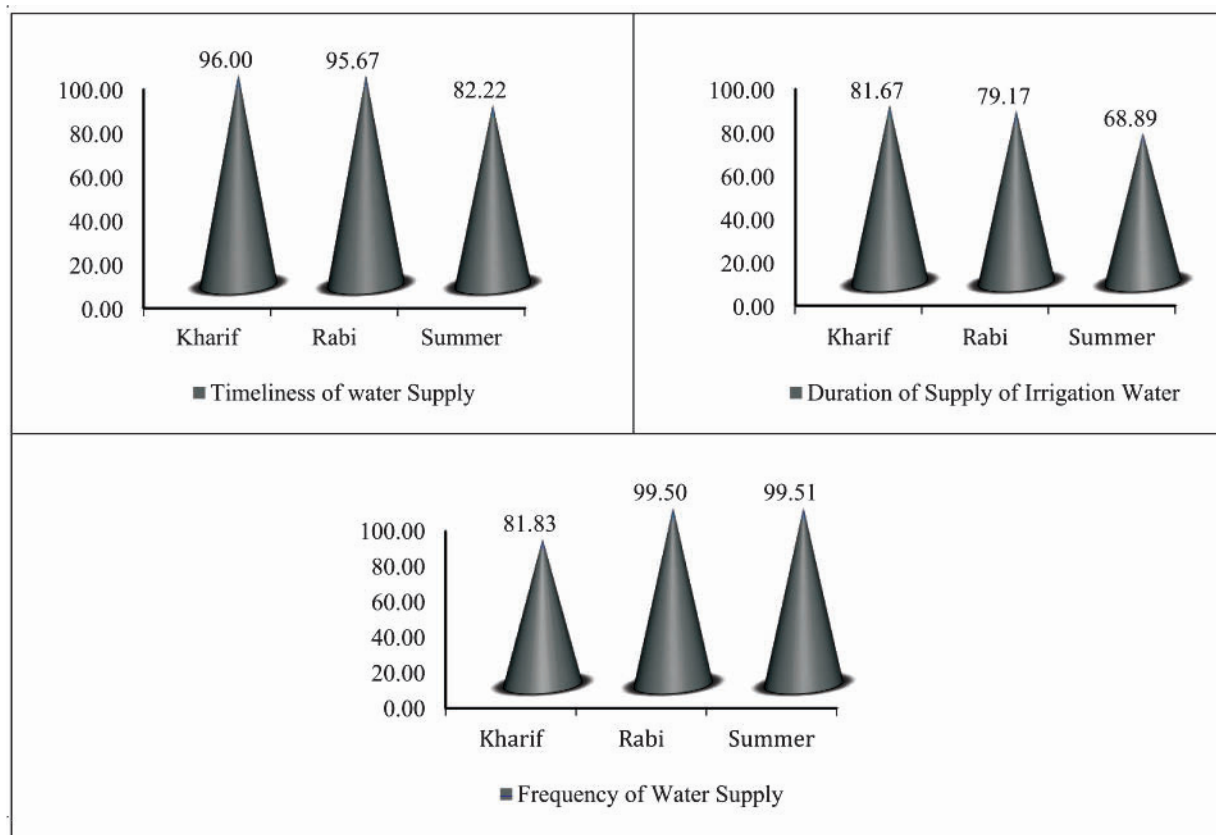


Figure 2. Convenience of water supply as perceived by farmers in groundwater irrigated area

occurrence of rainfall that used to help cultivating the crops. Therefore, interval between two irrigations might be lengthened.

The predictability and prior knowledge of irrigation schedules helped farmers to undertake timely crop management decisions. Figure 3 depicts farmers' perception on predictability of irrigation system. Certainty of water delivery in groundwater command area was perceived by the farmers highly in summer season (56.30%) followed by kharif (53.33%) and rabi (49.50%) season at critical growth stage of the crops. Among all the parameters being perceived by the farmers, the certainty of water delivery was judged lowly that need to be addressed by the WUAs managing irrigation system to make the irrigation service further effective. It is observed that all the farmers used to get the same quantity of water from the groundwater irrigation source in kharif (index 90.83%) and rabi (index 90.50%) season to irrigate a particular crop during the irrigation period. But in summer season, the index value with respect to equity in water supply was decreased (80.25%). Irrigation performance under the jurisdiction of WUA was perceived very good by all the farmers for all three seasons with index values more than 93 per cent. Farmers perceived this parameter favourably as they used to have knowledge of water supply roster/ advance water supply roster, enabling them to take management decisions/ farming operations influenced by water supply.

Present study emphasized the performance of groundwater irrigation system transferred to WUAs under PIM programme. Groundwater irrigation is often reported to be preferred by the farmers as compared to surface (canal) irrigation in terms of irrigation

efficiency (Ali et al., 2018). Narayanamoorthy (2011) mentioned that due to insufficient supply of canal water, the dependence of farmers on groundwater for irrigating the crops had increased many folds during the last decade; groundwater irrigation command showed better poverty reduction as compared to canal irrigation. Cheap and un-metered electricity, slow development of surface irrigation, and poor management of canal systems further encouraged groundwater irrigation (Ali et al., 2017; Shah et al., 2009). Over the last two decades, 84 per cent of the total addition to net irrigated area came from groundwater, and only 16 percent from canals. Fourth Minor Irrigation Census (2006-07) indicated that about a quarter of the total groundwater extraction devices (GEDs) have become nonfunctional over a period of time that has led to poor utilization of irrigation potential. Moreover, many of the non-functional GEDs have not been working because of mainly less discharge rate and mechanical breakdown. Poor infrastructure and unfavourable geological conditions are reasons for poor groundwater irrigation condition in eastern Indian states (Srivastava et al., 2014) that prompted implementation of PIM through WUAs. Ghosh et al., (2005) assessed the utility of irrigation water supply in a major canal irrigation in Khurda district of Odisha, which revealed that farmers' level of satisfaction with the factors in an increasing order was predictability, convenience and tractability. The most important factor is found to be predictability followed by tractability and convenience. Mishra et al., (2011) reported that farmers perceived adequacy of irrigation water and overall performance of minor irrigation system relatively better. Ghosh et al., (2016) in their study

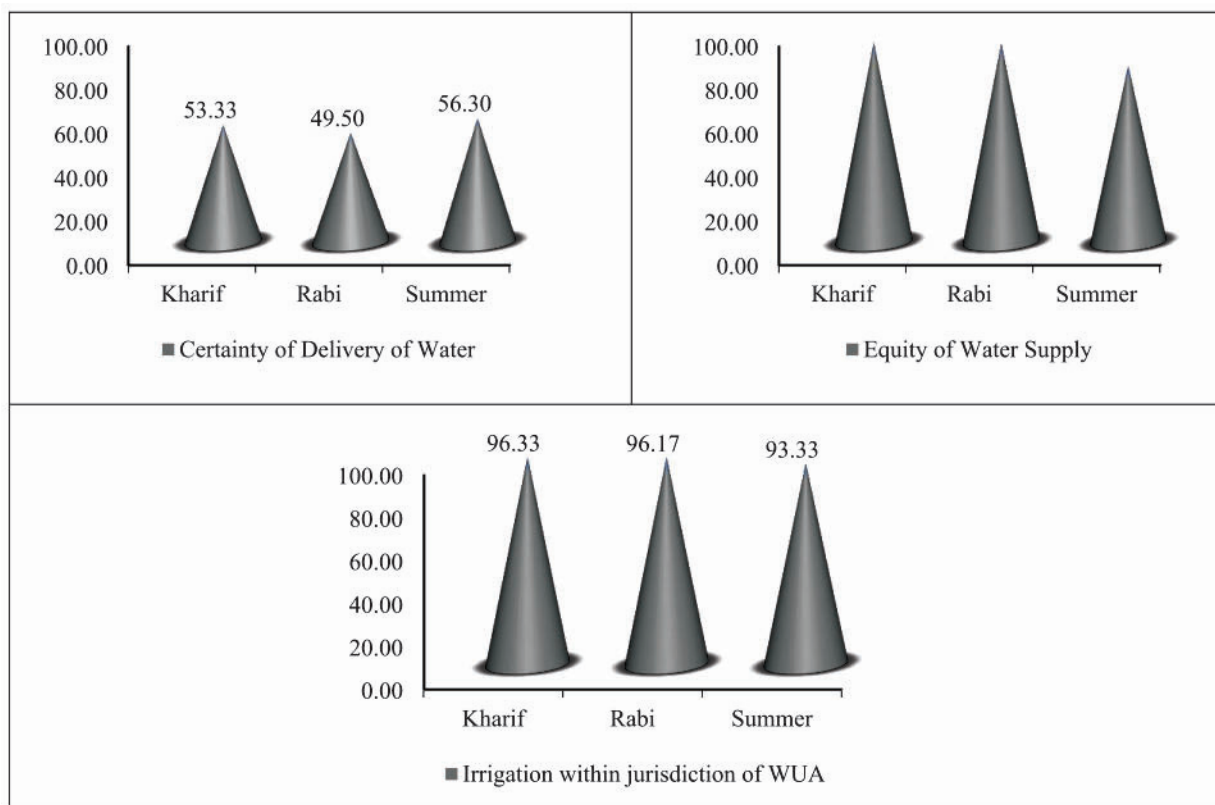


Figure 3. Predictability of water supply as perceived by farmers in groundwater irrigated area

on assessment of PIM in Kuanria Medium Irrigation Project in Nayagarh district of Odisha reported that the irrigation performance found better in kharif season as compared to rabi season in most of the WUA's jurisdiction areas, which is contrasting to the findings of present study. Groundwater irrigation is mostly prevailing in Indo-Gangetic plains, where rice-wheat cropping system is dominant and major user of irrigation raising the concern of sustainability and food security (Gautam et al., 2021; Kaur & Sharma, 2022), thus needed due attention for efficient use of groundwater through proper crop planning and irrigation management under aegis of WUAs. Findings of present study have unraveled the importance of groundwater irrigation as productive irrigation during rabi and summer season besides protective irrigation in kharif season.

CONCLUSION

Farmers in groundwater irrigation command area perceived most of the parameters of irrigation performance in term of irrigation service utility favourably except the certainty of water delivery leading to overall perceived irrigation service utility very good in both kharif and rabi season. Farmers perceived groundwater irrigation service in summer relatively low but better than average. Overall irrigation performances under the jurisdiction of WUA is perceived very good by all the farmers for all three seasons that warrants speedy implementation of PIM through WUAs in all minor irrigation projects to alleviate the often-reported constraints of irrigation inefficiency and management of irrigation infrastructure. Pluralistic extension approach involving WUAs, irrigation department and state department of agriculture would improve the agricultural scenario through improved irrigation performance.

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An Insight into Value Chains of Green Gram in Bundelkhand Region of India

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ABSTRACT

The study was conducted during 2019-2021 to document the existing value chains of green gram in Bundelkhand region of India. The cost of production estimation showed crop to be profitable for farmers (1:2.61 BC ratio), however, poor uptake (10.9%) of improved varieties among farmers was recorded. An array of value chains actors and their inter linkages were engaged in furthering green gram from producers to consumers through four prominent channels. In addition, a number of enabling factors were observed to support green gram production in the region. Results indicated that producers added highest value to green gram (Rs. 2942.58/q to Rs. 3343.62/q), followed by processors (Rs. 1392.00/q to 2193.65/q) across all marketing channels. Processing component added highest share (29.28 to 35.55%) in total marketing cost across all the channels. Share of producer in consumer rupee for split grains (63.14%) and whole grains (72.78%) was lowest in marketing channel 4 wherein maximum actors were involved. Policy interventions for promotion of green gram producers for aggregation and trading functions need to be taken for them to draw better share in consumer rupee.

INTRODUCTION

Value chains refers to all sets of activities that are required to bring a product or services from conception through different phases of production, delivery to final consumer and final disposal after use (Kaplinsky & Morris, 2001). Value Chain Analysis (VCA) identifies the value being introduced to the service or product at each stage of chain (Kaplinsky & Morris, 2007). It refers to the degree of relationships among the different actors involved in different phases and coordination mechanism (Trienekens, 2011) with focus on the dynamics of complex linkages within a set of network, involving suppliers, distributors, partners, and collaborators (Zott et al., 2011).

Green gram (*Vigna radiata* L.) is an important legume crop that is cultivated in all the three crop seasons in different agro-

ecological situations of India. Green gram grains forms an important ingredient of cuisines across India and are consumed as cooked whole seed, split grain, flour or as sprouts. Green gram grains are rich source of nutritional protein (24-28%), carbohydrate (59-65%), fiber (3.5-4.5%), mineral (4%) and ash (4.5-5.5%) (Kowalewska, 2018). Green gram is an important pulse crop cultivated in Bundelkhand region of Uttar Pradesh (Sah et al., 2021a; Kumar et al., 2017). The crop occupies about 3.44 million hectare in the region with about 1.78 million tonnes production (Anonymous, 2021). Bundelkhand is a hot and semi-humid region of UP state that lies between the Indo-Gangetic Plain toward the north and the Vindhya Range toward the south (Sah et al., 2021b) and is characterized by undulating topography and poor irrigation facility (Narain et al., 2016). The average productivity of green gram in UP Bundelkhand region (0.24 t/ha) and UP state (0.41 t/ha) is lower than the

corresponding national figures (0.47 t/ha). The crop has been traditionally cultivated as rainy season crop in the region, however, since past two decades, area under spring/summer green gram has witnessed increasing trend (Sah et al., 2021). Translating green gram cultivation into a better remunerative proposition for producers warrants better availability of seeds, fertilizer, plant protection chemicals and storage facilities in the region. Further, better post harvest management including value addition and market price for the green gram are needed for attracting larger area under the crop in the region as most times, the lack of regulated market (Kumar et al., 2010), poor adoption of harvesting and post-harvest management practices (Nain et al, 2014), poor availability of inputs (Kumbhare et al., 2014) etc. are reported reasons of low profitability in pulses.

The present research study was conducted to bring out a comprehensive perspective of green gram value chain in Bundelkhand region of UP for generating empirical evidences to support policy decisions as well as better understanding among researchers and development wings for devising appropriate technology design and delivery options. The results may also support producers for enhancing their capacities for a greater market proportion. The study brings out the share of value added by different actor working along the value in furthering green gram from producers to consumers.

METHODOLOGY

The study was carried out in 2019-21 in the Bundelkhand region of Uttar Pradesh using descriptive research design (Koh & Owen, 2000). All of the seven districts of UP Bundelkhand region were selected for the purpose. Multistage stratified random sampling was used for selection of blocks (14), villages (28), farmers (840), members of Agriculture produce marketing Committee (APMC) (14), retailers (21), whole sellers (21), trader (56) and village trader (28),

green gram processors (18) from the region. Data on variables like cost of production, marketing efficiency, marketing cost, and margin carried out with use on the prevailing green gram market prices were recorded using semi-structured interviews, group meetings and focused group discussions to elicit facts from respective sampled respondent. Marketing Efficiency Index (MEI) and producer's share in consumer's rupee were also worked out (Acharya & Agarwal, 2016). The value added by an actor was operationalised as the sum of cost incurred by the actor in performing value chain functions in furthering the green gram to consumers and the marketing margin gained by the actor in the process.

Value chain map indicates an array of actors and activities involved in drift of transaction from sourcing of raw materials and inputs, to production, processing, marketing and ultimately consumption. Illustrative methodology of value chain analysis as enunciated by FAO (2005) was used for the study. The related activities and actors in green gram chains operating in the region were mapped and the value added by each actor during the activity performed by them were worked out and analyzed.

RESULTS AND DISCUSSION

Green gram production scenario in Bundelkhand region of Uttar Pradesh

Analysis of temporal data on green gram indicates substantial area expansion (76%) along with productivity enhancement (39%) in the span of 2000-01 to 2019-20 in Bundelkhand region of Uttar Pradesh. Further, the annual growth rate during the period was recorded to be 3.48 per cent, 3.61 per cent and 0.13 per cent in area, production and productivity of green gram, respectively, which was higher than pigeon pea, chickpea, lentil, field pea, urdbean and comparable with total pulse crop in the region during the same period (Sah et al., 2022).

