ISSN 0971-3123
Online ISSN 2456-1282
CODEN: JEEOBM:35(1): 6939-6994

Journal of Extension Education

Vol. 35 January - March 2023 No. 1

Inside

Included in UGC-CARE list of Quality Journals

Published by
Extension Education Society(EES)
Tamil Nadu Agricultural University Campus, Coimbatore - 641 003.
http://www.extensioneducation.org

Extension Education Society is established to promote the cause of Extension Scientists in India by (i) Providing a forum for Extension Scientists to meet periodically for discussion, exchange of information, findings and experiences on different aspects on agricultural extension education, (ii) Publishing a quarterly journal called "Journal of Extension Education" and (iii) such other means consistent with the aims of society as the Executive Committee decides.

Membership is open to persons with specialisation in Extension Education and who are professing the discipline, subject to approval of the Executive Council.

Copies of the journal are supplied free to all members of the society. The rate of subscription is as follows:

Life Member (7 Years)	-	Individual	:	Rs. 4000.00	$160
Annual Member	-	Individual	:	Rs. 750.00	$50
Annual Subscription	-	Other faculty members	:	Rs. 750.00	$50
		Institution Jan - Dec	:	Rs. 5000.00	$200
	-	Single copy	:	Rs. 150.00	$20

JOURNAL OF EXTENSION EDUCATION
AUTHOR GUIDELINES

- The Journal of Extension Education (JEE) is the official refereed journal of the Extension Education Society. It accepts articles representing original work, analytical papers and papers grounded in theory in the field of Extension Education. Articles should relate to emerging issues, cite appropriate literature, and draw out implications for extension education.
- Invariably all the authors of article should be the members/subscribers (annual /life) of the Journal of Extension Education, which should be mentioned during registration
- Please be informed that only papers that are uploaded using the online submission system of Journal of Extension Education (JEE) will be considered. Sending papers as email attachments to the journal will not be considered.
- To submit a paper, you need to log in to JEE site, **www.extensioneducation.org** which requires you to be registered. If you are not registered, please complete the form on our registration page (which will log you in after it is submitted). If you are registered, please go to the paper submission page (which will ask you to log in if you are not already logged in).
- Before uploading a paper for consideration for publication in JEE, please check that the content is relevant by reading other articles in JEE.
- The submission must follow the most recent version of the APA style guide (For detailed information, please see the Publication Manual of the American Psychological Association, 6th edition, http://www.apastyle.org/ and http://blog.apastyle.org)
- An abstract is required for an article submission. Please be sure to complete the text box for an abstract in the submission's metadata section. All articles should include an abstract of not more than 120 words.
- Please see the Submission Preparation List for specific guidelines.
- Authors must include their profile, including affiliation and rank, when submitting a manuscript.
- Only one submission by an author will be considered at a time.
- Please ensure that your article does not contain work taken from other sources without the appropriate acknowledgements.
- Page printing charges: All the authors whose papers are accepted for publication are required to pay page printing charges.The rate list of page printing charges will be supplied to authors along with the acceptance letters by mail. JEE, however, does not collect 'article submission fees'.
- Submissions that fail to meet these guidelines will not be considered for publication in JEE
- Clarifications, if any in this regard can be obtained from the Chief Editor at **editorextension@gmail.com**

Journal of Extension Education
Vol. 35 No. 1, 2023

CONTENTS

FROM THE EDITOR'S DESK

My dear readers of Journal of Extension Education,

Wish you all a happy and prosperous New Year !

Recently I had a chance to interact with the Post Graduate and Doctoral scholars of Agricultural Extension at Tamil Nadu Agricultural University on 'literature search' in agricultural extension; A few tasks assigned to the students as part of a practical exercise were, to frame the research questions, list out the key areas, identify the relevant primary, secondary and tertiary literature sources and finally evaluate shortlisted sources using the **CRAAP test**. In this era of information overload, research scholars find it difficult to evaluate the credibility of the information collected, without an instrument. The CRAAP test, developed by Meriam Library at California State University is an instrument that can be used to evaluate the information with a list of questions, a few of which are given below (Meriam Library, 2010).

Currency: ***The timeliness of the information.***

- When was the information published or posted?
- Does your topic require current information, or will older sources work as well? Are the links functional?

Relevance: ***The importance of the information for your needs.***

- Does the information relate to your topic or answer your question?

Authority: ***The source of the information.***

- Who is the author/publisher/source/sponsor?
- What are the author's credentials or organizational affiliations?
- Is the author qualified to write on the topic?
- Is there contact information, such as a publisher or email address? Does the URL reveal anything about the author or source? Such as : .com .edu .gov .org .net

Accuracy: ***The reliability, truthfulness and correctness of the content.***

- Where does the information come from?
- Is the information supported by evidence?
- Has the information been reviewed or refereed?
- Can you verify any of the information in another source or from personal knowledge?
- Does the language or tone seem unbiased and free of emotion?
- Are there spelling, grammar or typographical errors?

Purpose: ***The reason the information exists.***

- What is the purpose of the information? Is it to inform, teach, sell, entertain or persuade?
- Is the information fact, opinion or propaganda?
- Does the point of view appear objective and impartial?
- Are there political, ideological, cultural, religious, institutional or personal biases?

Besides the research scholars, the extension professionals also can employ this test while seeking information for satisfying their information-needs.

This issue of JEE has papers on topics such as socio-economic determinants of dairy farmers' knowledge in Uttar Pradesh and dairy entrepreneurial ecosystem in Kerala. Do send your feedback on these papers to *editorextension@gmail.com*.

(D PUTHIRA PRATHAP)
Chief Editor

RESEARCH ARTICLE
Journal of Extension Education
Vol. 35 No.1, 2023
DOI: https://doi.org/10.26725/JEE.2023.1.35.6940-6950

Socio-economic Determinants of Dairy Farmers' Knowledge on Dairy Farming Practices in Uttar Pradesh, India

Saurabh Sharma[1], Herojit Singh[2] and Sabbithi Pavan[3]

ABSTRACT

The study was carried out among dairy farmers of Balamau block of Hardoi district of Uttar Pradesh to assess the socio-economic landscape and dairy farming practices. Utilizing a multistage purposive cum random sampling approach, data from 60 dairy farmers were collected and analyzed. Findings revealed diverse socio-economic backgrounds and educational levels among farmers, influencing their farming decisions. Buffalo predominated the livestock, with significant variations in milk production of cross breeds. Reproductive parameters underscored opportunities for improvement. Correlation and regression analyses elucidated education, training participation, social participation and scientific orientation as pivotal predictors of knowledge level in dairy management. Higher education and greater participation in training sessions were associated with better management practices. The study emphasizes the significance of education, continuous learning and scientific orientation in optimizing dairy farming practices and enhancing industry profitability offering valuable insights for stakeholders in the field. Regression analysis explained 62.10% of knowledge variation, emphasizing education, family type, training, social participation, and scientific orientation.

Keywords: *Dairy farming; Socioeconomic factors; Livestock diversity; Animal care methods; Calving timing; Cooperative milk enterprises; Uttar Pradesh*

INTRODUCTION

India, a prominent player in global milk production, represents roughly 20 per cent of the world's milk output. This sector has become a vital source of income for millions of rural households, particularly small-scale and landless farmers (Economic Times, 2015). In contrast, Hardoi district in eastern Uttar Pradesh faces distinct challenges due to lower rainfall compared to neighboring areas. This climate has led to reduced agricultural productivity, frequent crop failures, and diminished farmer incomes (Kochewad, 2017). However, dairy farming presents an opportunity for income diversification within local communities. Low milk production per animal in this region is primarily due to traditional farming practices and limited knowledge of modern dairy management techniques. Acquiring knowledge of improved practices is essential for boosting livestock production. Numerous studies across India stress the importance of adopting scientific dairy management to enhance productivity. Therefore,

[1]Department of Agricultural Extension Education, Nagaland University, SAS, Medziphema campus, (Nagaland), India.
[2]Department of Agricultural Economics, SAS, Nagaland University, Medzipnema campus (Nagaland), India.
[3]Department of Entomology, SAS, Nagaland University, Medzipnema campus (Nagaland), India.

Submitted: 02.12.2023 **Accepted:** 11.03.2024

conducting surveys in rural areas is vital to assess the adoption of these practices. Understanding the current situation and promoting modern dairy management techniques can foster sustainable growth in the sector, improving the economic status of dairy farmers, not only in Hardoi but also in similar regions.

The present study aims to fill this knowledge gap by comprehensively assessing the socio-economic profile of dairy farmers, their knowledge of dairy management, the output and breeding status of dairy animals in Balamau block of Hardoi district. Our goal is to contribute to the gaps in knowledge on dairy farming practices among farmers so as to provide insights to policy formation and interventions for sustainable growth in the dairy sector. Ultimately our efforts aim to enhance the livelihoods of rural communities in this region and beyond.

METHODOLOGY

The present study conducted in the year 2022-23, aimed to analyze dairy farming practices among individuals owning more than four milch animals within selected villages of Balamau block, located in the Hardoi district of Uttar Pradesh, India. The study utilized an *ex-post facto* research design and employed a multistage purposive cum random sampling approach. To ensure representativeness, the study employed a stratified random sampling design. From the 19 blocks in the Hardoi district, Balamau block was purposively chosen as the focus area. From the selected block, six villages were randomly chosen, resulting in a total of six villages for the study. Within these villages, dairy farmers owning more than four or more milch animals constituted the sampling frame. Ten farmers were randomly selected from each village, totaling 60 units for data collection. Out of a total of 305 livestock, 80 were indigenous cows, 34 were mix-crossbred cows and 191 were the buffaloes. Data collection was conducted using a meticulously designed interview schedule, which underwent pilot testing to validate its efficacy. Feedback from the pilot study led to refinements in the interview schedule, particularly addressing confusing questions and optimizing the time and length of the interview. Personal interviews were conducted in the early morning to ensure accessibility and foster cooperation with the farmers, facilitating comprehensive data collection. The collected data underwent thorough analysis using various statistical tools, including frequency and percentage calculations, as well as correlation and multiple regression analysis, utilizing SPSS software. These analytical techniques enabled meaningful interpretation of the data, contributing to the study's overall value and significance. It highlighted the importance of factors such as breed selection, feeding practices, healthcare management and economic factors affecting dairy farmers' decision-making processes.

FINDINGS AND DISCUSSION

Socio-Economic Status of the Respondents

Table 1 offers valuable insights into the socio-economic characteristics of dairy farmers, shedding light on their demographic, educational and experiential profile as well as their land holding, housing conditions, diversified enterprises and income levels (Kumar et al. 2023). A significant portion, 56.67 per cent, belonged to the Other backward class category with 25.00 per cent in the general category, 16.67% among the Scheduled Caste (SC) and only 1.67% representing the Scheduled Tribe (ST) category. This distribution suggests a diverse representation of social categories among dairy farmers. The higher OBC representation suggest that this group tends to adopt dairy enterprise as a major earning resource than other groups (Vekariya et al. ,2016).