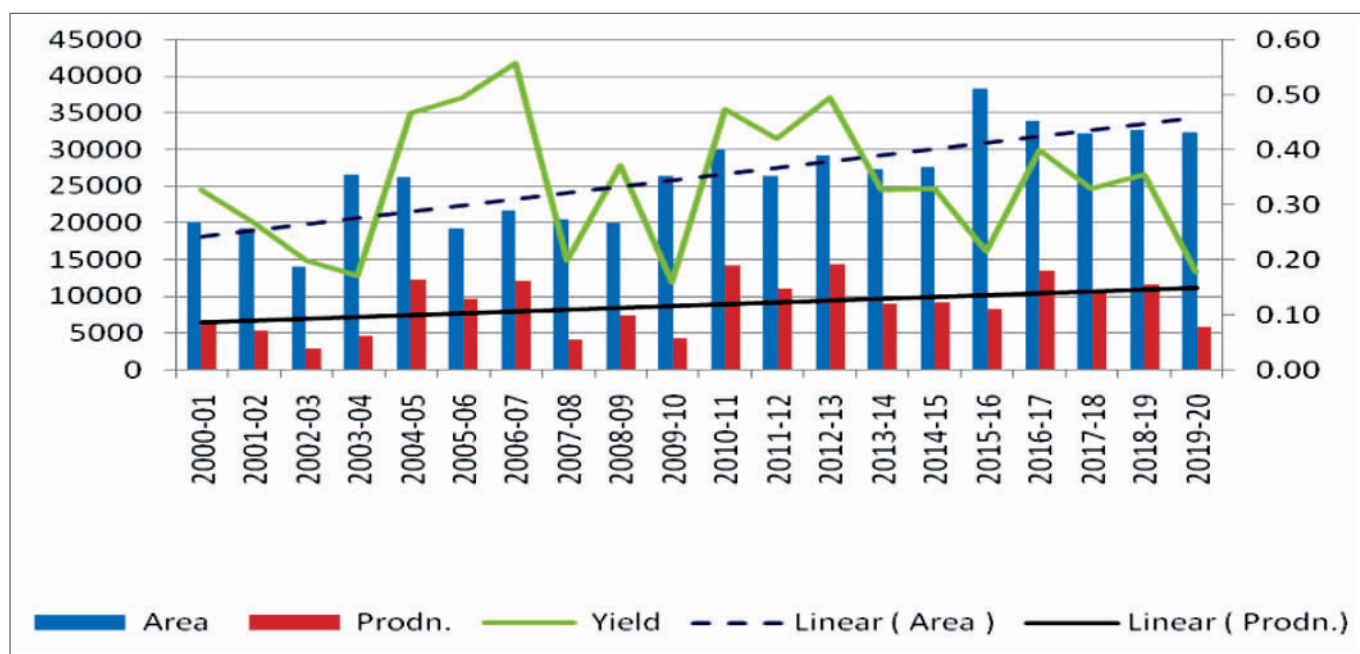


Figure 1. Time trends of green gram in Bundelkhand region

Table 1. Existing Mungbean varieties in the Bundelkhand region

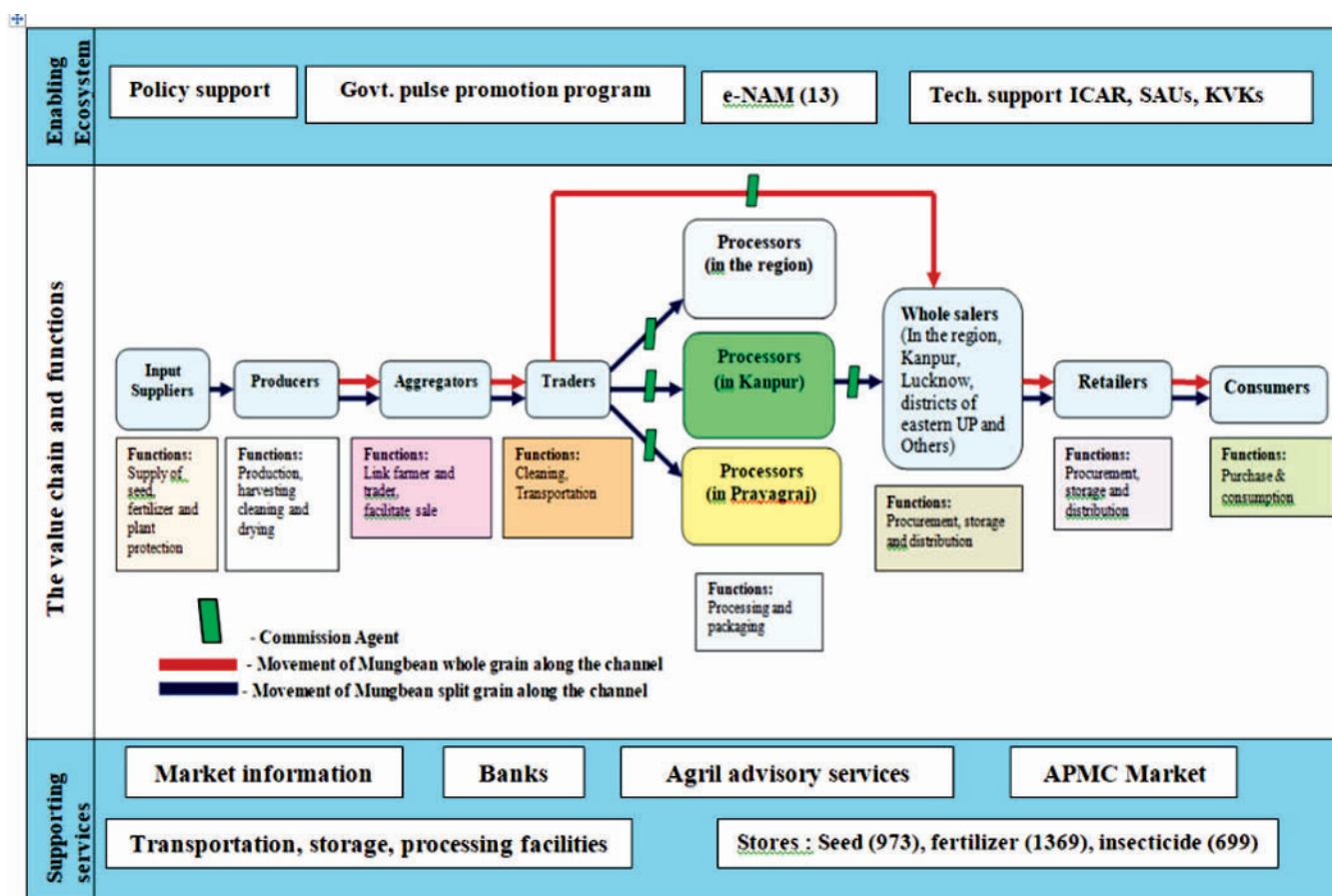
S.No.	Green gram varieties	Frequency (%)
1.	PDM 139 (Samrat)	27 (3.2)
2	IPM 2-14	19 (2.3)
3	IPM 2-3	22 (2.6)
4	IPM 410-3	03 (0.36)
5	IPM 205-07 (Virat)	24 (2.9)
6.	Local non descript and to	745 (88.7)

Varietal mapping of green gram in Bundelkhand region of Uttar Pradesh reflected poor uptake (10.9%) of improved green gram varieties among the sampled farmers. Among the improved varieties, PDM 139 (Samrat) followed by IPM 205-07 (Virat) and IPM 2-3 were documented to be cultivated by 3.2, 2.9 and 2.6 per cent of the sampled producers, respectively.

Mapping of green gram value chains

Input dealers, producers, village level aggregators, aggregators, trader, processors, wholesalers, retailers, market intermediaries, and consumers were the major actors associated in the green gram value chain in the region. Well developed linkages were observed to exist among them for forwarding the green gram from producer to consumers in the region. Four prominent channels engaged in this process as mentioned and discussed in Table 3. Green gram production in the region was enabled by technological support from

existing research institutes, *Krishi Vigyan Kendras*, agricultural universities and extension advisory support from state agriculture department. Further, presence of network of APMC markets provided the needed support for sale of green gram in the region. Presence of six seed hubs in the region supported farmers' access to quality green gram seed. The favorable policy environment also complimented green gram production in the region that included declaration of minimum support price and presence of electronic national agriculture markets (e-NAM). The existing seed stores (973 nos), fertilizer stores (1369 nos), and plant protection chemicals stores (699 nos) provided basic production inputs for supporting green gram production in the region. The value chain by and large in this region, is depicted in Figure 2 and can be inferred that green gram value chain involved flow of both split grain and whole grain from producer to end consumers. Presence of multiple channels in green gram value chain was reported to exist by several studies. Mahendra et al., (2020) recorded three major channels for marketing of green gram including producer -village trader-wholesaler-cum-commission agent - retailer -consumer; producer - wholesaler-cum-commission agent- retailer- consumer and producer -consumer from Rajasthan. From the same state, Kumawat (2020) also recorded multiple channels for marketing of green gram including producer-wholesaler- miller -retailer-consumer, producer-wholesaler-retailer-consumer and producer- commission agent- wholesaler-miller - retailer-consumer.

**Figure 2.** Map of green gram value chain of Bundelkhand region

The results suggest limited direct access of producers to traders or processor in the region. Market intermediaries or the commission agents acted as the primary link between every two marketing nodes right from aggregators to retailers in green gram value chains. The commission agent added value to the produce by providing assurance for payment, quality and timely delivery of produce between the value chain actors. During harvest season and a few months after, green gram was disposed of by traders to processors located in the region or processing units located in nearby cities like Kanpur or Prayagraj. During off season, these processing units received green gram from traders located outside states specially Chhattisgarh state. The outward movement of processed green gram from these processing units catered to the demands of nearby districts like Kanpur, Lucknow, Pratapgarh and other districts of eastern UP state. The quantum of transacted produce however depended on the negotiation for the prices, best and timely delivery between the commissions agents present between the trader and processor. Kumawat (2020) also reported presence of commission agents in the marketing channels of green gram in Rajasthan.

Build-up of value of green gram along the value chains

For estimation of value build up at producers' level, cost of cultivation of green gram was worked out. The average cost of cultivation of green gram in Bundelkhand region of Uttar Pradesh was recorded to be Rs. 14451/ ha. The cost incurred on human labor constituted highest cost (28.3%), followed by machine labour (23.6%). The share of insecticides use (8.3%), irrigation (9.9%) and fertilizer and manures (10.9%) was least in the total cost of cultivation of green gram in the region. The results indicate low resource use situation in which green gram is cultivated in the region (Table 2). The average productivity level of green gram 5.89q/ha and producers received an average gross return of Rs. 37696/ha. The green gram cultivation in the region was fairly profitable with benefit cost ratio of 2.61.

The presence of series of actors and the inter linkages between them were observed to exist in movement of green gram from producer to consumers. Each of these actors in the value chain performed certain functions and added their margins before furthering the green gram towards consumers. The two values

together added to the total value addition by the actor. In view of the market demand for consumption of green gram in split as well as whole grain, all the green gram marketing channels were recorded to bifurcate into two channels at traders' level.

In marketing channel 1, the trader incurred marketing cost Rs. 323.04/q and added value of Rs. 706.80/q before shifting green gram to processor and wholesaler in the chain. Processor incurred marketing cost of Rs. 350.29/q for processing of green gram into split grain and added highest value (Rs. 1408/q) to the produce. On the other hand, while forwarding the green gram whole grain, wholesaler incurred marketing cost of Rs. 200/q and added highest value (Rs. 771.04/q) among all the actors in furthering green gram to retailer. Retailer on the other hand incurred least cost (Rs. 38.36/q) in furthering green gram to consumer and added least value (Rs. 413.70 to 460.81/q). Wholesaler and retailer were recorded adding higher value in the chain in furthering green gram whole grain than split grain. Total marketing cost and total value added were observed to be lower in case of whole grain as compared to split grain. However, the marketing efficiency (2.67) and producer share in consumer rupee was found to be higher (Rs.73.98/q) in marketing of whole grain as compared to split grain.

In channel 2, the producer furthered green gram to aggregator cum trader (ACT) located in the marketing yards. In this channel the ACT collectively incurred marketing cost (Rs. 308.08/q) and accrued market margins (Rs. 558.67/q) and thus added value (Rs. 866.75/q) in moving the green gram from traders to wholesalers. Among all the actors operating in this channel value added by processor was highest (Rs. 1407.6/q) with maximum market margin (Rs. 1059.28/q). The value addition in green gram value chain was observed to be least at retailer level for both the products. Among all the existing marketing channels, this marketing channel was found to be most efficient for split (1.75) as well as whole grain (2.82). Further, producer share in consumer rupee was also found to be highest (75.09) in this channel (Table 3).

In channel 3, producer was observed incurring relatively higher marketing cost (Rs. 112.35/q) as compared to other existing marketing channels. In this channel, the aggregator performed without incurring any cost observed gaining a margin of Rs. 248.63/q before moving the produce to trader. The trading and processing functions were observed integrated at one marketing node in this channel. The marketing cost incurred (Rs. 683.15/q), the margins earned (Rs. 1509.75/q) and the total value added (Rs. 3674.52/q) at this marketing node was recorded to be highest within the channel as well as across all the existing marketing channels, resulting into highest marketing margins (Rs. 2193.65/q) drawn.

Marketing channel 4 was observed to include an additional actor who was engaged in aggregation of green gram for marketing directly from producer at the village level. Among all the existing marketing channels, the producer was recorded incurring least cost (Rs. 81.24/q). The village level aggregator incurred cost of Rs. 93.24/q and earned a margin of Rs. 127.48/q before supplying the green gram to aggregator located in APMC market yards. The aggregator in turn forwarded the produce to trader after adding value of Rs. 253.5/q. The value added by trader (Rs. 312.80/q) and processor (Rs. 1392/q) found to be least in this channel among all other marketing channels. The total marketing margin (Rs. 1647.73/q) earned in this

Table 2. Average cost of cultivation of green gram in Bundelkhand region of Uttar Pradesh

Particular	Operational cost (Rs)
Human labour	4092 (28.3)
Machine labour	3417 (23.6)
Seed	2054 (14.2)
Fertilizer & manure	1570(10.9)
Insecticides	1199.52(8.3)
Irrigation charges	1435(9.9)
Total operational cost	13767.52(95.3)
Interest on working capital	683.38(4.7)
Total cost	14450.9
Average yield (q./ha)	5.89
Gross return (Rs/q)	37696
Benefit-cost ratio (gross return)	2.61

Figures in parenthesis indicate percentage

Table 3. Value addition along the green gram value chains in Bundelkhand region

Actors	Heads	Marketing channel 1		Marketing channel 2		Marketing channel 3		Marketing channel 4	
Producer	Marketing cost	105.67		107.78		112.35		81.24	
	Marketing margin	3237.97		3223.85		3080.30		2861.34	
	Total value added	3343.64		3330.93		3192.65		2942.58	
	Producers Price	6220.15		6207.44		6215.75		6124	
Village aggregator	Marketing cost	-		-		-		93.24	
	Marketing margin	-		-		-		122.48	
	Total value added	-		-				215.72	
Aggregator	Margins	248.81		-		248.63		253.59	
Trader/Aggregator	Marketing cost	323.64		308.08		-		312.80	
	Marketing margin	383.44		558.67		-		329.66	
	Total value added	706.78		866.75		-		642.46	
		WGG	SGG	WGG	SGG	SGG	WGG	SGG	
Processor	Marketing cost	350.29	-	348.29	-	683.13	347	-	
	Marketing margin	1057.71	-	1059.28	-	1509.75	1045	-	
	Total value added	1408	-	1407.57	-	2193.65	1392	-	
Whole saler	Marketing cost	190.33	200.04	188.71	198.90	192.37	187.42	199.69	
	Marketing margin	493.28	571	509.09	546.43	503.75	487	532	
	Total value added	683.61	771.04	697.80	745.33	696.12	674.42	731.69	
Retailer	Marketing cost	38.36	38.36	39.64	39.64	37.50	37	37	
	Marketing margin	375.43	422.45	367.15	407.15	386.25	360	410	
	Total value added	413.79	460.81	397	446.79	423.75	397	447	
	Total Marketing cost (Rs/q)	1008.09	667.71	991.60	653.71	1026.75	1058.70	723.97	
	Market margin	2558.37	1625.40	2494.38	1512.24	2648.38	2597.73	1647.73	
	Total value added	3566.65	2293.10	3485.91	2165.94	3674.52	3656.43	2290.46	
	Marketing efficiency index	1.71	2.67	1.75	2.82	1.66	1.65	2.64	
	Producer share in consumer rupee	64.25	73.98	64.75	75.09	63.57	63.14	72.78	

SGG: Split Green Gram; WGG: Whole Green Gram

channel for moving green gram whole grain was observed to be highest among all the existing channels. This channel was observed to be least efficient along with lowest share of producer in consumer rupee for split grains as well as whole grains. The results of the study indicated that producers incurred substantial cost (Rs. 81.24 to Rs. 112.35/q) in marketing of green gram in different channels. In contrast, Kumawat (2020) reported that producers incurred cost of Rs 44.5/q in performing marketing function in the green gram value chain in Nagaur district of Rajasthan. In contrast to results of present study, Mahendra et al., (2020) from Rajasthan recorded that producer share in consumer rupee was 89.9 percent, 91.49 percent and 100 percent in sale of green gram at village, regulated market and direct sale to consumer, respectively.

Findings helped to understand that the constrained linkages between producers and traders/processors made the value chain longer and less efficient. Strengthening these linkages shall work for mutually useful arrangements with assured quantity and quality of green gram to processors as well as assured market place for producers. This arrangement could secure farmers against the fluctuation in market prices. Besides producers, processors were observed to bear highest marketing cost and gain maximum margins among all the value chains actors across all the existing channels for furthering green gram to consumers. This could be attributed to high investment in establishment of processing units with high maintenance and operational cost involved in processing of green gram. Traders were also observed adding substantial value to the green gram while furthering it in the value chains. Marketing

efficiency as well producers share in consumer rupee was found to be highest in movement of green gram whole grain across all the reported channels as compared to green gram split grain. This could be attributed to involvement of lesser number of actors in marketing of whole grains as compared to split grains of green gram. The results are in tandem with those of Deep et al., (2020).

Share of cost components in the marketing cost

Component wise assessment of marketing cost incurred on various value addition functions was carried out for each marketing channel (Table 4). The total marketing cost was observed to be highest for green gram split (Rs. 1058.7/q) and wholegrain (Rs. 723.96/q) in channel 4 that included maximum value chain actors while it was recorded lowest for channel 2, wherein aggregation and trading functions were integrated. Among different cost components, processing component was recorded to add highest share in total marketing cost across all the channels, with highest share (35.55%) in channel 3. Besides processing component, share of transportation cost followed by cost incurred on commission charges of market intermediary was highest across all the channels, in the same order. However, the actual cost incurred under these component varied with the product handled i.e., green gram split and wholegrain. Among all the cost components, the share of rental cost was found to be least across all the channels. The low share of rental cost could be attributed to the practice of short period of storage of green gram followed in the region. High share of transportation component in the total marketing cost could be explained on

Table 4. Percent share of different cost component to total marketing costs

Cost component	MC 1		MC 2		MC 3	MC 4	
	WGG	SGG	WGG	SGG	SGG	WGG	SGG
Weighing on related	85.53 (12.81)	75.53 (7.49)	83.63 (12.79)	75.65 (7.63)	82.85 (8.07)	76.74 (10.60)	69.24 (6.54)
Loading unloading	53.43 (8.00)	53.54 (5.31)	54 (8.26)	54 (5.45)	69 (6.72)	66 (9.12)	66 (6.23)
Transportation	123.21 (18.45)	144.54 (14.34)	118.09 (18.06)	139.78 (14.10)	105.5 (10.28)	115 (15.88)	133 (12.56)
Aggregation	-	-	-	-	-	61.24 (8.46)	61.24 (5.78)
Cleaning	31.53 (4.72)	11.43 (1.13)	30.86 (4.72)	10.86 (1.10)	10.59 (1.03)	29 (4.01)	10 (0.94)
Packing and handling	40.13 (6.01)	40 (3.97)	40.23 (6.15)	40 (4.03)	40 (3.90)	39.64 (5.48)	40 (3.78)
Storage	15 (2.25)	35 (3.47)	15 (2.29)	35 (3.53)	35 (3.41)	15 (2.07)	35 (3.31)
Commission charges	112.17 (16.80)	129.31 (12.83)	107.68 (16.47)	119.54 (12.06)	111.97 (10.91)	113.9 (15.73)	125.9 (11.89)
Market fee	97.03 (14.53)	97.03 (9.62)	93.11 (14.24)	93.11 (9.39)	96.97 (9.44)	93.9 (12.97)	98.9 (9.34)
Rental	5 (0.75)	5 (1.60)	5 (4.71)	5 (0.50)	5 (0.49)	5 (0.69)	5 (0.47)
Other misc.	106.67 (15.98)	103.76 (10.29)	106.11 (16.23)	102.23 (10.31)	104.87 (10.21)	108.54 (14.99)	104.42 (9.86)
Processing		313.14 (31.06)		311.43 (31.41)	365 (35.55)		310 (29.28)
Total marketing cost	667.7 (100.0)	1008.17 (100.0)	653.71 (100.0)	991.6 (100.0)	1026.75 (100.0)	723.96 (100.0)	1058.7 (100.0)

MC: Marketing Channel; WGG: Whole Green Gram; SGG: Split Green Gram

grounds of distant location of market yards and processing units from the production sites. This calls for suitable infrastructural support for establishing more number of processing units within the region for catering to the regional consumption demands of green gram. A high share of cost incurred as commission agent charges could also be attributed to the fact that the commission agents actually facilitated the movement of green gram from trader to processor and from processor to wholesaler, wherein certain commission was levied from actors operating on either side.

CONCLUSION

Efforts for enhanced awareness among producers about available varietal options need to be taken for sustaining the growth in green gram production in the region. Green gram value chain was long and complex with an array of actors performing diverse functions for furthering the it from producers to customers. Integration of value addition functions along the value chains though existed, however, they failed to translate better share of monetary benefits for producers. Promotion of farmer associations for aggregation and trading function in green gram value chain need to done to help them draw a larger share in consumer rupee. Green gram being a premium pulse in terms of cost and nutritional value, offers several entrepreneurial opportunities for improving market efficiency. Suitable infrastructural support for processing units in the region may contribute for meeting the demands of consumers at better price and higher returns to producers.

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Knowledge Level of Respondents Regarding Important Aspects Covered under DAESI Programme in Rajasthan

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ABSTRACT

Diploma in Agricultural Extension Services for Input Dealers (DAESI) programme is a one year diploma programme started by National Institute of Agricultural Extension Management (MANAGE) to impart technical knowledge on agriculture to input dealers. The programme is being implemented by MANAGE through SAMETIs under overall guidance and supervision of respective state departments. State Institute of Agriculture Management (SIAM) is designated as state level implementing institute in Rajasthan. The present study was conducted in agro-climatic zone IIIa (Semi Arid Eastern Plain) and V (Humid South Eastern Plain) of Rajasthan in the year 2021-22. Total 320 respondents, 160 beneficiaries and 160 non-beneficiaries were selected. Almost two third (64.37%) of beneficiaries had medium level of knowledge regarding important aspects covered under DAESI programme whereas in case of non-beneficiaries (68.12%) of respondents had medium to high level of knowledge. The beneficiaries also found high in level of knowledge in all the selected aspects to measure the knowledge level under study.

INTRODUCTION

The use of high-pay inputs like high yielding varieties seeds, fertilizers, pesticides, irrigation etc. have helped in bringing the 'Green Revolution' in agriculture. India being a vast country with varying situations and lack of infrastructure facilities, supply of key inputs in agriculture to the doors of farmers is a difficult task. However, the major sources of supply of farm inputs to the farmers are the dealers. These dealers mostly supply seeds, fertilizers and pesticides to the farmers. Farmers are mostly guided by the dealers/retailers in selection and use of plant protection chemicals because mostly the farmers are not aware about particular agrochemicals and its dosage required for different crops and new technologies. So, the input dealers recommend them agricultural inputs based on their own experience and commercial interest. It leads to

indiscriminate and unbalanced use of inputs by farmers. Further, leading to increase in the cost of cultivation and deteriorate the quality of natural resources viz-land, water, air and affect the environment. Pesticide dealers have become one of the important sources of farm information to the farming community, although they themselves are not equipped with adequate knowledge (Ram et al., 2014). Considering that the dealer network has spread out in almost all major villages of the country and being an important mechanism to reach out to large farming community, it is felt necessary to expose them to a diploma course and build their capacity in handling field problems and extension communication abilities by increasing their skills in dealing with inputs and discharging regulatory responsibilities. In this context, MANAGE has designed a one year diploma programme titled "Diploma in Agricultural Extension Services for Input Dealers" (DAESI). This

program was launched in the year 2003 on pilot basis on self-financing mode. The sole objective of this program is to impart technical knowledge on agriculture to input dealers and to transform them into para-extension professionals, so as to enable them to address the day to day problems and issues faced by the farmers at field level.

Based on the success of the pilot program, Diploma in Agricultural Extension Services for Input Dealers (DAESI) was made as Central Sector Plan Scheme from the year 2015-16 by Ministry of Agriculture and Farmers Welfare, Government of India by subsidizing 50 per cent of the course fee for the licensed input dealers and up scaled to across the country. The programme is being implemented by MANAGE through SAMETIs under overall guidance and supervision of respective state departments. State Institute of Agriculture Management (SIAM) is designated as state level implementing institute in Rajasthan. So, keeping in the view, the scope for effective implementation of this programme in the state with around 16 thousand working agri input dealers all over Rajasthan the study was undertaken.

METHODOLOGY

the study was conducted in semi-arid eastern plain and humid south eastern plain of Rajasthan in the year 2021-22. Out of the ten agro-climatic zones of the state, zones were selected purposely on the basis of highest number of registered agri-input dealers under Diploma in Agriculture Extension Service for Input Dealers (DAESI) programme. After selection of these agro-climatic zones, one district from each agro-climatic zone i.e., Jaipur from semi-arid eastern plain and Kota from Humid South Eastern Plain was also purposely selected based on highest number of registered/beneficiary agri input dealers under DAESI programme. (Beneficiaries are the respondents who have completed their diploma and have certificate in Agriculture Extension Services for Input Dealers and involved in profession of input dealing). From both the selected districts, total 320 respondents, 160 beneficiaries and 160 non-beneficiaries (80 beneficiaries and 80 non-beneficiaries from each district separately) were selected. (The non-beneficiaries are the respondents who are not having formal diploma like diploma in Agriculture Extension Services for Input Dealers but involved in profession of input dealing). Knowledge level of respondents was operationalised as extent of important aspects covered under DAESI programme known to input dealers in order to provide appropriate agro advisory services and input supply.

The data were collected through knowledge test developed with a total 63 items under five heads having the combined maximum and minimum attainable score 71 and 0 respectively. After summing

up of the scores, the respondents were categorized into three groups based on mean and standard deviation. Further to know the difference between knowledge level of beneficiaries and non-beneficiaries 'z' test was applied.

RESULTS AND DISCUSSION

Knowledge level of respondents regarding important aspects covered under DAESI programme

It clearly indicates that a little less than two third of beneficiaries (64.37%) belongs to medium level of knowledge, followed by high (26.25%) and low (09.38%) level of knowledge regarding important aspects covered under DAESI programme (Table 1). In case of non-beneficiaries, a little more than two third of respondents (68.12%) belongs to medium level of knowledge, followed by low (22.50%) and high (09.38%) level of knowledge regarding important aspects covered under DAESI programme. When the whole sample was considered, also two third of respondents (66.25%) had medium level of knowledge, followed by high and low with 17.81 per cent and 15.94 per cent level of knowledge, respectively regarding important aspects covered under DAESI programme.

Aspects wise comparison of level of knowledge

Efforts were made to study the difference between beneficiaries and non-beneficiaries regarding knowledge of important aspects covered under DAESI programme. To find out the variation in the knowledge of the respondents 'Z' test was applied.

Table 2 shows that the calculated 'Z' value was found to be greater than its tabulated value at 1 per cent level of significance for all the five aspects. Overall calculated 'Z' value was higher than the tabulated value at 1 per cent level of significance leading to the conclusion that there was a noteworthy difference in level of knowledge between beneficiaries and non-beneficiaries respondent regarding important aspects covered under DAESI programme like Soil health management, Seed & seed production, Act, rules & regulations related to agricultural inputs, Pest & disease control and Schemes related to agricultural sectors. The mean value further indicates that beneficiaries had higher knowledge in comparison to non-beneficiaries.

The significant difference between beneficiary and non-beneficiary respondents in level of knowledge regarding important aspects covered under DAESI programme in the study was not unexpected. It might be due to the fact that beneficiary remained in continuous touch with the extension personnel throughout the session of the diploma programme. So, they might have acquired

Table 1. Distribution of respondents according to their level of knowledge regarding important aspects covered under DAESI programme

S.No.	Category	Beneficiaries (n=160) (%)	Non- beneficiaries (n=160) (%)	Overall (n=320) (%)
1.	Low level of knowledge (below 29.56)	09.38	22.50	15.94
2.	Medium level of knowledge(29.56 to 54.58)	64.37	68.12	66.25
3.	High level of knowledge (above 54.58)	26.25	09.38	17.81
	Overall	100	100	100

Mean= 42.07; SD= 12.51

enough knowledge pertaining to various aspects which were taught under DAESI programme. These findings are in contradiction with the findings of Srinivas (2013); Khatri (2017). Srinivas (2013) found that majority 41.70 per cent of DAESI dealers belonged to medium to high knowledge level about cotton production technology and 43.40 per cent of DAESI dealers had high level knowledge about paddy production technology. Whereas Khatri (2017) concluded that majority (50.00%) of DAESI input dealers had medium level of knowledge, while 45.00 per cent, 02.50 per cent and 02.50 per cent of them high, very high and low level of knowledge, respectively about varieties, crop practices and plant protection from research recommendations of Anand Agricultural University.

Association between profile characteristics and knowledge level of respondents

In case of beneficiaries, the r-values in Table 3 indicated that out of thirteen independent variables four variables like, education, risk orientation, decision making and extension agency contact were found to be positively significant at 1% level of probability and economic motivation, management orientation, self-confidence and mass media exposure were found to be positively significant at 5% level of probability. Other five variables, viz., age, caste, business experience as input dealer, social participation and annual income were in negative relation with knowledge level of respondents

regarding important aspects covered under DAESI programme. In case of non-beneficiaries, the r-values in Table 4 revealed that out of thirteen selected independent variables, only three variable i.e., education, economic motivation and decision making were found significant at 1% level of probability and three were found significant at 5% level of probability i.e. risk orientation, management orientation and extension agency contact. Whereas rest seven were found non-significant.

Further analysis of Table 5 to know the association of independent variables of overall respondents with their knowledge level indicated that the education, business experience as input dealer, annual income, economic motivation, risk orientation, management orientation, decision making, self-confidence, mass media exposure and extension agency contact were positively correlated with knowledge level of respondents and the association was found significant either at 1 or 5 per cent level of probability. The r-values of age, caste and social participation showed non-significant relation with knowledge level of respondents.

The findings could be explained as, the higher the education, economic motivation, risk orientation, management orientation, decision making, self-confidence, mass media exposure and extension agency contact the higher would be the knowledge level of respondents regarding important aspects covered under DAESI programme.

Table 2. Aspects wise comparison of level of knowledge regarding important aspects covered under DAESI programme

S.No.	Aspects	Beneficiaries (n=160)		Non-beneficiaries (n=160)		'Z' value
		S.D.	Mean	S.D.	Mean	
1.	Soil health management	4.43	15.57	3.59	12.89	5.95**
2.	Seed & seed production	2.58	6.83	2.37	5.42	5.09**
3.	Act, rules & regulations related to agricultural inputs	1.86	5.59	1.97	4.51	5.04**
4.	Pest & disease control	3.25	9.22	3.25	7.78	3.96**
5.	Schemes related to agricultural sector	2.76	8.98	2.86	7.35	5.19**
	Pooled	12.29	46.19	11.34	37.95	6.23**

** 1% level of significance

Table 3. Relationship between independent variables of beneficiaries and their knowledge level regarding important aspects covered under DAESI Programme

S.No.	Characteristics	Correlation Coefficient (r)	Beneficiaries (n=160)		
			b Value	Standard error	t value
1.	Age	0.1334 ^{NS}	0.154	0.181	1.239 ^{NS}
2.	Caste	0.0501 ^{NS}	-0.005	1.686	-0.068 ^{NS}
3.	Education	0.3260**	0.170	0.319	2.786**
4.	Business experience as input dealer	0.1192 ^{NS}	0.112	1.111	0.901 ^{NS}
5.	Social participation	0.0935 ^{NS}	0.102	0.511	1.449 ^{NS}
6.	Annual income	0.0182 ^{NS}	-0.119	0.787	-1.439 ^{NS}
7.	Economic motivation	0.1906*	0.223	0.390	2.187*
8.	Risk orientation	0.2670**	0.316	0.336	3.574**
9.	Management orientation	0.1772*	0.193	0.176	2.043*
10.	Decision making	0.2712**	0.076	0.436	1.023 ^{NS}
11.	Self confidence	0.1662*	0.129	0.286	1.461 ^{NS}
12.	Mass media exposure	0.1598*	0.138	0.347	3.746**
13.	Extension agency contact	0.3851**	0.339	0.415	4.452**

** = Significant at 1% level, * = Significant at 5% level, NS = Non-significant
Coefficient of determination (R^2) = 0.709

It could be concluded that the knowledge level of respondents regarding important aspects covered under DAESI programme was independent of age, caste and social participation. The findings are in accordance with the results of Srinivas (2013) who reported that education, management orientation, mass media exposure and extension agency contacts were found positively significant either at 1 or 5 per cent level of significance.

Relationship between profile characteristics and knowledge level

In order to ascertain the relationship multiple linear regression analysis was done. Through multiple linear regression, data was critically analysed to work out the separate as well as combined relative influence of selected independent variables.

A critical examination of the data presented in Table 3 shows that age, caste, business experience as input dealer, social participation, annual income, decision making and self-confidence were non-significantly associated with the knowledge level of beneficiary with 0.154, -0.005, 0.112, 0.102, -0.119, 0.076 and 0.129 'b' value, respectively, which indicates that there is no association between age, caste, business experience as input dealer, social participation, annual income, decision making and self-confidence with knowledge level of beneficiary respondents. This might be attributed to the fact that respondent can gain knowledge throughout his life time. Knowledge has no bar of specific age group. Caste, business experience as input dealer, social participation, annual income, decision making and self-confidence are not a determining factor of the knowledge level. While education, economic motivation, risk orientation, management orientation, mass media exposure and extension agency contact were positively and significantly associated with the knowledge level of respondents.