In education 48.33 per cent had primary education, while 33.33 per cent had graduate and

above educational qualifications. Additionally, 16.70 per cent completed secondary education and only 1.70 per cent were illiterate. These educational levels indicate a diverse range of educational backgrounds among dairy farmers. Farmers with higher education levels may be more inclined to adopt modern farming practices and innovations. To leverage this educational program tailored to the needs of illiterate and less-educated farmers can be designed to uplift the entire farming community. These findings are also aligned with that of Kochewad (2017).

About 66 per cent had a medium level of experience in dairy farming while 16.67% had low and high levels of experience respectively. Farmers with medium experience may exhibit a balance between traditional and modern practices. These findings also aligned with Khode et al. (2021). However, the relatively low percentage of highly experienced farmers suggests that the industry could benefit from knowledge transfer and mentoring programmes to ensure the sustainability of dairy farming practices. A similar trend was observed by Gangasagare et al., 2009 with 54.17 per cent. Pertaining to the farming lands 75.00 per cent of farmers had irrigated lands while 25.00 per cent had un-irrigated/rainfed lands. Access to irrigation can significantly impact crop and fodder production (Chapman et al. , 2008). Farmers with irrigated lands may have better fodder availability and consequently, higher milk production. Investment in irrigation infrastructure and water management could further enhance the productivity of dairy farms. About 65.00% lived in concrete roof houses 33.33% in tin roof houses and 1.67% in thatched roof houses. Housing conditions are indicative of overall well-being. Farmers with better housing may have higher socio-economic stability. Efforts to improve housing conditions for all farmers could contribute to enhanced living standards and well-being. Regarding occupational/entrepreneurial engagements over 50.00% were solely involved in dairy-related activities while 22.58% combined dairy with goatry 19.35% integrated dairy with poultry, 6.45% embraced dairy and mushroom farming and 1.61% ventured into Dairy + Poultry + mushroom. Farmers practicing mixed farming may have diversified income sources reducing risks associated with fluctuations in dairy prices. Encouraging such diversification and providing training in integrated farming practices could enhance resilience. These studies are also aligning with the research of Ahirwar et al. (2016). Financially, the majority (55.00%) fell into the medium-income group, followed by 35.00% in the low-income bracket, and a notable 10.00% in the high-income category. This complex economic spectrum among dairy farmers adds depth to the multifaceted nature of their livelihoods. Income levels may reflect access to markets, productivity, and resource availability. Strategies to increase income for low-income farmers, such as value addition and market linkages, could help improve their livelihoods.

Table 1: Dairy Farmers' Socio-Economic Status

Sl. No.	Characteristics	Frequency	Per centage
1	**Category**		
	General (OPEN)	15	25.00
	Other backward class (OBC)	34	56.67
	Scheduled tribe (ST)	1	1.67
	Scheduled caste (SC)	10	16.67

Sl. No.	Characteristics	Frequency	Per centage
2	**Educational status**		
	Illiterate	1	1.70
	Primary	29	48.33
	Secondary	10	16.70
	Graduate & above	20	33.33
3	**Experience in Dairy farming**		
	Low (up to 10 years)	10	16.67
	Medium (between 11 to 20 years)	40	66.67
	High (above 20 years)	10	16.67
4	**Type of land**		
	Irrigated	45	75.00
	Rainfed	15	25.00
5	**Household type**		
	Thatched roof and mud-brick walls	1	1.67
	Metal roof	20	33.33
	Cement concrete	39	65.00
6	**Enterprises performed along with dairy**		
	Dairy	31	50.00
	Dairy + Goatry	14	22.58
	Dairy + Mushroom	4	6.45
	Dairy + Poultry	12	19.35
	Dairy + Poultry + Mushroom	1	1.61
7.	**Annual income**		
	Low-income families (Up to Rs. 1,00,000)	21	35.00
	Middle income level families (Rs. 1,00,001 to 2,00,000)	33	55.00
	High income (Above Rs. 2,00,000)	6	10.00

Table 2 provides a comprehensive overview of the livestock population nurtured by dairy farmers shedding light on the types of animals, their production status, animal husbandry practices, average milk selling and milk production patterns. The data presented in this table offers valuable insights into the dynamics of dairy animal production in the surveyed area. Buffalo dominated the scene at 62.62 per cent closely followed by indigenous cows at 26.23 per cent and crossbred cows at 11.15%. The prevalence of buffalo in the dairy sector

suggests their suitability for milk production in the region (Mandi et al., 2022). To enhance dairy productivity initiatives to improve the genetic potential of indigenous and crossbreed cows may be beneficial. This could lead to an increase in the proportion of crossbreed cows over time this study is also aligning with World agriculture group (2009) findings. Regarding milking pregnant animals, they constituted a significant portion at 61.64%, followed by milking non-pregnant animals at 32.46%. The Dry and dry non pregnant animals made up only 3.93% and 1.97% of the heard respectively. The high percentage of milking pregnant animals indicates a focus on milk production, while the presence of dry animals suggests the need for better reproductive management. There is potential for increasing the efficiency of milk production by addressing reproductive health and nutrition in dry animals. The low adoption of practices like de-worming and mineral mixture feeding suggests opportunities for capacity building and awareness campaigns among dairy farmers. Increasing the adoption of these practices can contribute to healthier animals and higher milk yields (Gaur et al., ,2011) reported a higher rate of 88.67% for consistent vaccination, indicating the need for more awareness and education. Additionally, only 27.74% provided mineral mixture feed regularly to their dairy animals, suggesting room for improvement (Gadhavi et al., 2020). The survey also explored milk utilization patterns. A substantial 61.67% opted to sell their milk to co-operative dairies, while 23.33% sold to direct customers. Khoa making centers accounted for 11.67%, and government dairies attracted 3.33%. These diverse practices highlight the dynamic nature of the dairy industry, offering insights for further analysis and strategic planning. The preference for co-operative dairies by a majority of farmers may indicate trust in these institutions and possibly better remuneration. Expanding and strengthening co-operative dairies could further incentivize dairy farmers to enhance their milk production. The average daily milk production (kg) for 24 crossbred cows of the heard was 9.65 kg and 148 buffaloes of the heard was 6.50 kg, while for 40 indigenous cows of the heard was 3.01 kg. According to Singh, 2016 the average daily milk yield was 5.35 liters for crossbred cows and 3.29 liters for native animals. The significant difference in milk production between indigenous and crossbred cows highlights the potential for crossbreeding programmes to improve overall milk production. Efforts to promote crossbreeding while ensuring the well-being of indigenous breeds can be explored (Sharma et al. , 2013).

Table 2: Status of Dairy Animal Production

Sl. No.	Characteristics	Frequency	Percentage
1	**Dairy animal**		
	Indigenous cow	80	26.23
	Mix crossbred cow	34	11.15
	Buffalo	191	62.62
2	**Production status of dairy animal**		
	Milking non-pregnant	99	32.46
	Milking pregnant	188	61.64
	Dry pregnant	12	3.93
	Dry non-pregnant	06	1.97

Sl. No.	Characteristics	Frequency	Percentage
3	**Animal husbandry practices followed by the farmer**		
	Mineral mixture feeding	53	27.74
	De-worming	33	17.27
	Vaccination	205	54.97
4	**Selling pattern of milk**		
	Direct customer	14	23.33
	Co-operative dairy	37	61.67
	Government dairy	2	3.33
	Khoa making centre	7	11.67
5	**Average per day milk production (kg)**		
	Indigenous cow	3.01	-
	Crossbred cow	9.65	-
	Buffalo	6.50	-

Table 3. depicts the essential reproductive parameters like number of services per conception, age of first calving. The average age at first calving (AFC) for indigenous, crossbred cows was 48 months and 32 months respectively. The AFC for buffaloes was 36 months. The number of services per conception for indigenous and crossbred cows was 1.66 and 1.58 respectively and that for buffaloes was 1.68. The AFC has adverse effect on lactational milk yield. The AFC can be reduced with standard feeding practices. The reproductive parameters being less heritable, can be managed with standard managemental and husbandry practices. This highlights the need for acquiring knowledge about dairy management, underlining the importance of field training for dairy enterprise. The importance of dairy enterprise for farming community makes training an unavoidable part of the dairy enterprise.

Table 3: Dairy Animal Reproductive Characteristics

Dairy Animal Type	Indigenous cow		Crossbred cow		Buffalo	
	First calving age (months)	Number of services per conception	First calving age (months)	Number of services per conception	First calving age (months)	Number of services per conception
Values	48	1.66	32	1.58	36	1.68

The table also indicates the potentials for enhancing milk production, improving animal husbandry and health practices and optimizing marketing strategies to benefit the farmers. Only through collaborative efforts of stakeholders, policy makers and researchers, we can unlock the full potential of dairy sector to benefit the dairy farmers.

Table 4: Correlation between Independent Variables and Dependent Variable, Knowledge of Dairy Farmers N=60

Sl. No.	Independent Variables	Coefficient of Correlation Knowledge (r)
1.	Age	0.156 NS
2.	Education	0.446**
3	Experience in Agriculture	-0.356**
4.	Type of family	0.453**
5.	Socio-economic status	-0.126 NS
6.	No. of training attended	-0.346**
7.	Landholding (ha)	0.573**
8.	Social participation	-0.131 NS
9.	Scientific orientation	0.504**

*** P < 0.01 * P < 0.05 NS = non-significant*

Table 4 indicates that there is a negative but non-significant correlation (r = -0.156) between the age of dairy farmers and their knowledge level regarding management practices. The association between age and knowledge of dairy management practices was not found to be statistically significant. This aligns with the results reported by Arora, 2006 and Sharma et al., 2018. and we concur with their findings. Education is recognized as a pivotal factor in the success of any enterprise. In the current study, our findings reveal a positive and highly significant correlation (P < 0.01) between education and knowledge. Similar results were reported by Arora, 2006 and Fuerst waltl et al., 2018 substantiating the idea that education significantly influences the level of knowledge in the context of dairy management practices.

The current findings clarify that the experience in agriculture and the number of training sessions attended exhibit a negative but highly significant correlation with knowledge level of the dairy farmers. This suggests that the experience in agriculture and the attendance of training sessions play a crucial role in shaping the knowledge level of dairy farmers. Similar results were noted in the studies conducted by Gaur (2008).

In contrast, Soodan et al. (2020) reported correlation coefficients for various factors such as age (0.107), education (0.231), experience in agriculture (0.086), type of family (0.265), land holding (0.126), number of training sessions attended (0.137), land holding (0.360), social participation (0.165), and scientific orientation (0.257).

It was found that the type of family has a positive and highly significant correlation (P < 0.01) with knowledge. This aligns with similar findings (Singh et al., 2010). Additionally, land holding was found to have a positive and highly significant correlation with knowledge. This could be attributed to advanced payments from the dairy, subsidies on purchasing dairy animals, and low-interest loans provided by the dairy cooperative. The study also indicated that socio-economic status and social participation show a negative and non-significant correlation with knowledge. This may be due to the favorable agricultural conditions in Balamau including irrigation, productive soil, and a favorable climate, as well as effective marketing of agricultural products. Similar results were observed by Hundal et al. (2016) and Razzaq et al. (2011). Scientific orientation is crucial, contributing to an increase in the knowledge level of dairy farmers and the eventual adoption of improved management practices. The research highlights that a positive and highly significant correlation exists between

the scientific orientation and knowledge. This can be attributed to the cooperative dairy's efforts in providing information about enhanced dairy management practices through activities like health camps, demonstration camps, livestock shows, dairy shows and entrepreneur training. These findings align with those reported by Singh et al. (2014).

The correlation coefficients for independent variables like age, socio-economic status, and social participation showed a range from negative and not significant to highly significant. This strongly indicates that these factors are indeed constraints affecting the acquisition of knowledge about managing dairy animals.

Table 5. Regression Co-efficients

Sl. No.	Variables	Coefficients	SE (b)	t value
1	Age	-0.013	0.014	-1.071
2	Education	0.09*	0.041	2.671
3	Experience in Agriculture	0.004	0.009	0.529
4	Type of Family	-0.050	0.018	-3.827
5	Socio-economic status	-0.089	0.079	-1.142
6	Number of trainings attended	0.072*	0.031	1.662
7	Landholding (ha)	-0.216	0.416	-0.531
8	Social Participation	0.254*	0.095	2.816
9	Scientific Orientation	0.025*	0.020	2.401

Table 6. Analysis of Variance

Source of Variation	DF	Sum of Squares	Mean Squares	F-Calculated	Significance
Regression	9	4.360	0.507	4.462	0.01358
Residual	15	3.440	0.165		
Total	24	9.000			

R- square value: 0.6210, Multiple R-value: 0.7353

Table 5 shows that the regression analysis considered nine independent variables. The R-squared value, which is 0.6210, indicates that these variables together account for 62.10% of the variation in the knowledge level. Among these nine variables, education, number of trainings attended, social participation, and scientific orientation displayed significant results at the 0.05 and 0.01 percent levels . For education, the positive coefficient of 0.09 suggests that higher education levels are linked to a better knowledge level. This underscores the importance of

investing in education for enhancing marketing strategies in agriculture. Similarly, the variable number of trainings attended has a positive coefficient of 0.072, indicating that attending more training sessions is associated with an increase in the knowledge level.

In the regression model, the number of training sessions attended had a coefficient of 0.072. This means that for each additional training attended, the knowledge level was expected to increase by 0.072 units. These findings align with the observations made by Subha et al. (2022) and Rao et al. (2009). Social participation showed a positive coefficient of 0.254, indicating that active engagement in social activities related to agriculture positively influenced the knowledge level. Collaborating and networking within the agricultural community are beneficial for enhancing knowledge about marketing. Scientific orientation also had a positive coefficient of 0.025, emphasizing that a stronger scientific approach to farming is linked to a higher knowledge level. Adopting evidence-based practices is crucial for effective agricultural marketing strategies. The study's findings were supported by other researchers, adding credibility to the identified relationships. The results can guide policymakers, educators, and agricultural professionals in developing strategies to improve marketing skills, disseminate knowledge, and encourage social engagement in agriculture. The text briefly mentions the training needs of a group in dairy management practices, highlighting the importance of expertise in areas like breed improvement, feeding management, and general entrepreneurial skills for success in commercial dairy management. Overall, the study underscores the significance of education, continuous learning, social engagement, and scientific orientation in enhancing dairy management practices, providing valuable insights for stakeholders in the field.

CONCLUSION

The study offers insights into the socio-economic landscape and dairy farming practices in the Balamau block of Hardoi district, U.P. The educational background, and varied occupational engagements underscore the complexity of this sector. The findings offer insights into reproductive parameters, adoption of scientific management and animal husbandry practices for improvement & optimization. The alignment of our results with previous research enhances the credibility of our findings, holding significant implications for dairy sector policies and interventions. Prioritizing education and awareness, particularly in animal health practices, is crucial for dairy farmers' progress. Promoting enhanced breeding techniques and addressing age at first calving challenges, can bolster productivity. The findings also reveal that poultry and mushroom enterprises need heightened focus, milk cooperative societies and cross breeding programmes need to be expanded which are crucial for the industry's growth.

REFERENCES

Ahirwar, M., Singh, H. S., Patel, R., Kumar, M., & Mondal, M. K. (2016). Socio-personal and economic profile of peri-urban and rural dairy farmers in Rewa district of Madhya Pradesh. *International Journal of Agricultural Sciences*, *8*(63), 3548-3551.

Arora, A. S. (2006). Socio-economic and communication variables associated with the level of knowledge and degree of adoption of improved dairy husbandry practices. *Indian Journal of Dairy Science*, *59*, 337-343.

Chapman, D.F., Kenny, S.N., Beca, D., & Johnson, I.R. (2008). Pasture and forage crop systems for non-irrigated dairy farms in southern Australia. *Agricultural Systems*, *97*(3), 108-125.

Chauhan, P. D., Srivastava, H. D., Ankuya, K. J., Prajapati, R. K., & Paregi, A. B. (2018). Healthcare Management Practices Followed by Dairy Farmers of Aravalli District of North Gujarat. *International Journal of Current Microbiology and Applied Sciences*, *7*(11), 1129-1135.

Economic Times. (2015). Crop failure and below-normal rains bring down farmers' purchasing power. Retrieved from https://economictimes.indiatimes.com/news/economy/agriculture/crop-failure-and-below-normal-rains-bringsdown-farmers-purchasingpower/articleshow/49345007.cms?from=mdr

Fuerst-Waltl, B., Lang, B., & Fuerst, C. (2018). Economic values for a total merit index of dairy goats in Austria. *Journal of Land Management, Food and Environment*, *69*(2), 97–104. doi:10.2478/boku-2018-0009.

Gadhavi, D. N., Sorathiya, L. M., Rathva, A. L., Patel, V. R., & Patel, N. M. (2020). Study of prevailing healthcare management practices in specialized dairy farms. *Pharma Innovation Journal*, *9*(4), 18-22.

Gangasagare, P. T., & Karanjkar, L. M. (2009). Status of milk production and economic profile of dairy farmers in the Marathwada region of Maharashtra. *Veterinary World*, *2*(8), 317-320.

Gaur, M. L., & Pathodiya, O. P. (2008). Constraints perceived by farmers in goat rearing. *Indian Journal of Animal Science*, *78*(1), 124-126.

Gaur, M. L., Gaur, B., Gupta, B. R., Prakash Gnana, M., Sudhaker, K., & Reddy, V. R. (2011). Housing, breeding and management practices of Mahabubnagar goats. *Indian Journal of Animal Science*, *81*(8), 875-879.

Hundal, J. S., Singh, U., Singh, N., Kansal, S. K., & Bhatti, J. S. (2016). Impact of training on the knowledge level of goat farmers in Punjab. *Haryana Veterinary*, *55*(1), 47-49.

Khode, N., Singh, B. P., Chander, M., Bardhan, D., Verma, M. R., & Awandkar, S. P. (2021). Effects of Dairy Farm Training: A Path Analysis. *Indian Journal of Extension Education*, *57*(4), 7-12.

Kochewad, S. A. (2017). Effect of socio-economic traits on the level of knowledge of dairy farmers. *International Journal of Agricultural Science Research*, *7*(1), 287-292.

Kumar, A., Chandel, B. S., Dixit, A. K., Tiwari, S., Haritha, K., & Kumar, M. (2023). Distribution and Preference of Selected Dairy Breeds among Farmers of Bihar: A Socio-economic Analysis. *Indian Journal of Extension Education*, *59*(3), 85-89.

Mandi, K., Chakravarty, R., Ponnusamy, K., Kadian, K. S., Dixit, A. K., Singh, M., & Misra, A. K. (2022). Impact of Jharkhand State Cooperative Milk Producers' Federation on Socio-economic Status of Dairy Farmers. *Indian Journal of Extension Education*, *58*(2), 47-52.

Rao, M. S., & De, D. (2009). Dimensions of entrepreneurial behavior. *Indian Journal of Extension Education*, *45*(1&2), 16-20.

Razzaq, A., Ali, T., Saghir, A., Arshad, S., & Cheema, A. (2011). Training need assessment of poultry farmers in Tehsil Faisalabad. *Journal of Animal and Plant Sciences*, *21*(3), 629-631.

Sharma, K., Yadav, J. P., & Yadav, V. P. S. (2013). Constraints faced by dairy farmers in the adoption of dairy husbandry practices. *Indian Journal of Social Research*, *54*(6), 561-567.

Singh, C. V. (2016). Cross-breeding in cattle for milk production: Achievements, challenges, and opportunities in India-A review. *Advances in Dairy Research*, *4*(3), 1-14.

Singh, J. P., Gangwar, Singh, P., & Pandey, B. K. (2010). Design and development to integrated farming system module for livelihood improvement of small farm holders of western plain zone of M.P. *Journal of Farming Systems Research and Development*, *16*(1&2), 90-96.

Singh, R., Nain, M. S., Sharma, J. P., Mishra, J. R., & Burman, R. R. (2014). Institutional convergence of synergistic strengths for developing women agripreneurs. *Indian Journal of Extension Education*, *50*(3&4), 1-7.

Soodan, J., Kumar, S., & Singh, A. (2020). Effect of goat rearing on farmers' income. *International Journal of Livestock Research*, *10*(8), 89-97.

Subha, L., Sarbani, D., Bibhuti, M., Biswajit, S., & Abhiram, D. (2022). Communication behaviour analysis of the member farmers of Farmer Producer Organizations (FPOs). *Biological Forum - An International Journal*, *14*(1), 1656-1660.

Vekariya, S. J., Kumar, R., Savsani, H. H., Kotadiya, C. R., & Chaudhari, G. M. (2016). Socio-economic profile of Maldhari dairy farmers of south Saurashtra region. *Current Agriculture Research Journal*, *4*(2), 186-190.

RESEARCH ARTICLE
Journal of Extension Education
Vol. 35 No.1, 2023
DOI: https://doi.org/10.26725/JEE.2023.1.35.6951-6960

Dairy Entrepreneurial Ecosystem of Kerala, India

S.R.Shyam Suraj

ABSTRACT

During the recent times, studies on entrepreneurship are found to shift their focus from entrepreneur-centered to environment-centered; outlining the role of entrepreneurial ecosystem in creating productive entrepreneurship. An attempt was made to map the dairy entrepreneurial ecosystem of Kerala state in India, to understand the actors and factors, functional stages of the actors and the linkages among them. The methodology followed was desk research, key informant interviews and focus group discussions. Mapping exposed the major actors under the financial, support, technology, human capital, culture and legal domains; and factors were direct, partially direct and indirect. The actors were grouped under the different functional stages of ideation, establishment, survival, early and late growth and maturity; as well as their linkages were portrayed. The findings shall enable appropriate planning and interventions to refurbish the ecosystem for a more dynamic dairy entrepreneurial development.