The data presented in Table 3 explained that these independent variables of beneficiary exerted 70.90 per cent influence on their knowledge level. From the above discussion it can be concluded that education, economic motivation, risk orientation, management orientation, mass media exposure and extension agency contact were

the important variables which determined the level of knowledge of beneficiary respondents regarding important aspects covered under DAESI programme.

The study of Table 4 revealed that the corresponding calculated 't' values of variables education, economic motivation, risk orientation, decision making, self-confidence and extension agency contact were higher than the tabulated 't' value at 1 per cent level of significance except economic motivation which was significant at 5 per cent level. This elucidates that education, economic motivation, risk orientation, decision making, self-confidence and extension agency contact were positively and significantly associated with the knowledge level of the non-beneficiary respondents. It means that education, economic motivation, risk orientation, decision making, self-confidence and extension agency contact affect significantly on their knowledge level.

Further, the independent variables like age, caste, business experience as input dealer, social participation, annual income, management orientation and mass media exposure were non-significantly associated with the knowledge level of respondents. The value of coefficient of determination indicated that these independent variables combinedly had 73.80 per cent effect on knowledge level of non-beneficiaries regarding important aspects covered under DAESI programme.

Overall respondents and their knowledge level

In case of overall respondents, it was observed from the Table 5 that the coefficients associated with the variables like education, economic motivation, risk orientation, management orientation, decision making, mass media exposure and extension agency contact had a positive relation with a high significance at 1% level of probability towards the knowledge level of respondents regarding important aspects covered under DAESI programme.

Thus, it can be concluded that these are the determining factors for knowledge level of overall respondents. If we see all the thirteen independent variables of overall respondents, they exerted 68.80

Table 4. Relationship between independent variables of non-beneficiaries and their knowledge level regarding important aspects covered under DAESI Programme

S.No.	Characteristics	Correlation Coefficient (r)	Non-beneficiaries (n=160)		
			b value	Standard error	t value
1.	Age	0.0254 ^{NS}	-0.159	0.149	-1.173 ^{NS}
2.	Caste	0.0239 ^{NS}	0.027	1.476	0.353 ^{NS}
3.	Education	0.2083 ^{**}	0.310	0.216	3.102 ^{**}
4.	Business experience as input dealer	0.0971 ^{NS}	0.182	0.995	1.470 ^{NS}
5.	Social participation	0.0381 ^{NS}	0.084	2.249	0.932 ^{NS}
6.	Annual income	0.0906 ^{NS}	0.058	0.885	0.748 ^{NS}
7.	Economic motivation	0.3103 ^{**}	0.178	0.466	1.975 [*]
8.	Risk orientation	0.1895 [*]	0.289	0.488	2.909 ^{**}
9.	Management orientation	0.1975 [*]	-0.060	0.212	-0.730 ^{NS}
10.	Decision making	0.3851 ^{**}	0.379	0.376	4.658 ^{**}
11.	Self confidence	0.0501 ^{NS}	0.338	0.270	2.764 ^{**}
12.	Mass media exposure	0.1042 ^{NS}	0.130	0.447	1.709 ^{NS}
13.	Extension agency contact	0.1740 [*]	0.222	0.394	2.560 ^{**}

** = Significant at 1% level, * = Significant at 5% level, NS = Non-significant
Coefficient of determination (R²) = 0.738

Table 5. Relationship between independent variables of overall respondents and their knowledge level regarding important aspects covered under DAESI Programme

S.No.	Characteristics	Correlation Coefficient (r)	Non-beneficiaries (n=320)		
			b value	Standard error	t value
1.	Age	0.1413 ^{NS}	0.024	0.114	0.271 ^{NS}
2.	Caste	0.0008 ^{NS}	-0.031	1.110	-0.601 ^{NS}
3.	Education	0.2121**	0.251	0.430	2.844**
4.	Business experience as input dealer	0.1571**	0.125	0.740	1.502 ^{NS}
5.	Social participation	0.0657 ^{NS}	0.140	1.314	1.400 ^{NS}
6.	Annual income	0.1221*	0.006	0.562	0.117 ^{NS}
7.	Economic motivation	0.2561**	0.243	0.291	2.639**
8.	Risk orientation	0.3457**	0.296	0.256	4.408**
9.	Management orientation	0.2678**	0.347	0.230	3.754**
10.	Decision making	0.3169**	0.250	0.286	4.540**
11.	Self confidence	0.2366**	0.185	0.189	1.323 ^{NS}
12.	Mass media exposure	0.1474*	0.137	0.272	2.607**
13.	Extension agency contact	0.3126**	0.264	0.279	5.003**

** = Significant at 1% level, * = Significant at 5% level, NS = Non-significant

Coefficient of determination (R^2) = 0.688

per cent influence on their knowledge level regarding important aspects covered under DAESI programme.

CONCLUSION

A clear difference in knowledge level of beneficiaries and non-beneficiaries in all the five aspects was observed. It can be concluded that DAESI programme was able to enhance the knowledge of input dealers to an optimal extent. DAESI programme is a very creative and innovative step to help the input dealers in getting and delivering the right knowledge and information regarding agri inputs to the farmers. Hence, efforts must be made to provide required knowledge through conducting more training programmes by the extension functionaries, extension scientists of SAU's, local NGO's and KVK's for the input dealers on topics like soil health management, Act, rules & regulations related to agricultural inputs, Schemes related to agricultural sector etc.

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Socio-psychological Determinants for Technology Socialisation of Jute Production in West Bengal

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ABSTRACT

Jute is a major commercial crop grown by majority of the small and marginal farmers of West Bengal. To make this venture profitable ICAR-Central Research Institute of Jute and Allied Fibres (CRIJAF) had developed innovative jute production technologies. The study was conducted during 2021 at villages of North 24 Parganas and Nadia districts of West Bengal where ICAR-CRIJAF had disseminated its innovative technologies. A sample of 160 jute growers comprising of 80 adopter farmers and 80 non-adopter farmers were selected randomly. The objective was to identify the influence of the socio-psychological characteristics of the jute growers on their level of technology socialisation. Canonical correlation analysis was carried out to find the association between these two sets of variables. The variables; achievement motivation, innovativeness, education, land holdings etc. moved together with adoption whereas farming experience and age followed the same direction as rejection and discontinuance.

INTRODUCTION

In West Bengal, the total cultivated area of jute was 12.47 thousand hectares, total production is 162.10 thousand bales with a productivity of 2340 kg/ha in the year 2020-21. As compared to the financial year 2017-18 with area of 525.44 thousand hectares, production of 7637.85 thousand bales and productivity of 2616 kg/ha (Office of Jute Commissioner, 2022) jute farming is declining over the past few years. There was an overall decrease in the production, area and productivity over the past few years. In fiscal year 2021, India produced 962 thousand metric tons of jute products and goods. An overall decline was recorded over the last decade (Statista Research Department, 2022) owing to the cost advantageous polypropylene as a packaging material.

Therefore, to improve this scenario of jute venture, ICAR-Central Research Institute for Jute and Allied Fibres (CRIJAF) has introduced innovative jute production technologies that could boost up the jute cultivation. The innovative jute production technologies that were developed and disseminated by ICAR- CRIJAF are

improved varieties of jute seeds, integrated weed control strategies, soil testing based fertilizer application, efficient microbial consortium for retting, cost effective machineries like multi-row seed drill, flax extractor, bast fibre extractor, herbicide brush, nail weeder, etc. (Mahapatra et al., 2012).

In India, jute is mostly produced by the marginal (65%) and small farmers (25%) of West Bengal comprising of 80 per cent of jute production of the nation. Therefore, the positive impact of the adoption of jute production technologies will directly benefit these farming communities (Chapke, 2013). Although the innovative jute production technologies are effective technology that can make the venture of jute cultivation more profitable, the actual adoption of such technology is low and is mainly confined to the trainee farmers (Sadat et al., 2017). Although the extension wing of the research stations, SAUs and KVKs are putting their efforts to motivate the farmers for adopting the improved production technologies related to jute cultivation. But, still there exists a socio-psychological gap that restricts the jute growers to adopt such innovative technologies. A study carried out by Chapke (2009)

revealed that about 83 per cent jute growers were unaware about the technologies developed by ICAR-CRIJAF such as jute varieties, fibre extractor machine, herbicide, intercropping, recommended fertilizer dose, line sowing by furrow seed drill and seed treatment. The lack of awareness and low adoption of modern agricultural technologies have increased the vulnerability of the farm households towards production risks (Nain et al., 2014; Singha et al., 2016). Therefore, it is important to recognize the particular characteristics that will determine not only their adoption behaviour but their rejection and discontinuance as well. Nain et al., (2018) observed that characteristics of innovation like its relevancy and financial sustainability becomes utmost important. Previous studies revealed that environmental factors along with socio-economic and psychological attributes of the farmers effect significantly towards adoption and diffusion of agricultural technologies in different farming systems (Lestrelin et al., 2012). For this purpose, the study has been carried out with an objective to find out the association between levels of socialisation of jute technology with those socio-psychological variables.

METHODOLOGY

In order to carry out the ex-post facto research those villages were selected purposively where ICAR-CRIJAF disseminated the innovative jute production technologies to the practicing jute cultivators. Therefore, Kumra village under Habra Block and Brahmapur village under Haringhata Block of 24 Parganas (North) and Nadia districts respectively were selected purposively for the present study respectively. Forty jute growers were selected randomly from each village who had already adopted the innovative jute production technology developed by ICAR-CRIJAF. Similarly, 40 jute growers were selected from each village randomly who have not adopted the recommendations of ICAR-CRIJAF. Therefore, a total 80 respondents were selected from each village using simple random sampling method. A total of 160 respondents were selected in order to carry out the study. An exploratory research design was followed as it aims to identify the underlying relationships between the sets of variables.

To measure the socio psychological characteristics of the jute growers, fourteen independent variables were selected viz. achievement motivation, innovativeness proneness, risk orientation, marketing orientation, scientific orientation, economic orientation, age, education, farming experience, extension contact, land holding, mass media exposure, economically active member of the family and family size.

Similarly, technology socialisation was dependent variable which was operationalised as the complex interaction of the social processes like technology adoption, discontinuance and rejection. The adoption, rejection and discontinuance scores of the respondents were computed considering twelve technology indicators recommended by ICAR-CRIJAF. These recommendations include improved variety of seeds viz. JRO 204, seed treatment, optimum sowing period of jute, optimum seed rate, fertilizer application, weed management, insect, pest and disease management, optimum harvesting period, CRIJAF SONA, CRIJAF Nail Weeder and use of multirow seed drill for sowing of jute seeds. The scores

indicate how much the technologies were adopted, rejected or discontinued by the jute growers.

Accordingly, the extent of adoption/rejection/discontinuance was measured through improvisation over the adoption scale developed by Pareek & Chattopadhyay (1966). The following formula was given in order to measure the variable.

$$A_E = \frac{\sum_{i=1}^n Y_{Ai} \times L_{Ai}}{n_A}$$

Where, A_E = Adoption / Rejection / Discontinuance Quotient of the respondent

Y_{Ai} = Period of Adoption / Rejection / Discontinuance for i^{th} items of adoption of the respondent.

L_{Ai} = Level of Adoption / Rejection / Discontinuance for i^{th} items of adoption of the respondent.

n_A = Total number of items of Adoption / Rejection / Discontinuance.

The data were collected using structured interview schedule during May-July 2021. Canonical correlation analysis was carried out through SPSS v26.

RESULTS AND DISCUSSIONS

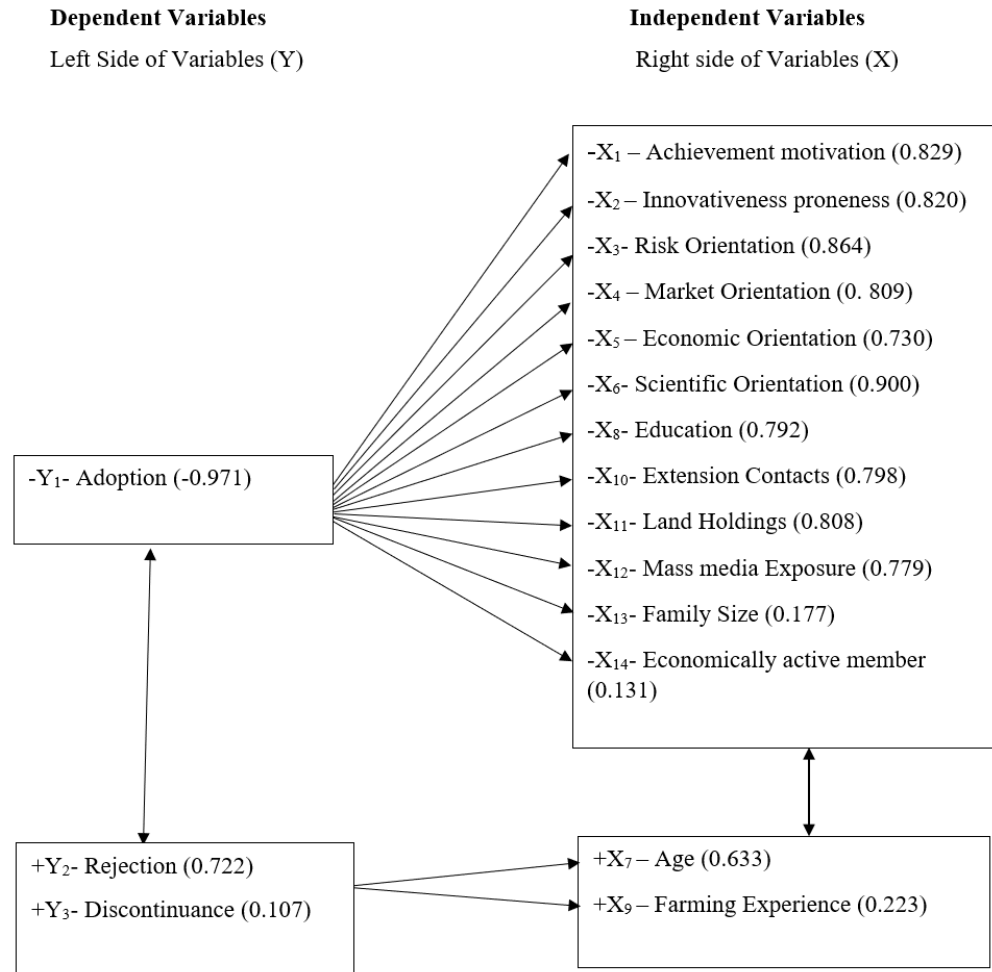
Association between level of technology socialisation and socio-psychological variables

Figure 1 present CCA (Canonical Correlation Analysis) wherein two sets of variables were elucidated based on the cross loadings. CCA was carried out since there were more than one set of dependent variables (Y) and multiple numbers of independent variables (X). It was found that the left side variables (adoption-Y) had preferred to move in a solitary manner, while the other two variables rejection and discontinuance had created a sub-conglomeration which has been impacted by right side (X) variables i.e., age and farming experience. So, adoption behaviour of a respondent was distinctly impacted by the variables like achievement motivation, innovativeness proneness, risk orientation, market orientation, scientific orientation, economic orientation, education, extension contacts, land holdings, mass media exposure, family size and economically active member.

The results implied that discontinuance and rejection had built up a close kinship and this is simply because of the nature of the two eventualities of having neighbourhood proximity. The innovative jute production technologies which were discontinued subsequent to adoption, had it been gone through a proper contemplation, could have been rejected earlier and these two variables took farming experience and age as contributing causal factors. Adoption can take place as an impromptu effect of induced extension intervention, away from this. For rejection and discontinuance, the same respondent may need deeper insights and logical discourses. The entire paradigm suggests that these complex interactions amongst and between two sets of variables go occurring isochronously, yet with some clandestine relationship having exerted between two sets of variables. Adoption can here be considered as an ephemeral phenomenon while rejection and discontinuance merit more time and deeper insights.

Similar outcomes were found from the study by Mondal & Bandyopadhyay (2015), identified the factors viz. personal cosmopolite sources, mass media exposure, extra village contact and

Figure 1. Canonical correlation analysis to derive the interaction pattern of left and right side variables (dependent and independent variables)



education having a significant influence on the extent the knowledge and adoption of the jute production technologies. Kumar et al., (2017) found that the sources of information utilization, scientific orientation and social participation of the respondents exhibited significant relationship with adoption of jute production technologies. Mishra et al., (2020) found that age, annual income, education, social participation, family type, mass media exposure, use of information sources, land holdings, knowledge and socio-economic status were correlated with adoption of improved practices. Shasani et al., (2020) revealed variables viz., social participation, extension participation, attitude, mass media exposure and knowledge had positive and significant association with the adoption of the technology. Kakkad et al., (2019) found education, social participation, extension contacts, land holdings, economic motivation and risk orientation had significant association with extent of adoption. Gautam et al., (2007) revealed that social participation, herd size, family education and occupation had positive correlations with adoption while farm size was correlated negatively with adoption of dairy practices.