Keywords: *Entrepreneurial ecosystem; dairy; factors; actors; linkages; roles; Kerala*

INTRODUCTION

Entrepreneurial Ecosystem usually abbreviated as 'EE' is the recently emerged systemic view of entrepreneurship. This new concept has its roots from the studies relating to clustering of innovation and regional innovation systems (RIS). Stam (2015) defined Entrepreneurial Ecosystem as 'a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship within a particular territory'.

It is advocated that the research system should map and understand the evolving entrepreneurial ecosystem (EE) in agriculture and allied sectors; and increase the understanding on entrepreneurship (Prasad, 2018). Hence a primary effort was made to map the entrepreneurial ecosystem of the dairy sector of Kerala (India) to determine the actors and factors contributing to dairy entrepreneurship in the state and study their relationship with the dairy entrepreneur. Kerala was chosen for the study owing to several valid reasons, the prominent among them being the award which it received as the best state in raising milk productivity instituted by India Today Agro-Summit and Awards 2018; the performance getting linked with affirmative dairy entrepreneurship and the contributing dairy entrepreneurial ecosystem (DEE). Also, the state was ranked high in dairy progressiveness (Kale et al, 2016) and milk marketing infrastructure (Mohapatra and Sendhil, 2020), which are key to the dairy entrepreneurial ecosystem. Looking

College of Dairy Science and Technology, KVASU, Thiruvananthapuram – 695 040 (Kerala)
Submitted: 27.09.2023 **Accepted:** 08.04.2024

into the depressing aspect, Kerala was also hit by floods during 2018 and dairy sector was worst affected (Arun and Senthilkumar. 2021).

According to GIZ (2018), mapping is the process of observing, analysing and visualizing the entrepreneurial ecosystem. Auerswald (*2015*) suggests that we map an entrepreneurial ecosystem as a relational inventory of participants and how they are connected. The relationships can be differentiated by type, direction and magnitude of interaction. In short, mapping helps to identify central players, key relational structures and linked domains of capabilities. If validated by entrepreneurs and sectoral experts, ecosystem maps are valuable tools in developing strategies. Accordingly, this study was taken up.

METHODOLOGY

The present mapping was done to record the dairy entrepreneurship scene in the given context and plot the relations and interactions between its elements. The data collection included desk research, key informant interviews and focus group discussions. Desk research included the collection of secondary information from government departments and state universities. Thirty Key Informant Interviews were conducted with two members each from the various stakeholders in the dairy sector including government and cooperative officials, banks, universities, dairy entrepreneurs/farmers and consumers. Five Focus Group Discussions were performed with groups of animal husbandry department officials, dairy department officials, dairy cooperative secretaries, dairy farmer groups and milk consumer groups. The data was analysed and along with other collected information, the ecosystem was pictured using appropriate visualization tools (tables and figures). Two key informants each from 15 different dairy stakeholder categories were interviewed and 10 focus groups discussions were conducted to collect data. The stakeholders included dairy entrepreneurs, government department officials, dairy co-operative secretaries, banks and grama panchayat members etc. The initial data collected from key informants was analysed, discussed and finalized in the focus group discussions.

The factors affecting the dairy entrepreneurial ecosystem were portrayed in line with the PESTEL analysis; acronym for political, economic, social, technological, ecological and legal factors (Walsh, 2005). Additionally, market factors were also included in the dairy entrepreneurial ecosystem along with other factors. Also depending on their influence on entrepreneurship; these factors were direct, partially direct and indirect (ANDE, 2013). Direct factors had immediate and straight influence on dairy entrepreneurial ecosystem; while partially direct though had straight effect, was not on regular basis. Indirect factors were those whose effect was unfamiliar to the entrepreneur; and were imperceptible and made an isolated appearance. The actors of the dairy entrepreneurial ecosystem were grouped into seven categories: financial, support, technology, market, human capital, culture and legal according to the ecosystem domain classification given by Isenberg (2011) with minor modifications. The functional stages of dairy entrepreneurship were expressed as per the six stages given by Kahan (2013) which included ideation (pre-establishment), establishment, survival, early growth, rapid growth and maturity or decline.

The relationship and flow of information (strong or weak) among the actors were mapped to enable reflection and action on refining the information flow leading to better system performance; as the frequency of contact of dairy entrepreneurs with information sources were found to be medium in Kerala (Shyam and Kadian, 2022). Actor-Linkage Matrix developed by Biggs

and Matsaert (2004) was used to explore linkages between the actors. Here the various actors of the ecosystem were listed along the vertical and horizontal axes and the key informants were asked to express the linkage scores as per their information and experience. The cells in the matrix represented the linkage expressed as the mean scores given by the key informants in a continuum of 3, 2, 1 for linkage strength and 0 for no linkage. The mean scores i.e., the total scores divided by the number of respondents, represented strong linkage (2.1-3.0), medium linkage (1.1-2.0), weak linkage (0.1 to 1.0), no linkage (0) and also blank (do not know) between the actors in the rows to actors in the columns as applied by Prasad and Sulaiman (2004) in their study on fodder innovation systems. The overlapping roles of actors, a weakness of the ecosystem was displayed qualitatively using Venn diagrams (Paradi, 2012) as they make the distinction visually clear for the audience. The overlapping shapes were given in circles and role title was inserted to show what was common to both shapes. Narrations followed to clarify the details of overlapping.

FINDINGS AND DISCUSSION

Factors of the Dairy Entrepreneurial Ecosystem

Table 1 represents the key factors affecting dairy entrepreneurship in Kerala. The most important directly influencing factors were milk price and bank loans (economic), market identification and marketing methods (market), attitude of officials and subsidies (political), experience and family labour (socio-cultural), knowledge and inputs (technological) and license of farm and purchase of animals from outside state (legal). Co-operative and food safety laws were only partially influencing legal factors. Training and mechanization were partially influencing; while R & D and waste disposal were indirectly affecting technological factors.

Media support and women participation in dairying were partially direct socio-cultural factors of entrepreneurship; while rural-urban differences and social status were indirect. Fund flow to the sector and milk inflow from other states was partially direct political factors; while welfare funds and govt. policies were indirect. Insurance and loan interest were partially direct; and record keeping was an indirect economic factor. Consumer demand was a partially direct market factor while milk pricing and agent's commission were indirect factors. It was also seen that there were only slight differences in the effect of certain direct and partially direct factors; particularly economic, market and technological factors.

Table 1: Key factors affecting Dairy Entrepreneurial Ecosystem

Factors	Degree of Influence		
	Direct	Partially Direct	Indirect
Political	Loan Norms Government Subsidies Attitude of officials	Plastic ban Milk inflow from other states Fund flow to the sector	Welfare Funds Command over co-ops Government policies

Factors	Degree of Influence		
	Direct	Partially Direct	Indirect
Economic	Bank loan Milk price Production cost By-products	Insurance Loan interest	Record keeping
Socio-cultural	Family labor Rearing practices Experience and awareness	Media support Women participation	Rural-urban difference Social status
Technological	Inputs Knowledge Advisory services Hygiene Diseases	Training Mechanization Management	Research and development
Ecological	--	--	Climate change Natural disasters Waste disposal
Legal	License Animal purchase Pollution	Cooperative Laws Food Safety Laws	Taxes
Market	Market identification Marketing methods	Consumer demand	Milk pricing Agents commission

Actors of the Dairy Entrepreneurial Ecosystem

Table 2 displays the various actors forming part of the dairy entrepreneurial ecosystem of Kerala state. The actors included individuals, groups, formal and informal institutions and organizations. Financial actors consisted of banks, money lending private agencies and friends/relatives who were sources of finance to the dairy entrepreneur. Support system actors were the Government departments (Dairy Development, Animal Husbandry, Rural Development etc.), public sector undertakings (Kerala Livestock Development Board, Kerala Feeds Ltd, Kerala Dairy Farmers Welfare Fund Board etc.), input agencies and utility service providers giving input in the form of product, services or infrastructure facilities to support the dairy entrepreneur. Actors providing technology were the Government departments, *Krishi Vigyan Kendras* (KVK) and Universities (Kerala Veterinary and Animal Sciences University - KVASU and Kerala Agricultural University - KAU) in the form of consultancy and training.

Table 2: Important Actors of the Dairy Entrepreneurial Ecosystem

Actor Category						
Financial	**Support**	**Technology**	**Market**	**Human Capital**	**Culture**	**Legal**
Nationalized banks	Government departments	Government Departments	Kerala Cooperative Milk Marketing Federation	Family Labor	Neighbors	Food Safety and Standards Authority of India
Cooperative banks	Public Sector Undertakings	*Krishi Vigyan Kendras*	Private Agencies	Skilled Labor	Media	Pollution Control Board
Money lending agencies	Input agencies	Universities	Milk vendors	Unskilled Labor	Dairy farmer	Local Self Governments
Friends and relatives	Utility services	Private Agencies	Consumers FPOs	--	Family members	--

The market actors were Kerala Cooperative Milk Marketing Federation-KCMMF (referred as MILMA), dairy cooperatives and private dairies providing marketing channels; and consumers. Family labour and skilled/unskilled labour were the human capital actor category. Family, neighbours, media and fellow dairy farmers were the cultural actors. Local Self Governments (comprising grama/village, block and district panchayats), Food Safety and Standards Authority of India (FSSAI) and State Pollution Control Board were the legal actors.

Functional stages of actors

Fig. 1 depicts the functional stage of the actors in dairy entrepreneurship in the state. The role of input agencies was from the establishment to the rapid growth stage. Establishment of the dairy enterprise required the support of input agencies for purchase of equipment; animals etc. followed by the role of feed, fodder and medicine suppliers during the next three stages (survival, early growth and rapid growth). The role of Kerala Veterinary and Animal Sciences University (KVASU) was during the ideation and establishment stage where the entrepreneurs consult the university experts for training and guidance for prior knowledge and opening the enterprise. The role of MILMA and dairy co-operatives were mainly in marketing and hence their role was from survival to maturity stage. The role of Kerala Livestock Development Board (KLDB) was during ideation, establishment and survival. The agency provided training to the dairy entrepreneurs and rendered inputs like semen and fodder seeds.

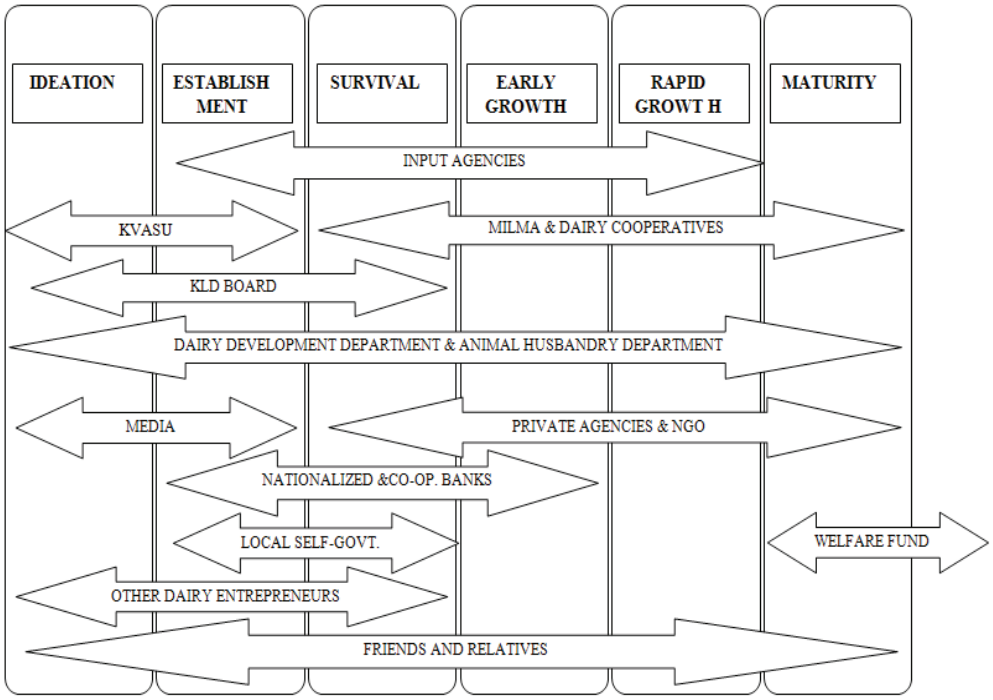

Figure 1: Actors and their functional stages in Dairy Entrepreneurship

The role of two major government departments – Dairy Development (DDD) and Animal Husbandry (AHD) were important in all the six stages of dairy entrepreneurship. These two departments had a day-to-day involvement in dairy entrepreneurship through schemes, services, training and extension. Under DDD functions, the Kerala Dairy Farmers Welfare Fund Board (KDFWFB), which provided pension to dairy farming community; a function performed even after the decline/maturity stage of entrepreneurship. The role of media was significant during the ideation and establishment stages for information and education. The role of private agencies marketing milk extended from the survival to maturity stage. Non-Governmental Organizations (NGOs) taking up dairy related activities functioned similar to private agencies; except that they contributed to ideation too. Banks had a role mainly from establishment to early growth. Local self-government institutions supported dairying mostly during establishment and survival. Fellow dairy entrepreneurs were important for ideation, establishment and survival. Friends and relatives supported the dairy entrepreneurship during all the six stages, which was inevitable. The roles played by the actors were expressed in terms of their significance at each stage; however, it may also extend to other stages at times as per necessities.

Actor-Linkage Matrix

Fig. 2 portrays the Actor-Linkage Matrix in the dairy entrepreneurial ecosystem. The matrix shows that there was a strong linkage of the dairy entrepreneur with the dairy cooperatives, Govt. departments, Local Self Government Department and bank; because there was regular contact of the entrepreneur with them.

There was no linkage with MILMA (regional milk unions and federation) because the marketing of milk by the dairy entrepreneur was through primary dairy cooperatives, which in turn was strongly linked with the unions of MILMA. The dairy cooperatives also had strong linkages with the government departments and regional milk unions; but weak linkage with KVASU and have no opinion on relation with KVK. Private agencies marketing milk have strong linkages with dairy entrepreneurs, AHD and banks; but have medium or weak linkages with other stakeholders.

ACTORS	DE	DCS	PVT	DDD	AHD	INPUT	LSGD	BANK	KVK	KVASU	MILMA
DE		2.5	1	3	3	1.5	2.5	3	0.5	1.5	0
DCS	3		0	3	2.5	2.5	2.5	3		2	2.5
PVT	3			1	2.5	3		3		1.5	0
DDD	3	3	0.5		2.5	2.5	3	1.5	0	1.5	3
AHD	3	3	2.5	3		3	2.5	2	1.5	2	1.5
INPUT	3	3	1.5	3	1.5		0.5	0	1.5	2.5	1.5
LSGD	1	2.5	1	3	3			1.5	1		
BANK	2	2.5	1.5	3	3	2.5	3		1	0.5	3
KVK	1.5		0	0	1.5		2	2		1.5	
KVASU	1	1	2	2.5	2.5	1		0.5	1		2
MILMA	2	2.5	0	3	0			2		0.5	

DE: Dairy Entrepreneur
DCS: Dairy Cooperative Society
PVT: Private Agencies
DDD: Dairy Development Dept
AHD: Animal Husbandry Dept
INPUT: Input Agencies
LSGD: Local Self Government Dept.
BANK: Nationalized and Others
KVK: Krishi Vigyan Kendra
MILMA: Apex Dairy Federation
LINKAGES: 2.1 – 3.0 = STRONG, 1.1-2.0 = MEDIUM, 0.1 – 1.0 = WEAK, 0 = NO LINKAGE AND BLANK FOR 'DON'T KNOW'

Figure 2: Actor Linkage Matrix in Dairy Entrepreneurial Ecosystem

Dairy Development Department (DDD) and Animal Husbandry Departments (AHD) had strong linkages with the majority of stakeholders. While DDD had strong linkage with MILMA, it was only medium for AHD. There was no linkage between KVK and DDD. Input suppliers had strong linkage with the DDD, entrepreneur and dairy cooperatives. MILMA had strong linkages with dairy cooperatives and DDD. Local self-government departments (LSGDs) had strong linkages with dairy cooperatives and the vital Government departments. The linkages of KVASU, KVK and banks with the stakeholders were medium to weak in comparison to others. The actor-linkage matrix revealed that there were stronger linkages mainly among the dairy

entrepreneurs, dairy cooperatives, Government departments, input agencies and MILMA; which was required for the facilitation and growth of dairy entrepreneurship. There was requirement for the universities and KVK to develop strong linkages with other stakeholders particularly in entrepreneur education and effective technology transfer.

There was absence of formal/informal mechanism for stakeholder coordination among government departments/agencies, who were key sponsors to the dairy entrepreneurial ecosystem; due to lack of combined efforts, ego problems of officials, overlapping of functions and compartmentalization. However, it can be overcome by proper initiatives for joint efforts, open discussions and non-overlapping of roles and functions.

Overlapping Roles of Ecosystem Actors

Fig. 3 depicts the overlapping roles of the dairy entrepreneurial ecosystem actors of Kerala. There were overlapping roles mainly among four actors – Dairy Development, Animal Husbandry, MILMA and Kerala Livestock Development Board. Extension/advisory services and dairy schemes were common activities among the two government departments (DDD and AHD). Nevertheless, there was a difference in subsidy norms between the departments. There was similarity in schemes and services between AHD and KLDB. Also, there were overlapping roles in schemes and extension activities between DDD and MILMA. With regard to KLDB and MILMA, there was overlap of training and extension. College of Veterinary and Animal Sciences (under KVASU) overlapped with AHD in training, while College of Dairy Science and Technology (under KVASU) overlapped with DDD and MILMA in the same. Recently MILMA had stopped its activities at its Training Centre due to lack of funds and non-availability of trainees. Local Self Governments had similarity of dairy related schemes with AHD and DDD.

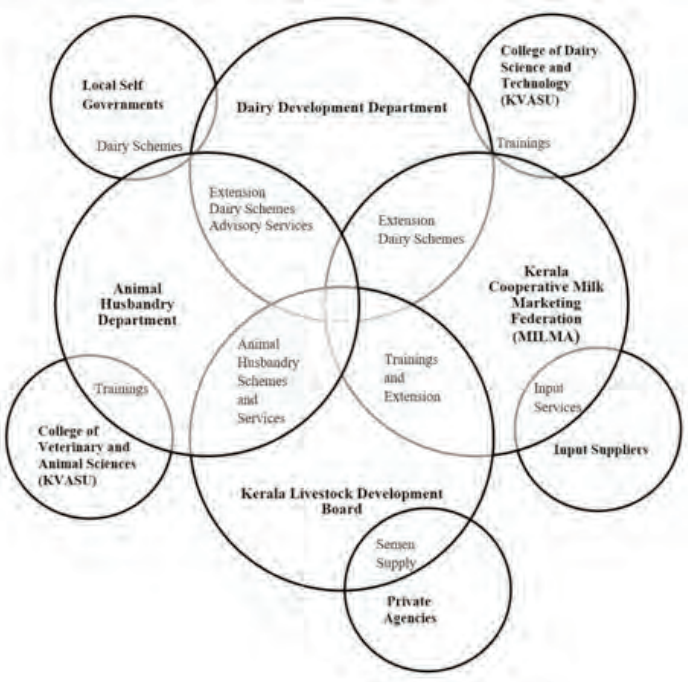

Figure 3: Overlapping Roles of Dairy Entrepreneurial Ecosystem Actors

CONCLUSION

The dairy entrepreneurial ecosystem of Kerala reveals a list of factors and actors contributing to dairy entrepreneurship; and the functional stages of actors throw light on their importance for its development. The actor-linkage matrix outlines the strength and types of linkages; revealing the mislaid networks in the system. Exposing overlapping roles shall aid in eliminating redundant functions and deciding on the proper nodal agencies. Altogether mapping shall assist the authorities to comprehend the dairy entrepreneurial ecosystem of the state with its contributions and limitations; and take steps for either detailed inquiry or initiate actions to amend the ecosystem for a dynamic dairy entrepreneurship.

ACKNOWLEDGEMENT

The author is grateful to the Director, ICAR-NDRI, Karnal and Dairy Extension Division for providing necessary facilities for conducting this research work.

REFERENCES

ANDE. (2013). *Entrepreneurial Ecosystem Diagnostic Toolkit*. Washington DC. Aspen Network of Development Entrepreneurs. Retrieved from https://assets.aspeninstitute.org/content/uploads/files/content/docs/pubs/FINAL%20Ecosystem%20Toolkit%20Draft_print%20version.pdf

Arun, L. & Senthilkumar, R. (2021). A scale to measure the knowledge level of dairy farmers affected by flood 2018 on disaster preparation. *Indian Research Journal of Extension Education*, *21*(4), 46-51.

Auerswald, P.E. (2015). *Enabling entrepreneurial ecosystems. The Oxford handbook of local competitiveness.* Oxford University Press. UK. 54-83.

Biggs, S. & Matsaert, H. (2004). *Strengthening poverty reduction programmes using an actor oriented approach: examples from natural resources innovation systems.* Agriculture research and extension network (DFID). Network Paper No.134.