CONCLUSION

It is the farmer who put the ideas into actions; to implement the new technology to his field. The factors like achievement motivation, innovativeness proneness, risk orientation, market

orientation, scientific orientation, economic orientation, education, extension contacts, land holdings, mass media exposure, family size and economically active member are found to move congruently with adoption, whereas farming experience and age were found to be moving in the same direction with rejection and discontinuance of the innovative jute production technologies in the study area. These determinants should be considered by the extension agencies to redesign the methods and techniques to transfer the technologies in the study areas having similar conditions. So that, it could lead to enhancement of adoption and reduce the rate of rejection and discontinuance of the available technologies. This would lead to improvement of their livelihood and well-being and that will help to achieve economic prosperity of jute growers.

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Effect of Nutrition Interventions on Knowledge and Adoption Feasibility of Gluten Free Products by Celiac Disease Patients

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ABSTRACT

The study was undertaken with the objective to improve the nutritional knowledge and technical skill of celiac disease patients. Since celiac is a disease which occurs due to gluten allergy and quite prevalent these days. Hence this study was planned to promote nutrition education to celiac patients and give them training on preparation of gluten free products during 2020-21. Thirty celiac disease patients were selected randomly using snowball method. Lectures cum demonstrations for preparation of gluten free quinoa based *laddoo*, *upma*, *porridge* and *pulao* were given. Leaflets containing the recipes for preparation and nutritional importance of quinoa products were distributed. Pre exposure scores (1.00 to 1.55) depicted that respondents had very less knowledge of celiac disease, its causes, gluten free foods, quinoa and its products, price of quinoa, nutritional importance and medicinal uses of quinoa seeds. A significant increase ($P < 0.01$) was observed in knowledge scores (1.71 to 2.00) of respondents after imparting nutrition education. All the quinoa products i.e. *laddoo*, *porridge*, *pulao* and *upma* were liked by them and they felt that they can easily make these products.

INTRODUCTION

Quinoa (*Chenopodium quinoa*) is a pseudocereal and can be explored in innovative food processing industry for development of highly nutritious functional foods. Quinoa due to its phytochemical and bioactive compound profile is known to be a potent antioxidant which can modulate the immune competency and metabolic processes involved in inflammation and can also serve to improve the gut health (Ng & Wang, 2021). It has been emphasised that the regular consumption of processed quinoa have hypolipidemic and hypoglycemic properties owing to unique resistant starch and dietary fibre contents and is very promising for human nutrition (FAO, 2011). What makes quinoa a unique potent source is its essential amino acids composition. Like pearl millet, quinoa is also being termed as climate smart crop as it can withstand the harsh climatic conditions (Angeli et al., 2020). In this

scenario of worldwide hunger, hidden hunger and climate concerns it is advisable to promote the utilization of quinoa in different food formulations (Singh, 2018; Mohammad et al., 2017). It has been observed that there is very little awareness among masses on importance and nutritional quality of quinoa and technology for its production and utilization (Alandia et al., 2020; Puri et al., 2020). The development of composite bar using low cost, locally available ingredients were nutri dense and a convenient snack for children and adults (Kumari et al., 2021). Replacement of wheat flour with pearl millet flour and chick pea flour increased the protein, fibers and iron contents proportionately to the level of substitution (Singh et al., 2020). There is need to promote utilization of quinoa and its products through government-sponsored mid-day meal programmes and public distribution system so that venerable section of society can get nutritionally superior quinoa in their daily diet (Praveen et al., 2021). It will be good for such people also who do not prefer

animal products and alternative uses of quinoa will give them high quality protein food. Lots of efforts are required to increase the utilization of quinoa at household and industrial level. Most important quality of quinoa is that it is gluten free and can be utilized for making food products for celiac patients.

There are a huge number of celiac disease patients in India and only a small part of them get diagnosed (Rajpoot & Makharia, 2013). It has been emphasised that management of patients with celiac disease by proper nutrition counselling, diet and care is an important aspect. The industrial production of reliable and affordable gluten free products and food labelling for gluten content is imperative for consumer information and awareness. Studies have reported that the nutrition education considerably improved the knowledge of celiac patients regarding causes, diagnosis and treatment and concluded that nutritional education increased the understanding of celiac disease among its patients, which could help to improve their health Barzegar et al., (2017). There is urgent need to increase awareness about the celiac disease and popularize the use of gluten free diet as a lifelong measure for celiac patients Malik et al., (2019). Keeping this mind it was planned to standardise and popularise gluten free products and also provide knowledge to patients to improve their life.

METHODOLOGY

The current research was carried out in Hisar district, Haryana state during 2020-21. Thirty respondents were selected randomly by using snowball method. Lectures cum demonstration for preparation of gluten free quinoa *laddoo*, *upma*, *porridge* and *pulao* were given. Leaflets containing the recipes for preparation and nutritional importance of quinoa products were distributed. Nutrition education was imparted to all the respondents for three months at 15 days intervals. After three months of the nutrition education programme, they were assessed for perceived feasibility for the preparation of demonstrated products. The difference in gain in knowledge and perceived feasibility in respect of ease of making gluten free products of 30 respondents were assessed at pre and post-exposure stage. Mean scores and paired t test were applied as the statistical tools.

RESULTS AND DISCUSSION

The data presented in Table 1 and 2 indicated the impact of nutrition education on knowledge gain of celiac disease patients and perceived feasibility in respect of ease of making gluten free products. Analysis of a total of 27 statements was carried out to

Table 1. Gain in knowledge score of celiac disease patients

S. No.	Knowledge	Pre scores	Post scores	Gain in knowledge	t-value
1	Wheat allergy and celiac disease are two same conditions	1.52±0.51	2.00±0.00	0.48	5.16*
2	Celiac Disease is genetic or auto immune	1.29±0.29	1.98±0.49	0.69	6.64**
3	Celiac disease refers to gluten intolerance and inflammatory injury to small intestine	1.45±0.50	2.00±0.00	0.55	6.02**
4	Intestine is most affected in celiac disease	1.26±0.23	1.98±0.46	0.72	7.67**
5	Celiac patients are generally malnourished	1.31±0.27	1.89±0.43	0.58	6.26**
6	Celiac disease patients should rely on gluten free diet	1.44±0.30	2.00±0.00	0.56	10.22**
7	Celiac disease causes abdominal distention and flatulence, diarrhoea, vomiting, anemia	1.55±0.48	1.94±0.42	0.39	3.35*
8	Regular intake of gluten by celiac disease patient can lead to intestinal ulceration and cancer	1.34±0.21	1.96±0.51	0.62	6.16**
9	Change in diet required in celiac disease	1.24±0.27	1.94±0.47	0.70	7.07**
10	While purchasing gluten free food for celiac patients from the market, it is necessary to read the label	1.55±0.43	2.00±0.00	0.45	5.73**
11	Does increases consumption of fruits and vegetables helps in celiac disease	1.35±0.56	1.95±0.47	0.60	4.50**
12	Wheat and wheat products should be consumed by celiac disease patients	1.37±0.41	1.97±0.50	0.60	5.08**
13	Corn flour <i>laddoo</i> is a better choice than wheat <i>laddoo</i> for a celiac patient	1.41±0.34	1.81±0.54	0.40	3.43*
14	Gluten free diet is good for celiac disease	1.18±0.24	1.98±0.42	0.80	9.06**
15	Gluten present in wheat, ragi and barley	1.31±0.25	1.71±0.43	0.40	4.40*
16	What gluten free products available in market	1.15±0.18	1.81±0.42	0.66	7.91**
17	Quinoa and its products	1.00±0.19	1.91±0.43	0.91	10.60**
18	Quinoa is a gluten free food	1.05±0.21	1.74±0.38	0.69	8.70**
19	Price of quinoa	1.00±0.10	1.79±0.36	0.79	11.58**
20	Quinoa is a good source of protein/dietary fibre/minerals	1.11±0.21	1.81±0.45	0.70	7.72**
21	Quinoa helps in diabetes/weight reduction/heart diseases	1.08±0.15	1.71±0.35	0.63	9.06**
22	Quinoa intake improves your nutrient intake	1.02±0.11	1.84±0.32	0.82	13.27**
23	Products supplemented with quinoa are more nutritious than maize and rice products	1.24±0.25	1.91±0.43	0.67	7.38**
24	What products of maize, rice and quinoa available in the market	1.12±0.21	1.81±0.31	0.69	10.09**
25	Would you like to buy quinoa, maize and rice products	1.18±0.25	1.84±0.42	0.66	7.40**
26	You can use quinoa to make <i>chapati</i> , <i>laddoo</i> , <i>khichdi</i> , <i>dalia</i> , <i>kheer</i> , <i>pulao</i> ?	1.26±0.21	1.81±0.37	0.55	7.08**
27	How to make quinoa <i>laddoo</i> , <i>chapati</i> , <i>daliya</i> .	1.19±0.24	1.94±0.46	0.75	7.92*

Values are Mean±S.D *Significant at 5% level of significance ** Significant at 1% level of significance

ascertain the exact extent of knowledge about the various aspects of celiac disease and quinoa. Pre exposure scores (1.00 to 1.55) depicted that respondents had very less knowledge of celiac disease, its causes, gluten free foods, quinoa and its products, price of quinoa, nutritional importance and medicinal uses of quinoa seeds. A significant increase ($P<0.01$) was observed in knowledge scores (1.71 to 2.00) regarding celiac disease, its causes, gluten free foods, quinoa and its products, price of quinoa, nutritional importance and medicinal uses of quinoa after imparting nutrition education which in line with the study of Barzegar et al., (2017). Results obtained were also in line with other workers (Barzegaret et al., 2017; Malik et al., 2019; Rajpoot & Makharia, 2013) who also reported that there was significant increase in the knowledge of celiac disease patients after imparting nutrition education. It is essential to provide proper nutrition education to celiac disease patients in order to make them aware about their nutritional needs and about different gluten free products available in market. Several other studies have also revealed that educational intervention programme lead to a significant gain in knowledge in the post test scores (Singh & Bisht, 2021; Ranjan et al., 2015; Rani, 2018).

Perceived feasibility in respect of ease of making gluten free products by celiac disease patients

All the quinoa added recipes were highly appreciated by respondents. *Laddoo* followed by porridge, *pulao* and *upma* scored highest in ease of making (Table 2).

Table 2. Perceived feasibility in respect of ease of making gluten free products by celiac disease patients

Products	Ease of making		
	Very easy	Easy	Cannot make
Upma	19	11	-
Pulao	20	10	-
Laddoo	25	5	-
Porridge	21	9	-

CONCLUSION

It is concluded that nutrition education plays an important role in knowledge gain and skill of making gluten free products of respondents. The leaflets prepared to increase knowledge about celiac disease, gluten free products and quinoa proved to be very effective. Thirty celiac disease patients with little information, attitude, or symbolic adoption were exposed to the media and they showed significant improvement in their behaviour towards consumption of different types of nutritious products and adoption of health promoting practices. A significant increase ($P<0.01$) was observed in knowledge scores (1.71 to 2.00) of patients regarding celiac disease its causes, gluten free foods, quinoa and its products, price of quinoa, nutritional importance and medicinal uses of quinoa after imparting nutrition education.

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Accessibility of Information and Communication Technology Services by Faculty Members of a State Agricultural University

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ABSTRACT

The research was carried out at the CCS Haryana Agricultural University, Hisar in 2021-22 to assess the availability and accessibility of information and communication technology services among faculty members. Data was collected with the help of well-structured questionnaire and analysed using Statistical Package for the Social Sciences (SPSS). 25 faculty members were selected randomly from four purposively selected college of CCSHAU, Hisar. Study concluded that all of respondents had computer/laptop, internet, e-mail, and mobile phone/ telephone facilities available at department/workplace. Majority of the respondents also had printer (97.00%), scanner (83.00%), photocopier (77.00%) and LCD projector (74.00%).

INTRODUCTION

Information and communication technology (ICT) is a comprehensive word that incorporates all computer hardware and software, as well as digital broadcast and telecommunication technologies and online and offline digital information repositories. It includes a wide range of technological tools and resources for creating, disseminating, storing, and managing data and information. On the other hand, newer digital technologies like computers and internet play an important role in educational transformation and reforms. The ability to access and utilize information sources are pre-requisite for improved targeting of extension, agricultural programmes and consulting services that promote information sharing and dissemination in the communities (Nain et al., 2015; Panda et al., 2019). Although developing countries like India achieved food self-sufficiency with the green revolution, now they are in danger of losing this self-sufficiency due to deterioration and decline of natural resources i.e. soil and water etc. which leads to stagnation in production and food shortages in the near future due to continue increasing population. Thus, in these situations' ICTs may use as a tool for redesigning agricultural education, research,

and extension networks throughout the country, which may increase the adoption of new agricultural technologies. ICT play a critical role in research and extension to increase professional capacity building among professionals (Arkhi et al., 2008). ICT tools increasing evidence of the pedagogical value of these technologies and their positive influence on learning activities of students and utilization of teachers about ICT tools was high (Kumar et al., 2019 & Malik et al., 2021). Thus, government should promote and encourage investments by private and internet service providers in ICTs (Singh et al., 2021). Keeping in view the importance of ICTs, the study was conducted to assess the availability and accessibility of information and communication technology services among faculty members.

METHODOLOGY

The study was carried out at CCSHAU in 2021-2. Four colleges i.e., College of Agriculture, College of Agricultural Engineering and Technology, College of Basic Sciences and Humanities, and College of Home Science of CCS HAU were selected, purposively. Further, 25 faculty members were selected randomly from each selected college making a total of 100 faculty

members with the help of questionnaire/goggle form. Respondents were informed also about the purpose of the study to take them into the confidence. They were assured that the information collected will be used only for research purpose and their response and privacy will not be public in any manner. The data was tabulated, analyzed and interpreted keeping in view the objectives of the study. SPSS tool was used for analysis of the collected data.

RESULTS AND DISCUSSION

The result pertaining to availability of ICTs facilities among faculty presented in Figure 1 clearly depicted that all of respondents had ICT tools available i.e., computer/laptop, internet, e-mail, and mobile phone/ telephone. While majority of the respondents also had printer (97.00%), scanner (83.00%), LCD projector (74.00%) and photocopier (77.00%). Study concluded that faculty members have ICT tools except digital camera and interactive kiosk. University administration should take care about the interactive kiosk which should be installed at departments or colleges. Study got strength from past research study of Bello et al., (2013); Oriogu et al., (2014), Samansiri & Wanigasundera (2014) & Gabadeen et al., (2015) who reported that majority of ICT facilities were

available for extension personnel, teachers and students. However, results are contradiction of the findings of Adedji (2011); Jude & Dankaro (2012) who reported that ICT facilities were only for administration purpose and ICT resources were not available at college level.

Data presented in Figure 2 showed the relationship between personality traits as independent variables and available ICT services as dependent variables. It was that job commitment had positive and significant correlation with available ICT services at 5 per cent level of probability. These finding are in contrast of the findings of Malik et al., (2020). While in case of the partial regression coefficient, job commitment found significant.

The data related to accessibility of ICTs services among respondents presented in Figure 3 and cleared that all the respondents had access to computer/laptop, printer, internet, e-mail and mobile phone at department/office and ranked 1st with weighted mean score (WMS) 2.00. While, majority of the respondents also had access to digital camera (97.00%), scanner (83.00%), photocopier (76.00%) and LCD projector (74.00%) ranked 2nd, 3rd, 4th and 5th, respectively. However, internet kiosk ranked 6th with lowest WMS 1.07. The results are in contrast with the findings of

Figure 1. Availability of ICTs services among faculty

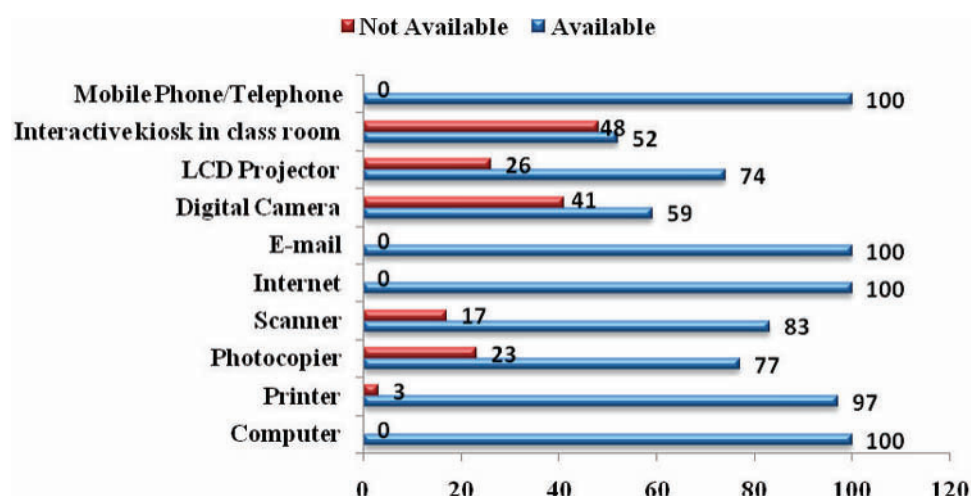


Figure 2. Accessibility of ICTs services among faculty

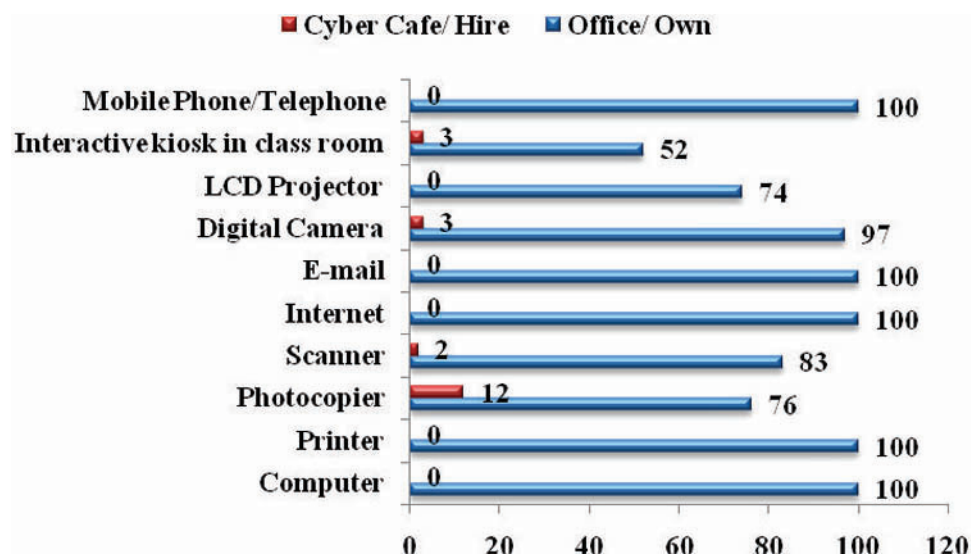


Figure 3. Relationship between available ICT services and personality traits

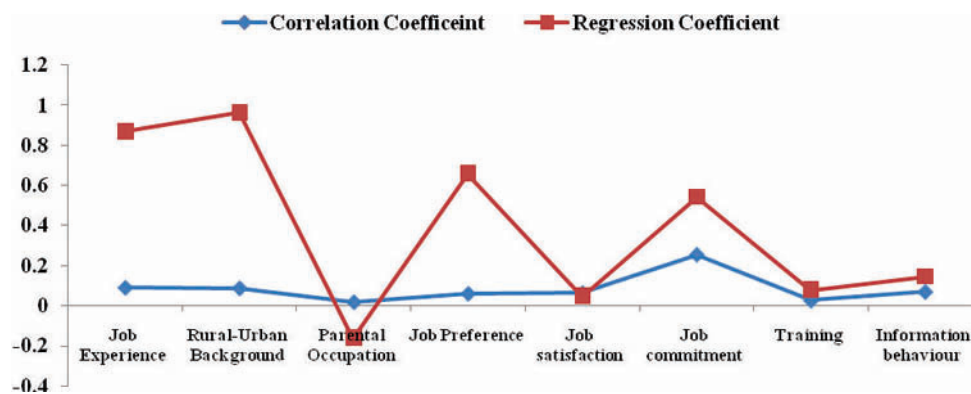
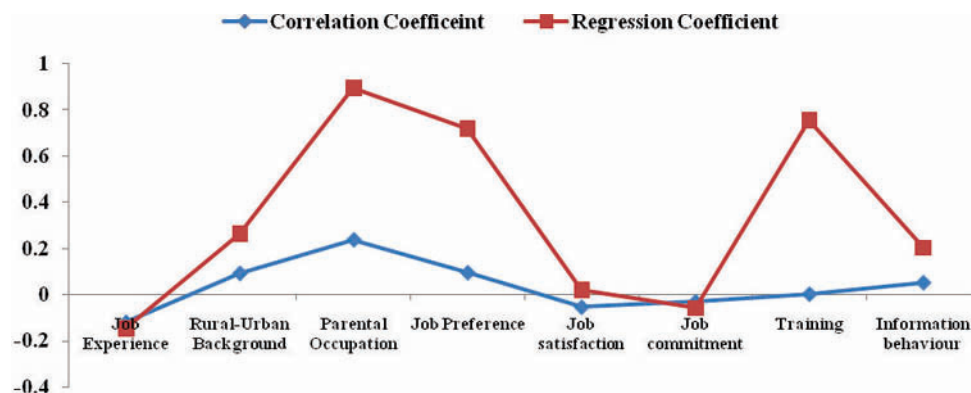


Figure 4. Relationship between accessibility of ICT services and personality traits



Nazim & Saraf (2006); Agwu & Elizabeth (2013) & Tiwari et al., (2014) who reported that modern ICT tools i.e., computer, internet and printer etc. were not accessible. University administration makes plan to increase the accessibility of ICT tools for faculty members which leads to increase the quality of teaching and research.

Figure 4 concluded that education qualification and parental occupation had significant correlation with accessibility ICT facilities at 5 per cent level of probability. These finding are in contrast of findings of Malik et al., (2020). While in case of the partial regression coefficient parental occupation and job commitment found significant.

CONCLUSION

ICTs play an important role in teaching in this modern era because it helps to make linkage between students and teachers by using of various tools. Study concluded that majority of ICT tools were available with the faculty members and accessible also. The tools which were not available and accessible may be provided with the help of well-structured and effective policy of university administration.

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Determinants of ICT Tools Accessibility by Farmers in Bihar

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ABSTRACT

The economy of a developing country like India is mostly dependent on performance of agriculture sector, and its growth highlights the need of transferring relevant timely information to farmers. Information and communication technology (ICT) plays an important role in this regard. India is progressively using ICT into its national development strategy and implementing tactics for widespread promotion in order to develop the country into a knowledge-rich, e-learning society. Present study was conducted during the year 2019 to determine the degree of access and use of ICTs by farmers and its determinants covering a random sample of 100 farmers in Katihar and Samastipur districts of Bihar. Majority of farmers were young and educated up to high school, mostly accessed mobile phone amongst the ICT tools. Farmers' diversified occupation, education, annual income, farming system/allied agricultural activities, mass media exposure, and extension contact were positively and significantly correlated with accessibility of ICT tools. Regression model revealed that selected farmers' attributes explained about 61 per cent variation in accessibility of ICT tools by the farmers.

INTRODUCTION

The goal to encourage improved information access in order to improve farming practices and enhance farmers' socio-economic conditions has long been the main objective of agricultural extensionists and rural advisory service providers. According to FAO (2011), disseminating information is crucial for players in the agricultural value chain in order to eliminate knowledge and communication asymmetries and the vicious cycle of poverty. Furthermore, the significance of ICTs in providing access to information in order to improve food security and rural livelihoods has been increasingly recognised and officially acknowledged at the World Summit on the Information Society (WSIS) 2003-2005 (IICD, 2007). Agriculture is the backbone of the Indian economy, with more than half of the Indian population relying on agriculture, hence agricultural development is critical for supporting economic development and feeding the rising population (Datt & Ravallion,

1996). The contribution of information and knowledge is one component that might enhance agricultural productivity. Since agricultural extension depends to a large extent on information exchange on the one hand and a broad range of other actors on the other (Mabe & Oladele, 2012), ICTs can be utilised to bridge the information gap. There is also a rising realisation among farmers regarding the value of knowledge, information, and proper learning techniques for moving towards development (Greenridge, 2003; Lightfoot, 2003).

ICT is a crucial facilitator and component of the emerging knowledge-based economy and information revolution (Dhaka & Chayal, 2010; Barh & Balakrishnan, 2018). In this 'Global Information Age,' the function of ICTs as a tool for advancement and development has been widely recognised, and it has been noticed that individuals from all walks of life are directly or indirectly touched by the IT industry. ICT is playing an important role in agricultural development by providing farmers with timely, reliable,

and accurate information, as well as decision support through ICT-based agricultural intelligence systems (Shalendra & Sharma, 2011). However, limited accessibility and use of ICT tools is difficulties in rural India due to the farmers' economic situation, a lack of infrastructure to support ICT applications, and a lack of trust in using ICT tools (Syiem & Raj, 2015). Keeping in view the importance and need of ICT tools' utilization in agriculture, present study was undertaken with an objective to assess the accessibility and use pattern of ICT tools by farmers and with its determinants in term of selected attributes of farmers.

METHODOLOGY

The study was conducted in Katihar and Samastipur districts of Bihar. A sample of 100 farmers was selected as respondents as per recommendation of KVK of respective districts representing one block and two villages in each district. Farmers' attributes considered as independent variables were age, education, family type, annual income, social participation, farming system with allied agricultural activities, mass media exposure, and extension contact. The dependent variables in the study were number of ICTs tool used, their accessibility/ availability and use pattern. The data were collected through a personal interview schedule survey in the year 2019. The various attributes of farmers were measured with the help of nominal/ ordinal/ interval/ ratio scale with the help of structured interview schedule. Accessibility to ICT tools was measured in terms of the possession of particular ICT tools by the respondents with their dichotomous responses in terms of "Yes" and "No" scored as 1 and 0 respectively. Accessibility score was computed on their total possession of various ICT tools. The data were compiled and analysed by using descriptive statistics like mean, standard deviation, correlation and regression.

RESULTS AND DISCUSSION

Farmers' accessibility to ICT tools

The differential accessibility to ICT tools by the respondent-farmers is presented in Figure 1. Majority of farmers used to access

mobile phone (91%) followed by television (87%), and radio (82%). Majority of farmers were having mobile phone that may be attributed to the fact that farmers appreciate mobile phone as easy, fast and convenient way to communicate and get relevant information of respective problems. Now a days, the mobile phone has generated an opportunity for the farmers to get the timely information about marketing and weather. Television programmes in channels like DD Kisan, Kisan TV etc. focused on identifying problems and providing relevant solutions including controlling of various crop related pests and diseases. Similarly, radio programmes like *Kheti-Grihasthi*, *Chaupal*, etc. provide relevant agricultural information and news about marketing of commodity, weather, etc. to farmers at their door step.

Similar to the findings of present study, Syiem & Raj (2015); Kumar et al., (2017); Sajesh & Padaria (2017); Nain et al., (2019) & Jat et al., (2021) also reported that mobile phone was highly accessible followed by television and radio among the farmers in Meghalaya, Haryana, Maharashtra and Rajasthan, respectively. The data also revealed that about 80 per cent respondents having internet connectivity and 77 per cent respondents having WhatsApp for accessing information. In contrast with the findings, Jayalakshmi et al., (2022) found that among the different modes of communication, the majority of farmers in Andhra Pradesh accessed agriculture information through mobile phones and further concluded that mobile apps, as an omnipresent tool in future extension.

Determinants of farmers' accessibility to ICT tools

Table 1 presents coefficient of correlation (r) values between farmers' attributes and farmers' accessibility to ICT tools. the attributes like diversified occupation, education, annual income, farming system including allied agriculture activities, mass media exposure, and extension contact were found to be positively and significantly correlated with accessibility or of ICT tools. That means, by improving all these factors, accessibility to ICT tools by the respondents will also be increased. People gain knowledge through the formal education system, which makes them more open

Figure 1. Farmers' differential accessibility to ICT tools

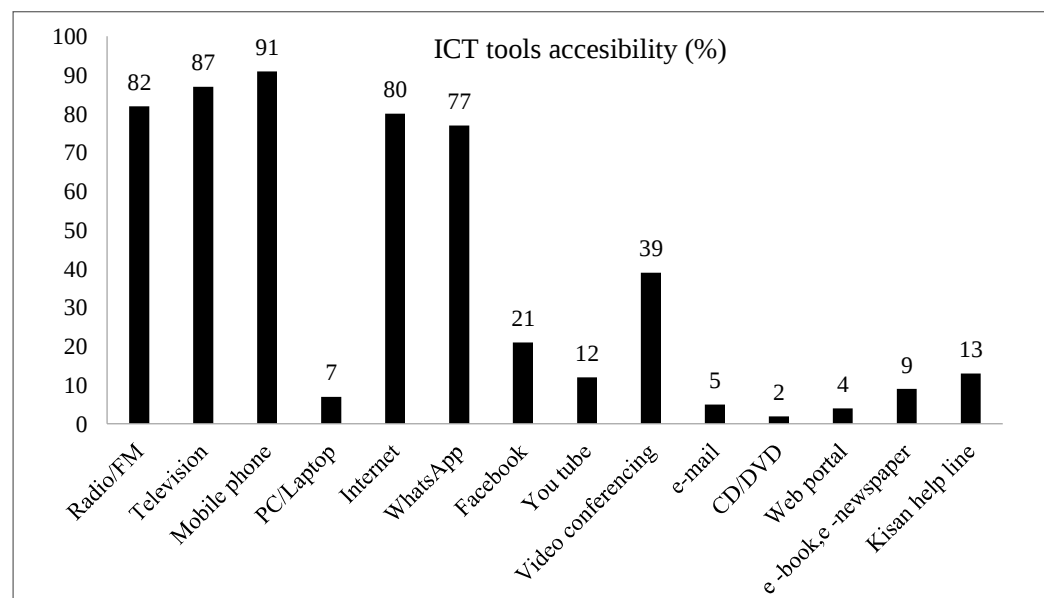


Table 1. Correlation between attributes of farmers and their accessibility to ICT tools

S.No.	Independent variable	Correlation coefficient (r)
1	Age	-0.103
2	Diversified occupation	0.280**
3	Education	0.569**
4	Annual Income	0.394**
5	Social Participation	0.083
6	Farming system including allied agricultural activities	0.407**
7	Mass media exposure	0.599**
8	Extension contacts	0.499**

Note: ** significant at 1% level and * significant at 5% level

Table 2. Multiple regression between attributes of farmers and their accessibility to ICT tools

S.No.	Independent variables	Regression coefficient	t value
1	Age	0.011	-0.474
2	Diversified occupation	0.490	2.042
3	Education	0.450	2.907**
4	Annual income	0.014	0.506
5	Social participation	0.001	0.460
6	Farming system	0.018	0.815
7	Mass media exposure	0.004	3.119
8	Extension contacts	0.005	2.657**

R square =0.609; F value=13.851**

** significant at 1% level and * significant at 5% level

to knowledge-providing agents such as ICT. Asset ownership is strongly tied to the family's economic situation, which makes the family more capable of using ICT tools and fosters a good attitude toward ICT. Farmers nowadays are keen to receive market information and a fair price for their produce, and ICT plays an important part in this. It might be the reason why mass media exposure and extension contacts are significantly and positively connected with ICT uses. Age is negatively and not significantly correlated.

Multiple regression examines the strength of the linear relationship between set of independent variables with a single dependent variable. A multiple regression analysis (Table 2) was done to determine functional relationship between farmers' attributes and their accessibility to ICT tools. The farmers' attributes like age, diversified occupation, education, annual income, social participation, farming system including allied agriculture activities, mass media exposure, and extension contacts together determined about 61 per cent variation in farmers' accessibility to ICT tools as evident from R square value of 0.609. Among eight attributes considered in multiple regression model, regression coefficients of education and extension contacts are found to be positively significant at 1% level of significance.

It was found that education and extension contact were positively and significantly contributing in shaping farmers' accessibility of ICT tools. This suggests that by enhancing these

aspects, farmers' access and use of the ICT tools will improve as well. Young farmers used to be more efficient in handling ICT tools than the elder ones. More the younger a person is, more he will accept new changes and try new technologies like ICTs (Kumar et al., 2017). Similar finding was reported by Panda et al., (2019) with respect to the farmers in West Bengal, where correlation coefficient of various farmers' attributes like education, socio-economic status, extension contact, mass media exposure, scientific orientation, economic motivation, and risk orientation were found positively and significantly associated with the attitude towards ICT tools. whereas, age was found negatively and not significantly correlated.

CONCLUSION

The proclivity of behaviour toward access of ICT tools can usher in a new era of information-based technology intervention in agriculture. The present study highlighted farmers' accessibility to ICT tools, as well as the effect of 'armers' attributes on it. The farmer's favourable access toward better using ICT technologies is enhanced by the family's educational status and economic wealth. Extension contacts are crucial markers for establishing favourable access toward successful ICT tool. As a result, future policy implications related to the development of positive attitudes among farmers toward accessibility and appropriate use of ICT tools need to consider perspectives such as high level of education and extension contacts besides other significant attributes of farmers like diversified occupation, income, diversified agricultural activities in farming system and exposures to mass media.