Deutsche Gesellschaftfür Internationale Zusammenarbeit (GIZ). *(2018). Guide for mapping the entrepreneurial ecosystem.* German Corporation for International Co-operation. BMZ. Bonn.

India Today Agro Summit and Awards. (2018). *Kerala wins best state in milk productivity*. Retrieved from https://www.indiatoday.in/india/video/india-today-agro-summit-awards-2018-kerala-wins-best-state-in-milk-productivity-1268051-2018-06-23

Isenberg, D.J. (2011). *The entrepreneurship ecosystem strategy as a new paradigm for economic policy: principles for cultivating entrepreneurship.* Babson Entrepreneurship Ecosystem Project. Babson College.Babson Park. MA.

Kahan, D. (2013). *Entrepreneurship in farming. Farm Management Extension Guide (5).* Food and Agricultural Organization (FAO) of the United Nations. Rome. Retrieved from http://www.fao.org/uploads/media/5EntrepreneurshipInternLores.pdf

Kale, R.B., Ponnusamy, K., Chakravarthy, A.K., Sendhil, R. & Mohammad, A. (2016). Assessing resource and infrastructure disparities to strengthen Indian dairy sector. *Indian Journal of Animal Sciences. 86*(6), 720-725.

Mohapatra, S. & Sendhil, R. (2020). Role of milk market infrastructure for sustainable dairy development. *Indian Journal of Economics and Development. 16*(SS), 402-407.

Paradi, D. (2012). *Use a Venn diagram to show overlapping relationships. Think Outside the Slide.* Retrieved from https://www.thinkoutsidetheslide.com/use-a-venn-diagram-to-show-overlapping-relationships/

Prasad, C.S. (2018). *Transforming agriculture into enterprise: Learning from entrepreneurship and incubating agri-enterprises. Taking stock and shaping the future: Conversations on Extension.* Agricultural Extension of South Asia. 273-277.

Prasad, C.S. & Sulaiman, R. (2004). *An innovation system study on fodder innovations project on enhancing livelihoods of poor livestock keepers in Krishna and Guntur districts of Andhra Pradesh.* Centre for Research on Innovation and Science Policy. Hyderabad (India). Retrieved from https://www.researchgate.net/publication/242262194

Shyam, S.S.R. & Kadian, K.S. (2022). Information sourcing and managing behaviour of dairy entrepreneurs of Kerala. *Indian Research Journal of Extension Education. 22*(1), 66-72.

Stam, E. (2015). Entrepreneurial ecosystem and regional policy: a sympathetic critique. *European Planning Studies. 23*(9), 1759-1769.

Walsh, P.R. (2005). Dealing with the uncertainties of environmental change by adding scenario-planning to the strategy reformulation equation. *Management Decision. 43*(1), 113-122.

RESEARCH ARTICLE
Journal of Extension Education
Vol. 35 No.1, 2023
DOI: https://doi.org/10.26725/JEE.2023.1.35.6961-6968

Innovative Approaches in Paddy Cultivation: An Analytical Study of Adoption Trends

Sanghamitra Rajnandini Saikia and S Rajalakshmi

ABSTRACT

Adoption of farm innovations in food crops is necessary to modernize agricultural practices, improve efficiency and increase yields to meet the growing global food demand. This study analysed the adoption trends of innovations in paddy cultivation. Key innovations were identified including the adoption of advanced agricultural machinery starting from seed preparation to harvesting and storage, improved irrigation systems and utilization of hybrid rice varieties by interviewing the paddy farmers of Assam, India. Percentage analysis and paired t-test were used to assess the impact of innovations on rice crop productivity. The results of the study indicate a positive and progressive trend in the adoption of innovations in paddy cultivation. The widespread acceptance of improved machineries and a diverse array of hybrid rice varieties showcases a collective effort among farmers to enhance productivity, optimize resource utilization, and embrace sustainable agricultural practices. To maximize the benefits of these innovations, farmers must receive adequate training.

Keywords: *Adoption; Hybrid Rice varieties; Farmers; Technologies; Innovation; Productivity; Paddy Cultivation; Assam*

INTRODUCTION

Paddy cultivation, also known as rice cultivation, holds immense significance in India's agricultural landscape, contributing significantly to the country's food security and rural livelihoods (Source: Ministry of Agriculture and Farmers Welfare, 2022). Assam, a state in north-eastern India, is renowned for its paddy cultivation. Rice, being a staple food in India, holds immense cultural and economic importance in Assam. The state's favourable climate, abundant water resources, and fertile plains make it an ideal region for rice cultivation. With its fertile plains and abundant water resources, Assam stands as a prominent state in India, contributing substantially to rice production. The state's unique agroecological conditions have fostered the growth of aromatic and high-yielding rice varieties, contributing to its reputation as a region of rice diversity.

Innovation in paddy cultivation has played a pivotal role in revolutionizing India's agricultural landscape. As the world's second-largest producer of rice, India has recognized the importance of technological advancements and modern practices in ensuring food security and

Department of Home Science Extension Education, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore-641043. India

Submitted: 16.09.2023 **Accepted:** 27.01.2024

sustainable agricultural growth. The rice farming sector has witnessed significant changes recently, largely due to technological innovations (Gopal, 2019; Kumar et al., 2023). Over the years, various innovative approaches have been adopted to enhance productivity, conserve resources, and improve the livelihoods of millions of farmers who are dependent on rice farming. India's rapid population growth and the need to increase rice production to meet domestic food demands and export goals require innovation in rice farming (Mishra et al., 2022; Singh et al., 2022).

Adoption of innovation by farmers is important for quicker development in agriculture. Innovation in farming helps the farmers expand their production, which can directly or indirectly affect them. Agriculture therefore , needs technology infusion to increase production.

This study aims to investigate and analyze the adoption and impact of innovations on paddy cultivation in the region (Dhemaji District, Assam). Similar studies conducted in Assam had omitted investigating hybrid rice varieties and had concentrated primarily on the knowledge and constraints faced by rice farmers. The significance of this study lies in addressing the challenges posed by a growing population and evolving agricultural demands. By examining the adoption of innovations in paddy cultivation, the study seeks to provide insights into how modern agricultural practices can enhance productivity, sustainability and economic outcomes for farmers in the study area. Additionally, the findings may offer practical recommendations for policymakers, farmers, and stakeholders to promote innovation-driven approaches, ensuring the resilience and adaptability of local agriculture in the face of demographic and agricultural changes.

The objectives of the study are to

1. Study the socio-economic background of rice farmers.
2. Identify the innovations adopted by the farmers.
3. Assess the impact of adoption of innovations on paddy productivity.

METHODOLOGY

The study was conducted in Dhemaji district, Assam, India, where rice farming is the major occupation among a mix of small and medium farmers. Two hundred farmers from two villages, namely Dusutimukh Mishing(100) and Uriamguri (100) villages of Dhemaji Development Block and Bordoloni Development Block of Dhemaji District, were chosen randomly. The primary focus of the present study is to explore the implementation of farm innovations in agriculture, particularly in rice farming. Percentage analysis has been used to study the socio-economic profile and innovation adopted by the farmers, and a paired t-test was used to see the impact of innovation on rice crop productivity.

FINDINGS AND DISCUSSION

Socio-economic Background of the Rice Farmers

A majority of the farmers, were between the ages of 31 and 40 years. This concentration of farmers within a specific age group could have implications for factors such as the adoption of modern farming practices, succession planning in agriculture, and the overall resilience and adaptability of the farming community to emerging challenges. A majority of the selected farmers belonged to the Scheduled Caste category (100%), were married, had joint families with 4-6 persons, had studied up to higher secondary level and had an annual income between 200001 and 400000 INR. The substantial representation of joint families may

foster collective decision-making and resource-sharing, positively influencing the adoption of efficient and sustainable paddy cultivation methods. While their income level may allow for some investment in agricultural innovations, it also suggests a need for cost-effective solutions to ensure widespread adoption among farmers in this income bracket.

Profile of the Respondents Related to Agriculture

Analysing the agricultural details of the farmers, it is clear that the majority (94%) of the farmers' primary source of employment was agriculture . The fact that majority of the farmers identify agriculture as their primary source of employment indicates a strong dependence on farming activities. This suggests that these farmers are more likely to invest in innovative practices in paddy cultivation as it directly influences their livelihoods. With 78% of land-owners, there exists a considerable degree of autonomy and control over farming decisions. Land ownership is often associated with a higher willingness to invest in and experiment with new technologies, positively impacting the adoption of paddy cultivation innovations. A majority of the farmers were found to have land holdings ranging from 2 to 5 hectares (medium farmers). Medium-sized farmers may have the financial capacity and resources to adopt innovative technologies at a more substantial scale compared to smaller landholders, potentially influencing the widespread adoption of paddy cultivation innovations.

Innovations Adopted in Paddy Cultivation

Innovations adopted in Paddy Cultivation by the farmers were analyzed and presented in Table 1.

Table 1. Innovations Adopted in Paddy Cultivation

N=200

Sl. No.	Innovation	Yes		No	
		F	P	F	P
Machinery					
1	*Seed Preparation:* Rice wheat seeder	20	10	180	90
2	*Transplanting :* Mechanized direct dry DSR (Direct Seeding of Rice)	79	39.5	121	60.5
	'Walking' paddy rice transplanter	80	40	120	60
	Engine-operated rice transplanter	125	62.5	75	37.5
3	*Weed Management:* Power Operated Weeder	182	91	18	9
	Cono Weeder	98	49	102	51
	Rotary Weeder	192	96	8	4
4	*Water Management:* Alternative wetting and drying	65	32.5	135	67.5

Sl. No.	Innovation	Yes		No	
		F	P	F	P
5	*Pest Management:* Multi-Nozzle boom sprayer	172	86	28	14
	Battery-operated sprayer cum spreader	187	93.5	13	6.5
	Power tiller-operated sprayer	71	35.5	129	64.5
6	*Harvesting and Threshing:* Reaper	19	9.5	181	90.5
	Mini Combine Harvester	135	67.5	65	32.5
	Axial flow thresher	112	56	88	44
	Open Drum thresher	68	34	132	66.5
7	*Drying and Storage:* Solar bubble dryer	65	32.5	135	67.5
	Recirculating batch dryer	102	51	98	49
	Super bag	162	81	238	119
	Rice Ring bin	167	83.5	33	16.5
Hybrid Rice varieties					
8	Swarna-Sub1	196	98	4	2
9	Ranjit-Sub1	110	55	90	45
10	RNR 15048	78	39	122	61
11	Jayamati	182	91	18	9
12	Dinanath	132	66	68	34
13	Swarnabh	165	82.5	35	17.5
14	Kanaklata	68	34	132	66
15	Bahadur Sub-1	181	90.5	19	9.5

F= Frequency; P = Percentage (%)

Machinery

A majority (62.5%) of the farmers had used Engine-Operated Rice Transplanter, indicating a shift towards efficient planting methods. This technology likely contributes to increased productivity and labour efficiency compared to traditional manual transplanting. About 91 per cent had used power-operated weeder tool for weed management and 96 % had used rotary weeders, suggesting a widespread recognition among farmers of the importance of efficient weed management. A majority ninety-three point five per cent (93.5%) used Battery-Operated Sprayer cum Spreader. This method is

likely preferred for its precision and efficiency in applying pesticides to the crops. Additionally, the preference for super bag storage (81%) and rice ring bins (83.5%) highlights the significance of efficient and organized storage methods in preserving the quality of harvested rice. A study conducted by Saikia and Barman in 2013 had highlighted the poor adoption rate of paddy cultivation technologies among farmers. but from the current study, we have seen a positive shift towards adopting innovations in paddy cultivation. This evolution could be attributed to a combination of targeted educational initiatives, improved accessibility to resources and the tangible benefits demonstrated by the successful integration of modern technologies into paddy cultivation practices.