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Constraints in Adoption of Scientific Fish Farming in Nagaon District, Assam

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ABSTRACT

The study is conducted at two randomly selected development blocks of Nagaon district, Assam viz. Rupahi and Kaliabor Block during 2019-2021 to find out the constraints faced by the farmers in adoption of scientific fish farming. A total of 50 farmers from each of the selected blocks were finally selected through simple random sampling. A structured questionnaire consisting of 20 questions was used to collect responses about scientific fish farming problems and related information specifically based on preliminary survey as well as focus group discussions and Constraint Index (CI) was calculated. Lack of quality fish seed of required size and number at the time of stock (CI 1.66) in both Kaliabor and Rupahi blocks were the most common constraint and poaching of fish (CI 0.05) was the least common constraint. It was also observed that most of the adopters in the studied area were within the age group of 18 to 30 years which calls for better entrepreneurship and employment generation.

INTRODUCTION

Fish production plays a crucial role in socioeconomic status of rural population in India. It is not only a rich source of protein and quality food which provide nutritional securities, but also a well-known fact that it is an important source of income for millions of rural farmers, especially women (Jacinto, 2004). The sector is also a major source of livelihood for a large section of economically weaker section in the country. Share of agriculture and allied activities in the GDP is constantly declining (Islam et al., 2006) and it has been observed that agriculture sector is gradually diversifying towards high value enterprises including fisheries (Anonymous, 2011). The Fishery sector has also been a part of a significant role in various socio-economic development programmes, self-employment, income generation and also in providing nutritional security to every sections of the people of Assam and Nagaon is such a district in the state which has a vast aquatic resource with immense potential as well as the involvement in the sector is much great. Also, this study will help to bring out constraints and bottlenecks in adoption of scientific technology and

also provide recommendation of a suitable aquaculture technology to the farmers for the socio-economic development of the community.

METHODOLOGY

Two development blocks viz. Rupahi block (26° 25' 0" North Latitude, 92° 44' 0" East Longitude) and Kaliabor block (26°54' North Latitude, E 93°10' East Longitude) were randomly selected from Nagaon district of Assam. The study was carried out from 2019 to 2021 and during the study a list of fish farmers was prepared from each of the selected blocks in consultation with fishery officials of respective blocks. Out of the prepared list, 50 farmers from each of the selected blocks were finally selected through simple random sampling. Altogether 100 fish farmers were selected as sample. A pilot survey was also conducted among 30 farmers following authoritative sampling (Kothari, 2004) with an open ended questionnaire to identify the problems of scientific fish farming to understand their degree of seriousness.

A structured questionnaire consisting of 20 items were used to collect responses from respondents about scientific fish farming

problems and related information specifically based on preliminary survey as well as focus group discussions. The questionnaire was distributed among 100 fish farmers. The perceived levels of responsiveness to various problems in the adoption of scientific fish farming practices were collected from the farmers through the questionnaire.

Constraint index (CI) was developed as suggested by Angral (2017). This index measured and compared the constraints expressed by different respondents.

$$CI = \frac{SC \times 2 + C \times 1}{N}$$

Where, SC = Severe constraints, C = Constraint, N = Total number of respondents

The constraints themselves were classified into 3 sets viz; severe, most severe and no constraints. The Constraint index was recorded on a 1 to 6 point scale, with 6 being the most severe and 1 being the least severe. The relevant data collected were tabulated and analyzed using different statistical tools of SPSS package.

RESULTS AND DISCUSSION

It was observed that lack of quality fish seed of required size and number at the time of stock (CI 1.66) in both Kaliabor and Rupahi blocks the most common constraint. Furthermore, lack of facilities for water and soil testing (CI 1.42), frequent occurrence of flood in the particular area (CI 1.41), high cost of feed (CI 1.39) and disease outbreaks (1.31) were some of the major concerns for the fish farmers faced while adopting scientific fish farming. The study shows that the factor of flood occurrence is more prominent in the selected development blocks of Nagaon District of Assam. Bhuyan et al., (2017); Dutta et al., (2019) also observed that occurrence of flood contributes to the loss of fish stock in Assam. It was also observed that, the perceived cost of medicine was very high in the observed district leading to a major problem at the time of occurrence of disease. Other major problems which were

perceived by the fish farmers were lack of proper distribution channels (CI 1.25), high cost of carried-over seeds (CI 1.14), low selling price at farm front (CI 1.09) and exploitation by middleman (CI 1.02). It was appraised that adequate marketing channels were not available in the study areas. Although in both the study area, fish has a high consumer preference and has a potential market but unavailability of organized distribution channel made it difficult for the fish farmers to sell the commodity. In both the surveyed blocks of Nagaon district, the fish farmers were marketing the fish through middlemen who took away lions' share of their profits leaving a meager amount for the fish farmers. Das and Goswami (2002) also mentioned the lack of efficient marketing structure as a major constraint perceived by the fish farmers of Nagaon and Morigaon districts of Assam. Das et al., (2014) and Chander & Rathod (2020) also focused on market driven approach and FPOs for better marketing. Another important observation was the absence of good quality brooders during breeding (CI 0.91) and difficulty in identifying good quality fish seed (CI 0.89) which are very important for scientific fish farming. Au & Enderwick (2000) explained that six beliefs, namely, compatibility, enhanced value, perceived benefits, adaptive experiences, perceived difficulties and suppliers' commitments, affect the cognitive process that determines the farmers' attitude towards technology adoption. The present study showed positive correlation with main occupation, scientific orientation, perceived difficulties, knowledge and problems and supplier's commitment. The study further revealed that were some other problems faced by fish farmers. Difficulty in institutional credit (CI 0.81), and irregular monsoon (CI 0.71) were also a matter of concern to the fish farmers. Similar constraints were reported on the perceived problems of few communities of Andhra Pradesh in adopting composite fish culture by Mandal et al., (2011); Dutta et al., (2019). The banks and financial institution were not granting the institutional credit for fisheries department for the reason best known to them which correlates with the findings of Angral et al.,

Table 1. Constraints faced by farmers in adoption of scientific fish farming

S.No.	Constraints	Constraint Index (CI)	Rank
1	Lack of quality fish seeds of required size and number at the time of stock	1.66	1
2	Difficult to identify good quality fish seed	0.89	12
3	Non availability of formulated feed	0.69	15
4	Difficulty in getting good brooders during breeding	0.91	11
5	Lack of fishery input supplier in the locality	0.37	18
6	Lack of facilities for soil and water testing	1.42	2
7	High cost of fingerlings/carried over seeds	1.14	8
8	Cost of fish medicine is high	1.28	6
9	High cost of feed	1.39	4
10	Low Selling price at farm front	1.09	9
11	Difficulty in getting institutional credit	0.81	13
12	Inadequate number of visits of extension personnel to farm site	0.52	16
13	Exploitation by middlemen	1.02	10
14	Inadequate training programme on fish culture	0.35	19
15	Low water retention capacity of soil	0.46	17
16	Irregular Monsoon	0.71	14
17	Occurrence of flood	1.41	3
18	Lack of proper distribution channel	1.25	7
19	Poaching of fish	0.05	20
20	Outbreak of disease	1.31	5

(2017). As far as the irregular monsoon was concerned, the fish farmers also need to adjust the work calendar of scientific fish farming or induced breeding programme with the changing monsoon which was also observed by Bhuyan et al., (2017). The factors which least bothered the fish farmers were inadequate visit of extension personnel to farm site (CI 0.52), lack of fishery input supplier (CI 0.37), inadequate training (CI 0.35) and poaching of fish (CI 0.05). It was also observed that most fish farmers were satisfied with the extension machineries although a few percentages of them had a problem. It was perceived that training was arranged in the district headquarters where, it was not possible for them to participate due to a number of reasons.

The current findings and focused discussions indicate that younger age fish farmers, had greater access towards extension machineries and financial freedom were more inclined towards adoption of scientific fish farming which correlates with the findings of Nirmalkar et al., (2022). These finding are also in line with Dutta et al., (2019). Further, greater adoption was observed from the farmers who had a propensity to increase their income and sustain in this area which also correlates with the works of Haque & Ray (1985); Biswas et al., (1991); Ghosh et al., (1993); Talukdar & Sontaki (2005).

CONCLUSION

It is observed that a maximum number of the adopters in both the studied area had a great exposure and a high degree of extension participation and financial motivation. Economic advantages of scientific fish farming need to be clearly highlighted to persuade fish farmers to undertake scientific fish farming. The observations of the prevailing study may assist all stakeholders related to fisheries sector in Nagaon district to take suitable steps to inspire and assist the fish farmers and triumph over the discovered issues confronted by them.

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Test to Measure the Attitude of Horse Stakeholders Towards Horse Keeping

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ABSTRACT

A scale was constructed and standardized to measure the attitude of horse keepers towards horse management using Thurstone's "equal-appearing interval" method from March 2021 to September 2021. Several attitude statements concerning the psychological object i.e., horse management were collected. 36 experts responded unbiasedly to the 22 attitude statements. On the basis of scale values and Q-values, only 8 statements were incorporated in the final attitude scale. When administered in a non-sample area, the reliability coefficient of the whole test was 0.88 in Spearman-Brown formula. The content validity was computed using index of reliability formula and it was 0.93. When the constructed attitude scale was administered among 60 horse stakeholders (horse keepers, veterinarians and NGOs) from October 2021 to April 2022, majority (66%) of the respondents had unfavourable attitude towards horse keeping which is evident from the declining horse population in India. The developed attitude scale can be applied practically for identifying the attitude of horse keepers which will aid policy-makers in right decision-making.

INTRODUCTION

Horses (*Equus caballus*) are the most prominent and significant equine species owing to their predominant role in shaping human civilization. They are believed to be the first domesticated animal in India. From being companions to kings and nobles, gradually horses became available to anyone who can afford it. Horses were increasingly used for transportation and sporting events all over the world. Horses are the species most differentiated into breeds throughout the world (Hall & Raune, 1993). When a group of horses has distinctive characteristics that are transmitted consistently to their offspring, they are referred as horse breeds. There are more than 300 horse breeds in the world today (Hedge & Wagoner, 2004). According to Khadka (2010), of the total horse breeds in the world, 22.60 per cent horse breeds are "at risk" and 11.50 per cent are extinct completely.

The rapid mechanization of transportation and agriculture after industrial revolution overshadowed the immense role played by horses in human civilization. More attention is being given to

develop horse breeds for sports and leisure activities. On the basis of geographical localization, three horse breeds (Marwari, Kathiawari and Kachchhi-Sindhi) has been characterized in India. These are the horses found in northwestern region of India and are used for transportation and sports (Pal et al., 2021). The onset of farm mechanization in India gave rise to higher food grain production and productivity; but decline in the population of working horses. According to the Indian livestock census 2019, there is a decline of horses and ponies population of about 45.58 per cent from the Indian livestock census 2012. This population decline of upto 50 per cent is contributed by various factors like increasing management costs, modern means of transportation and lack of organized scientific breeding practices. Looking into this heavy decline in horse population, it is imperative to study the attitude of horse stakeholders towards horse management. Attitude is considered as an important determinant of acceptance or rejection of a psychological domain (Gupta et al., 2020). It is the most indispensable concept in social psychology and plays a vital role in behavioural change (Sasmitha et al., 2021, Gupta et al., 2022).

Thurstone (1946) defined attitude as the degree of positive or negative affect (feeling) associated with some psychological object like symbol, phrase, slogan, person or ideas towards which people can differ in varying degrees. Equal-appearing interval scale developed by Thurstone (1929) was adopted in scale construction (Edwards, 1969). The specific steps delineated by Selltiz et al., (1976) in construction of Thurstone's attitude scale were followed in this study. Thus, an attitude scale has been constructed, standardized and administered to measure the attitude of horse stakeholders towards horse management.

METHODOLOGY

Large number of statements conceived to be related to horse management were gathered from literature, discussion with scientists and veterinarians. These statements were screened by following Edward's informal criteria for attitude statements (1969). Out of these large number of statements, 22 generalised attitude statements which were unique and relevant were chosen and arranged for judges' rating. All the 22 statements were mailed to 60 judges who comprised of extension scientists, veterinarians, equine scientists and equine welfare agencies from Haryana and Rajasthan state in April 2021. Out of the 60 judges, 42 judges responded to the 9-point continuum from 'least favourable' to 'most favourable'. The number of categories in this study was reduced from 11 to 9, as a greater number of categories makes judging difficult. Only 36 judgements were considered for computation of scale values and Q values and the remaining 6 responses were rejected owing to its biased judgement by the respective experts. The scale values and Q values were computed for 22 statements by applying the formula given by Thurstone & Chave (1929).

$$S = l + \frac{(0.50 - \Sigma pb)}{pw} \times i$$

where, S = the median or scale value of the statement
l = the lower limit of the interval in which the median falls,
 Σpb = the sum of the proportions below the interval in which the median falls,
pw = the proportion within the interval in which the median falls,
i = the width of the interval and is assumed to be 1.0

$$Q = C_{75} - C_{25}$$

where Q = Interquartile range, C_{75} – the 75th centile,

$$C_{75} = l + \frac{(0.75 - \Sigma pb)}{pw} \times i$$

$$C_{25} - \text{the 25}^{\text{th}} \text{ centile, } C_{25} = l + \frac{(0.25 - \Sigma pb)}{pw} \times i$$

The scale reliability was analysed by applying Spearman-Brown formula (split-half method) in SPSS software.

$$r_t = \frac{2r_h}{1 + r_h}$$

Where, r_t – reliability coefficient of the whole test

r_h – correlation between the two halves

Validity of the scale was analysed with the help of index of reliability.

Index of reliability, $r_{1\infty} = \sqrt{r_1}$

Where, r_1 – reliability of the scale

The total sample size of the study was 60 comprising of the horse stakeholders from North-western India (Haryana, Punjab, Gujarat and Rajasthan) sampled randomly from the list of horse stakeholders who availed training at ICAR-NRCE, Hisar in 2020-21.

RESULTS AND DISCUSSION

The final statements for inclusion in the attitude scale were selected by following the criteria given by Thurstone and Chave. i) Statements with large Q values were eliminated. ii) The scale values should have equal-appearing intervals. iii) Even representation of the universe of opinions. iv) More or less equal distribution of favourable and unfavourable attitudes. Based on these criteria, 8 statements with serial numbers 7, 19, 9, 17, 4, 15, 11 and 1 of the original list of 22 statements were selected. The range of scale values of the eight selected statements was from 1.81 to 4.83 and the range of Q-values was from 1.20 to 1.71. These limits were set arbitrarily for each scale construction based on the obtained scale values and Q-values. The final attitude scale on horse management along with its scale values and Q-values were given in Table 1.

Reliability and validity of the scale

Split-half method was employed to determine the reliability of the constructed attitude scale since it was considered as the best method to measure reliability (Garrett, 1979). This split-half method was developed by Charles Spearman and William Brown in 1910. Reliability refers to the consistency with which the scale measures what it aims to measure. The eight selected statements

Table 1. Final set of attitude statements selected

S.No.	Item No.	Scale value	Q value	Statement	Nature of statement
1.	7	1.81	1.20	Vaccination is beneficial for horse health.	Positive
2.	19	2.50	1.42	Insufficient medicines available for horse treatment.	Negative
3.	9	2.75	1.48	Sufficient income can be generated by the sale of horses.	Positive
4.	17	3.25	1.67	Adequate veterinary facilities for horses in India.	Positive
5.	4	3.90	1.71	Horse management is cost-effective.	Positive
6.	15	4.50	1.22	Exotic breeds should be promoted in our country.	Negative
7.	11	4.63	1.31	Artificial Insemination (AI) is better than natural services in horses.	Positive
8.	1	4.83	1.18	Horses are reared for pleasure over business.	Negative

were divided into two equal halves by following odd-even method. The part which contains the statements 1,3,5 and 7 were considered as part 1 and the part containing the statements 2,4,6 and 8 were considered as part 2. The two halves of the test were administered separately to 30 horse keepers in a non-sample area.

The reliability coefficient of the whole test was 0.88 in Spearman-Brown formula and 0.87 in Guttman formula for internal consistency. Since the reliability score is greater than 0.60, according to Kumar et al., (2015); Kumar et al., (2016) when the purpose of the test is to compare the means of the two groups of narrow range, a reliability coefficient of 0.50 or 0.60 would suffice and hence the constructed scale is reliable. Validity of the scale (what it intends to measure) was computed using index of reliability formula and was found to be 0.93. The index of reliability implies that the test measures true ability of the subjects to the extent of 93 per cent.

Administration of the scale

The constructed scale was then incorporated in an interview schedule for horse keepers, veterinarians and NGOs. After recording the responses, the scoring was done with the help of the method proposed by Eysenck & Crown (1949). Each of the statements in the scale were provided with a 4-point continuum response from 'strongly agree', 'agree', 'disagree' to 'strongly disagree'. The scoring pattern of positive and negative statements are shown in Table 2.

The first statement is positive with a scale value of 1.81. If a horse stakeholder strongly agrees with it, the score for the statement was computed as 1.81 multiplied by 4; which is 7.24. Following this method, the scores for all the statements were calculated. The

summation of all the scores were done to arrive at the attitude score of each horse stakeholder.

Attitude of horse stakeholders

It was found that the attitude score of the respondents ranged from 65 to 112 as mentioned in Table 3. By classifying the entire data into three classes (Unfavourable, Favourable and Most favourable) with a class interval of 16, the degree of attitude of each respondent is identified. More than half of the respondents had unfavourable attitude towards horse management which can be directly correlated with the declining horse population in India. Moreover, the lockdown due to COVID – 19 situation also triggered unfavourable attitude towards horse management when access to, for example, veterinary care, horse feed and adequate outdoor exercise spaces was limited (Ratschen et al., 2020). Around 26 per cent of the respondents had favourable attitude towards horse management. These respondents have easy access to veterinary facilities and are young. Only 6 per cent of the respondents had highly favourable attitude towards horse management because of their entrepreneurial capability. They are generating sufficient income from composting horse dung and organizing horse riding classes in schools. Another interesting finding is horse keepers are more optimistic about horse keeping than professionals like veterinarians or NGOs involved in horse welfare.

Table 4 reveals that majority (96.60%) of the horse stakeholders agreed or strongly agreed that vaccination is vital for maintaining a horse healthy and 83.40 per cent of horse stakeholders believed that sufficient income can be generated from horse keeping.

Table 2. Scoring of attitude statements

S.No.	Statements	Scale values	Scores			
			Strongly agree	Agree	Disagree	Strongly disagree
1.	(+) Vaccination is beneficial for horse health.	1.81	(4)	(3)	(2)	(1)
2.	(-) Insufficient medicines available for horse treatment.	2.50	(1)	(2)	(3)	(4)

Table 3. Frequency of respondents under various degrees of attitude towards horse management

S.No.	Attitude score	Degree of attitude	Horse keepers		Veterinarians		NGOs		Total	
			No.	Percent	No.	Percent	No.	Percent	No.	Percent
1.	65 to 80	Unfavourable	25	65.78	13	65	2	100	40	66.66
2.	81 to 96	Favourable	10	26.31	6	30	0	0	16	26.66
3.	97 to 112	Most favourable	3	7.8	1	5	0	0	4	6.66
		Total	38	100	20	100	2	100	60	100

Table 4. Attitude of horse stakeholders on each attitude statement

S.No.	Statements	Strongly agree	Agree	Disagree	Strongly disagree
1.	(+) Vaccination is beneficial for horse health.	29(48.30%)	29 (48.30%)	1 (1.70%)	1 (1.70%)
2.	(-) Insufficient medicines available for horse treatment.	4(6.70%)	26(43.30%)	23 (38.30%)	7 (11.70%)
3.	(+) Sufficient income can be generated by the sale of horses.	10 (16.70%)	40(66.70%)	9 (15%)	1 (1.70%)
4.	(+) Adequate veterinary facilities for horses in India.	9(15%)	23(38.30%)	26 (43.30%)	3(5%)
5.	(+) Horse management is cost-effective.	6 (12%)	40 (66.70%)	11 (18.30%)	0
6.	(-) Exotic breeds should be promoted in our country.	3 (5%)	25 (41.70%)	19 (31.70%)	13 (21.70%)
7.	(+) Artificial Insemination (AI) is better than natural services in horses.	14(23.30%)	31(51.70%)	12 (20%)	3 (5%)
8.	(-) Horses are reared for pleasure over business.	3 (5%)	27 (45%)	23 (38.30%)	7 (11.70%)

Most of the 60 horse stakeholders acknowledged the efficiency of Artificial Insemination over natural services in horses (75% agreed or strongly agreed). Among the interviewed horse stakeholders, almost 50 per cent indicated the advantages of exotic horse breeds in Indian horse industry whereas the remaining half per cent were having problems with the promotion of exotic horse breeds in India. Regarding accessibility to medicines and veterinary services, the respondents had divided opinion with equal share of them having favourable and unfavourable attitude. This finding agrees that most of the veterinary services received by farmers are curative in nature, rather than preventive (Pal et al., 2011).

When queried about the entrepreneurial opportunities in horse keeping, 50 per cent of the respondents agreed with the business arena present in this animal. The remaining 50 per cent of the respondents denied the remunerative nature of horse keeping. This implies that an equal per cent of horse stakeholders are rearing it for pleasure over profit.

CONCLUSION

The aim of this study was to provide insight into the attitude level of horse stakeholders towards horse keeping in North-western India, the breeding tract of Indian horse breeds. The results of this research will assist the veterinary department in framing appropriate strategies for stabilizing horse population in India. It is imperative to organize workshops and trainings for horse keepers to bring about favourable attitude towards horse management which will directly influence the population growth of horses. Horse keeping is increasingly becoming unaffordable to an average Indian due to inaccessible veterinary services and disease diagnostic facilities. Collaboration between different horse stakeholders is necessary for timely assistance to horse keepers. Several entrepreneurial options surrounding these companion animals like eco-tourism, equestrian sports, etc. has to be explored economically because more the animal is reared for pleasure, great is its decline.

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Development of Scale to Measure Sunflower Farmers' Perception on Public and Private Extension Systems

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ABSTRACT

To measure the perception of sunflower farmers on public and private extension systems, a scale was developed with Likert's summated rating technique during 2021-22. A list of 35 and 41 items regarding public and private extension systems, respectively were sent to 300 experts for their relevancy using google forms and personal follow up. Based on 45 experts' ratings, the relevancy percentage (RP), Relevancy Weightage (RW) and Mean Relevancy Scores (MRS) were estimated. Eighteen and 22 items with RP > 70, RW > 0.70 and overall MRS > 2.39 and > 2.44 were considered for item analysis regarding public and private extension systems, respectively. These items were administered to 60 farmers. Based on t-value (≥ 1.75) resulting from item analysis, 13 and 17 items were finally retained in the public and private extension systems scales, respectively. The Cronbach's alpha value was 0.71 and 0.74, Guttman split half method was 0.70 and 0.74 and Spearman-Brown coefficient was found to be 0.70 and 0.75 regarding public and private extension systems, respectively which showed high reliability. The validity and reliability measures of the scales indicated the precision and consistency.

INTRODUCTION

Agricultural extension services are being provided by public and private extension systems in India. Public extension services are provided by the respective state agricultural departments and Directorate of Extension at national level. The Indian Council of Agriculture Research (ICAR) through its institutes and KVKs and the State Agricultural Universities (SAUs) through the agricultural research stations and KVKs enable frontline extension at the district level. Private extension services are mostly delivered by input marketing companies such as seeds, fertilizers, pesticides and farm machinery through their dealers and marketing staff and contact farmers.

Sunflower due to its declining trend in area and production is not being considered as a major oilseed crop and hence much emphasis was not laid in technology transfer by the agriculture

department. Lack of commodity-based extension for crops such as sunflower is also a major constraint in effective technology transfer. The public extension system if any, related to sunflower is limited to distribution of subsidized inputs (on a limited scale) to progressive farmers. Small holder farmers, for whom the extension services are intended, rarely form pressure groups to pressurize for better extension services either at the state or the central level. Despite the weak and uncoordinated extension services, sunflower crop has potential to contribute substantially to the oilseed kitty. As the sunflower crop is being neglected or given limited attention by the public extension system, private sector operators are starting to provide extension services, selling inputs and purchase raw materials from the farmers. Although, private funding in extension is desirable for specific commodities, where there are buy-back arrangements, public support will be needed to ensure extension services for farmers growing other food and commercial crops in a

sustainable and equitable way. Hence, to understand the farmers' perception of public and private extension systems, scales were developed in the present study.

METHODOLOGY

The Summated Ratings method developed by Likert (1932) was used in the development of the measuring instrument. Based on the review of literature, 45 and 60 items regarding public and private extension systems, respectively were collected and edited based on criteria suggested by Edward (1957). After editing 35 and 41 items were retained for scale construction under public and private extension systems, respectively. Mahaliyanaarachchi et al., (2006) also initially taken 41 items for the development of scale. The items were sent to 300 experts in the field of extension education through mail and personal contacts for their critical evaluation of each item. The experts were requested to give their responses on a three-point continuum viz., highly relevant, relevant, and irrelevant with scores 3, 2 and 1, respectively. Out of 300 experts, only 45 experts responded in time and their relevancy score was ascertained by adding the scores on rating scale. From this data relevancy percentage, relevancy weightage and mean relevancy scores were calculated for all the items.

Relevancy percentage was calculated by summing up the scores of most relevant and relevant categories, which were converted into percentages whereas, Relevancy weightage (RW) was obtained by the formula

$$RW = \frac{MR+R+IR}{MPS}$$

Mean Relevancy Score (MRS) was obtained by the following formula

$$MRS = \frac{MR+R+IR}{N}$$

Whereas, MR = Most Relevant (3), R = Relevant (2), IR = Irrelevant (1), MPS = Maximum possible score ($45 \times 3 = 135$), N = Number of Judges (45)

Using these three criteria, the items were screened for their relevancy. Accordingly, items having relevancy percentage > 70, relevancy weightage > 0.70 and overall mean relevancy score > 2.39 and > 2.44 for public and private extension systems respectively,

were considered for final selection. Helen & Khaleel (2009) also followed the same procedure. By this process, 18 and 22 items were isolated in the first stage, which were suitably modified and rewritten as per the comments of experts. Item analysis was carried out on 60 farmers and their responses were taken on a five-point continuum viz., strongly agree (5), agree (4), undecided (3), disagree (2) and strongly disagree (1) with scores indicated in parenthesis for positive items and vice-versa for negative items.

The perception score of the respondent was obtained by adding up the scores of all items in the scale. Based on the total summated scores, respondents were arranged in descending order. Respondents with highest total scores (top 25%) and lowest total scores (bottom 25%) were made into two groups. The two groups provided the criterion groups in terms of which item analysis was carried out. Thus, out of 60 respondents, 15 respondents with high scores and 15 respondents with low scores were selected. The critical ratio was calculated by t-test. The 't' values were calculated by using the formula suggested by Edward (1957). Thakur et al., (2017); Kumar & Popat (2009) also followed the same procedure.

RESULTS AND DISCUSSION

Based on the t test values, items with t-value ≥ 1.75 were selected and retained in the final scale for measuring perception of farmers on public (Table 2) and private extension (Table 3) systems.

For standardization of the scale, reliability and validity were estimated. For testing reliability, Cronbach alpha (α), Guttman split-half method and Spearman-brown coefficient were used. The α values for public and private extension systems were 0.71 (Table 2) and 0.74 (Table 3), respectively. Kumar et al., (2021); Priyadarshni et al., (2021) also used α for testing reliability. For testing the reliability by Guttman split-half method the scales were split into two halves on the basis of odd and even number of items and administered to 60 farmers. Thus, two sets of scores were obtained. The scores obtained were 0.70 (Table 1) and 0.74 (Table 1) for public and private extension systems, respectively. The Pearson's product moment correlation coefficient was calculated. The value of correlation coefficient was 0.57 (Table 1) and 0.60 (Table 1) for public and private extension systems, respectively, and this was further corrected by using Spearman's Brown formula and the reliability coefficient of the whole set was obtained. The r-value for scales were 0.70 (Table 1) and 0.75 (Table 1) for public and private extension systems, respectively, which was significant

Table 1. Reliability statistics of perception scales for measuring farmers perceptions of public and private extension systems

Reliability Statistics			Public extension system	Private extension system
Cronbach's Alpha	Odd number items	α value	0.53	0.64
		N of items	7 ^a	9 ^a
	Even number items	α value	0.59	0.50
		N of items	6 ^b	8 ^b
	Total N of items		13	17
Correlation between forms			0.57	0.60
Spearman-brown coefficient	Equal Length		0.70	0.75
	Unequal Length		0.70	0.75
Guttman split-half method			0.70	0.74

a = Items with odd numbers; b = Items with even numbers

Table 2. Final scale for measuring farmers' perception of public extension system

S.No.	Public Extension System	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	α if item deleted
1.	The main objective of public extension is to create awareness about government schemes or programmes on sunflower crop	42.25	49.65	0.28	0.70
2.	Public extension assists sunflower farmers in planning and decision making of agricultural activity	42.12	47.49	0.45	0.68
3.	Public extension system provides advisory services on sunflower to farmers and solves their problems	42.23	49.98	0.29	0.70
4.	Public extension is overloaded with many programmes leading to poor dissemination of technical information on sunflower*	42.12	47.97	0.43	0.68
5.	Public extension staff conducts the programs according to situation, season and farmers needs in sunflower	41.98	50.32	0.25	0.70
6.	In public extension, regular campaigns and trainings are organized to update the knowledge level of the sunflower farmers	41.97	50.98	0.20	0.71
7.	Public extension collaborates with other departments to provide effective services to sunflower farmers	41.85	51.18	0.22	0.71
8.	Public extension caters to the requirement of small and marginal sunflower farmers*	42.00	49.42	0.32	0.70
9.	Public extension services supply timely inputs to sunflower farmers based on their needs	42.22	48.34	0.37	0.69
10.	Public extension system helps to bring socio-economic transformation of sunflower farmers in rural areas	42.33	46.80	0.44	0.68
11.	Public extension services are highly credible	42.23	49.13	0.31	0.70
12.	Only resourceful sunflower farmers can get the benefit of public extension services*	42.38	47.80	0.35	0.69
13.	Excess of political interference hinder the public extension services to reach the actual sunflower farmers*	42.12	46.51	0.41	0.68
Overall α					0.71

*Negative items; SA = Strongly Agree, A = Agree, UD = Undecided, DA = Disagree, SDA = Strongly Disagree

Table 3. Final scale for measuring farmers' perception of private extension system

S.No.	Public Extension System	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's α item deleted
1.	Personnel of private extension system can solve sunflower farmer's problems in time	56.37	72.74	0.24	0.73
2.	Private extension system provides demand-driven service in sunflower	56.27	72.74	0.31	0.73
3.	Private extension system provides improved technology to the sunflower farmers	56.45	69.03	0.45	0.71
4.	Private extension system charges sunflower farmers for their services	56.62	73.09	0.20	0.74
5.	Private extension personnel help sunflower farmers in processing of their produce	56.48	73.17	0.24	0.73
6.	Private extension system demonstrates the worth of new technology under local conditions in sunflower crop	56.47	70.69	0.32	0.73
7.	In private extension system, emphasis is more on documentation of success stories of sunflower farmers	56.62	71.39	0.29	0.73
8.	Private extension services on sunflower crop are very costly*	56.52	69.03	0.40	0.72
9.	Private extension system is profit motive*	56.55	73.44	0.24	0.73
10.	Private extension system ensures timely supply of required quality inputs to the sunflower farmers	56.80	69.15	0.44	0.71
11.	Private extension system increases the output quality and quantity of the products and helps to get higher income for sunflower farmers	56.45	73.40	0.22	0.73
12.	Sunflower farmer has more confidence in private extension services for increasing their yields	56.58	71.87	0.25	0.73
13.	Private extension services have personal bias towards large farmers*	56.48	67.51	0.51	0.71
14.	Only resourceful sunflower farmers can get the benefit of private extension service*	56.18	74.93	0.16	0.74
15.	Sunflower farmers are unknowingly exploited in private extension system	56.43	67.98	0.47	0.71
16.	Private extension system always recommends to use their products for sunflower crop	56.25	72.33	0.27	0.73
17.	Private extension system helps in developing better relationship between extension personnel and sunflower farmers	56.48	67.91	0.46	0.71
Overall α					0.74

*Negative items; SA = Strongly Agree, A = Agree, UD = Undecided, DA = Disagree, SDA = Strongly Disagree

at 0.01 % indicating high reliability of the scales. Kumar et al (2016); Shitu et al., (2018); Gupta et al., (2022); Singh et al., (2021); Rajeshwari & Dolli (2020) followed Spearman-Brown coefficient for testing the reliability. Data analysis was done with (Statistical Package for Social Sciences) (SPSS) 20. software.

Validity

Content validity was ensured while selecting perception items. Due care was exercised in selecting and wording the items to cover all the relevant aspects of public and private extension systems. Thus, ensuring a fair degree of content validity. Kumar & Ratnakar (2016); Saravanan & Gowda (1999) used content validity for testing the validity.

The final perception scales regarding public and private extension systems consisted of 13 and 17 items, respectively. Ghadei (2010) finally selected 22 items for the scale. The responses had to be taken on a five-point continuum viz., strongly agree (5), agree (4), undecided (3), disagree (2) and strongly disagree (1) with scores indicated in parenthesis for positive items and vice-versa for negative items.

Each respondent's perception score must be computed by adding the scores of he or she obtained on all the items. For each respondent, the minimum and maximum scores will range between 13 to 65 and 17 to 85 for public and private extension systems, respectively. The higher the score, the more favourable perception, the respondent feels towards the extension systems.

CONCLUSION

Scales to measure the perceptions of sunflower farmers on public and private extension systems were developed. The precision and consistency of the scales were ascertained through standard procedures and their reliability and validity were established. Even though commodity-based extension systems do not operate in general and oilseeds perse, the scales can be employed to understand the farmers perception of public and private extension systems pertaining to sunflower crop. The scales can also be used to understand the farmers' perceptions of public and private extension systems pertaining to other crops and other areas with suitable modifications in the items.

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