Hybrid Rice varieties

A majority of the respondents (98%) had adopted Swarna-Sub1 variety,followed by Bahadur Sub-1 (90.5%). The data underscores the varied choices of rice varieties among farmers, suggesting that different varieties cater to the distinct requirements and preferences of the local farming community. A study conducted by Singh and Barman in 2011 similarly reported that a significant proportion of farmers favoured hybrid rice varieties.

Impact of Innovations adopted by the Respondents

The impact of innovations adopted by the paddy farmers was ascertained and given in Table 2.

Table 2. Impact of Innovations

N=200

Sl. No.	Impact	Before		After	
		F	P	F	P
1	Faster cultivation	150	75	188	94.0
2	Increase in income	97	48.5	174	87.0
3	Minimization of human effort	110	55.0	181	90.5
4	Lesser production costs	79	39.5	163	81.5
5	Increased production	38	19.0	162	81.0
6	Enhanced Food Security	120	60.0	198	99.0
7	Capacity building through sharing of knowledge	111	55.5	179	89.5
8	Access to market	75	37.5	125	62.5
9	Improvement in Farm Efficiency	79	39.5	156	78.0
10	Increase in volume of Farm Produce	89	44.5	187	93.5
11	Value addition to the crop	81	40.5	119	59.5

**Multiple Responses ; F= Frequency; P = Percentage (%)*

About 93 % of the farmers had claimed that adopting innovations has improved their production while 87 per cent of farmers had reported that the innovations had enabled them to increase income. These comprehensive findings strongly support the notion that farming innovations have propelled a significant improvement in productivity, efficiency, and economic outcomes for farmers. These advancements not only benefit individual farmers but also contribute to the broader goals of sustainable and resilient agriculture. The results underscore the importance of ongoing investment in agricultural innovation to address the evolving challenges in the agricultural sector.

Association between Rice production Before and After Adopting Innovations

The data on association between the rice crop production before and after using innovations are given in Table 3.

Table 3. Association between Rice production Before and After Adopting Innovations

		Mean	SD	SE	t-value	Sig
Faster cultivation	Before	1.26	0.41	0.04	13.212	.000**
	After	2.18	0.67	0.05		
Increase in Income	Before	1.66	0.74	0.06	9.798	.000**
	After	2.16	0.69	0.06		
Minimization of human efforts	Before	1.99	0.58	0.05	8.121	.004**
	After	2.01	0.62	0.6		
Lesser production costs	Before	1.66	0.47	0.04	11.485	.000**
	After	2.12	0.78	.06		
Increased production	Before	1.18	0.39	0.03	12.356	.000**
	After	1.72	0.45	0.04		
Enhanced Food Security	Before	1.59	0.49	0.04	11.875	.000**
	After	2.03	.54	.07		
Capacity building through sharing of knowledge	Before	1.43	0.60	0.05	11.562	.000**
	After	2.38	0.68	0.06		
Access to market	Before	1.61	0.65	0.06	9.874	.000**
	After	2.37	0.69	0.06		
Improvement in Farm Efficiency	Before	1.72	0.66	0.06	9.121	.002**
	After	2.47	0.65	0.06		

		Mean	SD	SE	t-value	Sig
Increase in the volume of Farm products	Before	1.71	0.71	0.06	8.321	.004**
	After	2.33	0.71	0.06		
Value addition to the crop	Before	1.23	0.65	0.6	12.021	.000**
	After	2.45	0.78	0.6		

The results of the t test showed that there is a significant correlation between the introduction of innovation in agriculture and an increase in the yield of rice crops both before and after the innovation was implemented. Rice crop farmers are able to enhance their profits with the use of innovation, and they have been successful in accomplishing their goal of maximising their profits while minimising their costs. Notably, faster cultivation demonstrated a significant improvement, with a mean increase from 1.26 to 2.18 (t-value = 13.212, $p < 0.001$). The increase in income also exhibited a substantial rise, with a mean shift from 1.66 to 2.16 (t-value = 9.798, $p < 0.001$). Minimization of human effort, reduced production costs, improved production, enhanced food security, and capacity building through knowledge sharing all displayed statistically significant improvements after the implementation of specific measures. These findings suggest that the adopted agricultural interventions have led to multifaceted benefits, contributing to faster, more efficient, and economically viable agricultural practices, ultimately enhancing farmers' livelihoods and overall agricultural sustainability.

CONCLUSION

Understanding the adoption and impact of innovation on rice crop productivity is crucial for ensuring food security and reducing poverty in Assam. The research reveals that socio-economic factors and technological advancements strongly influence farmers of Assam to adopt innovative practices, leading to increased productivity. Statistical analysis shows a significant correlation between innovation introduction and enhanced rice yield, demonstrating its effectiveness before and after implementation. By embracing innovation, rice farmers have maximized profits while minimizing costs, highlighting the potential for economic advancement. Effective adoption of innovation requires training and knowledge among farmers, with government and non-governmental organizations playing a crucial role in implementing awareness programmes. This study underscores the importance of innovation in sustainable rice farming for food security and emphasizes its positive economic impact. The insights gained can inform policymakers and stakeholders, contributing to the community's overall economic development and well-being.

REFERENCES

Gopal, R., Jat, R. K., Malik, R. K., Kumar, V., Alam, M. M., Jat, M. L., ... & Gupta, R. (2019). Direct dry seeded rice production technology and weed management in rice based systems. *Gates Open Research*, *3*(207), 207.

Kumar, P., Sahu, N. C., Ansari, M. A., & Kumar, S. (2023). Climate change and rice production in India: role of ecological and carbon footprint. *Journal of Agribusiness in Developing and Emerging Economies*, *13*(2), 260-278.

Mishra, A. K., Pede, V. O., Arouna, A., Labarta, R., Andrade, R., Veettil, P. C., ... & Bouman, B. (2022). Helping feed the world with rice

innovations: CGIAR research adoption and socioeconomic impact on farmers. *Global Food Security*, *33*, 100628.

PBAS [Pocket book of agricultural statistics] (2019). Pocket Book of Agricultural Statistics, Directorate of Economics and Statistics, Government of India, New Delhi. Retrieved from https://eands.dacnet.nic.in/PDF/Pocket%20Book%202019.pdf.

PIB [Press Information Bureau] (2021). Fourth advance estimates of production of food grains for 202021. Retrieved from https://static.pib.gov.in/WriteReadData/specificdocs/documents/2021/aug/doc202181121.pdf.

Saikia, S., & Barman, U. (2013). Increasing rate of adoption of rice technologies in Assam: a need of the hour for food security. *Journal of Academic and Industrial Research*, *1*(11), 655-660.

Singh, P. K., & Barman, K. K. (2011). Adoption of rice production technologies by tribal farmers of Mandla District of MP. *Indian Journal of Extension Education*, *47*(3 and 4), 6-9.

Singh, R. B., Paroda, R. S., & Dadlani, M. (2022). Science, technology and innovation. In *Indian Agriculture Towards 2030: Pathways for Enhancing Farmers' Income, Nutritional Security and Sustainable Food and Farm Systems* (pp. 213-250). Singapore: Springer Nature Singapore.

RESEARCH ARTICLE

Journal of Extension Education
Vol. 35 No.1, 2023
DOI: https://doi.org/10.26725/JEE.2023.1.35.6969-6976

Living and Working Conditions of Women Tea Garden Workers in Assam

Shikhamoni Gogoi and T. Radha

ABSTRACT

Tea estate workers hold a significant position in Assam, India. This study examines the socio-economic aspects of living and working conditions of workers, in the tea gardens of Sivasagar district, Assam. 50 women who work in tea plantations formed the sample. Findings revealed that the more than half of the women workers generate a monthly income of Rs. 5001 to Rs.7000 and due to low income, workers find difficulty to cover their daily expenditure. It was also found that the women workers at the tea plantations have poor working conditions such as forced labour, continuous work-load without rest and health issues.

Keywords: *Living Condition; Tea; Plantation Workers; Work Ability; Working Condition; Assam*

INTRODUCTION

Tea plantations are predominantly located in North-Eastern and Southern States of India. The working class in the tea gardens of Assam, a North-Eastern state is the most exploited class in the organized sector of economy. The tea business saw a period of consistent expansion starting in 1870, during which time plantations encountered a shortage of workforce. Currently, the tea industry in Assam serves as the primary employer within the organized industrial sector, employing around 6,50,000 individuals on a daily basis. Notably, women workers account for over 50% of the total workforce in this sector. Since the inception of the tea industry, women have been employed alongside men as labourers (Baishya, 2016, Borgohain, 2020). Plantation work can lead to multiple exposures for workers due to the seasonal nature of the work, the variety of tasks, the type of working postures, and the length of the tasks. These exposures can include exposure to poisoning, infections, parasite diseases, allergies, toxicity, bites, infections, and other health issues (Rehena, 2018). In addition to their poor socioeconomic standing, the populations of tea gardens are defenseless against many diseases because of illiteracy, overcrowding, and unsanitary living circumstances. (Saikia et al, 2013). Women workers in tea gardens face significant challenges like discrimination in both domestic and professional spheres. Since the 19th century, issues such as low pay, inadequate housing, and a lack of social safety- nets persist in tea gardens. There is a glaring absence of a maternity benefit programme due to which women often work strenuously during pregnancy and the postpartum period without necessary support. The existing body of knowledge falls short in providing a thorough understanding of the socio-economic standing of women in tea gardens in Assam, highlighting the urgent need

Department of Home Science Extension Education, School of Home Science, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore. 641043

Submitted: 21.09.2023 **Accepted:** 31.12.2023

for targeted research and advocacy. The present study proposes to investigate in-depth about the living and working conditions of women tea plantation workers with the following objectives.

- To access the socio demographic profile of the women tea garden workers
- To examine the living condition of the respondents
- To observe the working condition of the respondents
- To analyze their work ability and working experience

METHODOLOGY

Locale of the study: The study was conducted in *Suntak* tea plantation in the Upper Assam region of Sivasagar district during July 2022. Upper Assam, chosen using a random sample technique, has a higher concentration of tea gardens compared to other Assam regions. The study offers a comprehensive analysis of socio-economic characteristics, living and working conditions, and wages of respondents, employing both descriptive and analytical elements.

Sample Size: Total numbers of tea plantation workers in Suntak tea estate is 123 casual women workers; out of which, 50 respondents were selected at random.

Data collection: Face to face communication, interview schedules, group discussions, and observations. This approach ensures a well-rounded understanding of the challenges and realities faced by women workers in the specified tea plantation setting.

Data Analysis: Frequency, percentage analysis, mean, standard deviation and one way ANOVA.

FINDINGS AND DISCUSSION

Socio- Demographic Profile of the Women Tea Plantation Workers

In examining the socio-demographic characteristics of respondents, the findings of the study reveal that majority of the respondents (32%) included in this study were of 20 to 25 years. Notably, studies by Sarma (2017) align with this finding, emphasizing the prevalence of young women, particularly in the age group of 15-25 years, engaged in tea plantation work and it was also found that majority (76%) of respondents were found to be married. The women in tribal areas generally get married at young age, and have to face both marital pressure as well as work pressure at such a young age.

A majority of the respondents (84%) belonged to nuclear families, emphasizing the potential influence of family environments on individual values and behaviors. Majority of respondents (64%) attained the primary level education. Most of the respondents (58%) had a monthly income ranging from Rs.5001 to Rs.7000. This income level is deemed insufficient by the respondents to cover their daily expenditure, leading to a financial instability. These findings align with Sharma (2022), This underscores the economic challenges faced by this demographic group, emphasizing the need for interventions to improve their financial well-being.

Living Conditions of the Women Tea Plantation Workers

The analysis focused on the living conditions of the respondents, examining factors such as the nature and kind of housing, accessibility to facilities, availability of assets, monthly expenditures, and patterns of savings and are presented in Table 1.

Table-1: Living Conditions of Women Tea Plantation Workers*

Variables	Frequency (N=50)	Percentage (%)
Nature of house		
Pucca	9	18
Kacha	23	46
Semi *pucca*	18	36
Type of house		
Line house	39	78
Separate house	11	22
Accessibility of facilities		
Education facilities*		
Primary school	50	100
Middle school	44	88
High school	30	60
Toilet facilities		
Available	36	72
Not available	14	28
If, available then type of toilet		
Low-cost latrine	43	86
Pit latrine	-	-
Sanitary latrine	7	14
Water facility*		
Water Taps	50	100
Hand Pumps/ Tube Well	35	70
Wells	16	36
Rain water	21	42
Others (river- water, pond water)	11	22
Electricity facilities		
Available	32	64
Not available	18	36
Access to health care		
PHC (Primary health center)	45	90

Variables	Frequency (N=50)	Percentage (%)
Garden hospital	50	100
Availability of Doctors	19	38
Availability of Nurses	32	64
Free-of-cost medicine	12	24
Ambulance	34	68
Labor room/Delivery room	-	-
Availability of Health workers	50	100
Possession of assets		
Gas connection	28	56
Television	41	82
Mobile phone	21	42
Two-wheeler	42	84
Computer	3	6
Music system	24	48
Others	50	100
Monthly expenditure		
Below Rs 3000	4	8
Rs 3001-6000	39	78
Above Rs 6001	7	14
Major expenditure on*		
Food	46	92
Clothes	37	74
Education of children	20	40
Medical treatment	41	82
Transportation	31	62
Is the Monthly salary sufficient to meet the monthly expenses of family?		
Sufficient	11	22
Not sufficient	39	78
Saving Pattern		
Saving	19	38
Not saving	31	62

**Multiple responses*

From the table, we can see that housing conditions of the participants varied. The survey revealed that 46% of the respondents possess rudimentary housing structures. According to a study conducted by Kabir (2007), it was found that tea plantation workers and their offsprings have the right to inherit their residential property upon their demise. Similarly, both studies found that majority of the respondents had *kacha* houses. Those were constructed with mud walls and have roofs made of straw. Majority of the respondents (74%) had access to separate toilet facilities. However, the prevalence of single toilets without water facilities underscores the urgent need for improved sanitation infrastructure in these areas.

The findings underscore the importance of targeted interventions to improve living conditions, ensuring a more equitable and dignified life for this community.

Association between Monthly Income and Expenditure

The association between the monthly income and expenditure of the respondents was assessed and presented in Table 2. The test of the mean differences in the expenditure of different income groups, one way ANOVA was applied.

Table 2: Association between Monthly Income and Expenditure (N=50)

Variable		MEAN	SD	SE	F – VALUE	P - VALUE
Expenditure	Below Rs 3000	2.00	.00	.00	3.628	.034*
	Rs 3001-6000	2.50	.56	.29		
	Above Rs 6001	2.30	.48	.08		

**Significant at 5% level*

The estimated 'F' was 3.628 and the corresponding 'P' value was 0.034. As the 'P' value was less than 0.05, it shows that expenditure has varied or different significantly across various income groups. The findings indicates the presence of a significant association between income levels and spending patterns, affirming the notion that as incomes fluctuate, so do expenditures, reflecting the dynamic nature of financial behaviors among the surveyed respondents.

Working Conditions of Women Tea Plantation Workers

The working conditions of women tea plantation workers were assessed and the results are presented in Table 3.

Table 3: Working Conditions of Women Tea Plantation Workers

Variables	Frequency (N=50)	Percentage (%)
Nature of work		
Plucking	20	40
Tipping	19	38
Weeding	11	22
Minimum wages per day (In rupees)		
Below 200	-	-
201-300	50	100

Variables	Frequency (N=50)	Percentage (%)
Above 301	-	-
Ways of calculation of wages		
Days	50	100
Working days in a week		
6 days	50	100
Working hours in a day		
7-8 hours	50	100
Working experience		
Less than 5years	4	8
Between 5&10years	11	22
Between 10&15years	25	50
Above 15years	10	20
Task completion Target		
Up-to 40kg	9	18
41-45 kg	11	22
46-50 kg	18	36
51-55 kg	8	16
More than 55 kg	4	8

Results show that a majority of the participants were engaged in tea leaf plucking . The findings also indicate that the minimum wage per day was between 201 & 300 rupees by all the respondents.

The findings also suggest that their living conditions are characterized by low or inadequate standards. 100% of the respondents had reported working six days a week on the tea plantations.

Typically, tea plantation workers engage in an eight-hour work schedule on a weekly basis. The designated working hours consist a duration of eight hours every day, commencing at 8 am. The tea plantation workers usually work for a fixed duration of 8 hours per day, adhering strictly to this timeframe without exceeding or falling short in the field.

The findings also says that a majority (36%) of respondents are made to work overtime to attain targets. An average person can pluck upto 35 kg but if they are forced to work overtime it may result in several health issues like, back pain, loss of weight etc.

Work Ability among Women Tea Plantation Workers

The capacity of the workers to perform their jobs at Tea Plantation was evaluated based on one of three grades.

Table 4: Working Ability among Women Tea Plantation Workers (N=50)

Variables	Frequency (N=50)	Percentage (%)
Poor	1	2.0
Moderate	41	82.0
Good	8	16.0

When the respondents' work abilities were evaluated, it was discovered that a majority of them had moderate ability (82%). Therefore, all of the women workers are involved in tea-related work, although their ability is moderate. The workers are actively involved in the execution of laborious tasks, resulting in a proportional rise in their proficiency as they accumulate more experience in the same occupation. The workers were involved in plantation work from a young age, allowing them to develop natural abilities in this area.

Association between Work Ability and Working Experience

An attempt was made to investigate the association between a person's level of job ability and the length of professional experience they have. The discussion of the results can be found in Table 5.

Table 5: Association between Work Ability and their Working Experience

Variable		MEAN	SD	SE	F – VALUE	P - VALUE
Experience	Less than 5 years	1.92	1.01	.21	7.562	.000**
	5 – 10 years	2.85	1.07	.30		
	10 – 15 years	2.50	.55	.22		
	More than 15 years	2.14	1.35	.21		

***Significant at 1% level*

The table illustrates the outcomes of a One-Way ANOVA analysis conducted to examine the relationship between job capacity and work experience. The obtained F-value of 7.562 and the corresponding P-value of .000 indicate a significant association between work ability and work experience. It was observed that individuals with limited working experience had favorable work ability. The observed trend aligns with prior research by Anbazhagan et al. (2016), strengthening the evidence for a connection between job experience and work ability. This emphasizes the importance of considering an individual's professional tenure in understanding and predicting their work ability, contributing valuable insights for effective work management.

CONCLUSION

This conclusion is drawn from the findings of an extensive field investigation into the living conditions, working conditions, and socioeconomic status of women workers in Assam's tea plantations. The working conditions of workers at the tea plantations are substandard, and unfavorable. It was also found that the women workers have poor working conditions such as forced labours to achieve targets, continuously work without rest and carry heavy loads of tea basket which causes several health issues. A majority had financial issues and had to face social and economic disparities. A majority of the participants engage in tea leaf plucking and a significant proportion of workers possess moderate work ability. Hence, it is the responsibility of the Government, policy makers and the tea board authority to improve the working conditions of women workers in tea gardens through appropriate measures.

REFERENCES

Anbazhagan, S., Ramesh, N., Surekha, A., & Fathima, F. N. (2016). Estimation of work capacity and work ability among plantation workers in South India. *Indian Journal of Occupational and Environmental Medicine*, *20*(2), 79–83.

Baishya, D. (2016). History of tea industry and status of tea garden workers of Assam. International Journal of Applied Research, *2* (9), 552-554.

Borgohain, J. (2020). Tea Garden Women, Issues of Socioeconomic Status: A Study on Tea Garden Women of Sivasagar District, Assam. *Journal of Emerging Technologies and Innovative Research (JETIR)*, *7*(3), 1626-1633.

Kabir, M. A. (2007). Tea Plantation workers and its working circumstances: A micro-level study. *The Economic Journal of Nepal*, *30*(119), 185-194.

Rehena, P. (2018). Health and economic conditions of tea garden female workers: A study on legal rights. *Green University Review of Social Science*, *4*(1), 111-132

Sarma, M.K. (2017). A Study on Socio-Economic Status of the Tea Garden Women Workers with Special Reference to Bokakhat Sub-division of Golaghat District of Assam. *International Journal of Emerging Technologies and Innovative Research*, *4*(12), 151-154.

Saikia, S., Misra, S., & Misra, B. (2013). Tea garden labour and their living conditions: a study on sarusarai tea garden of Jorhat district of Assam. In *XV annual international seminar on economy, enterprise and employment*, Delhi, India.

Sharma, R. (2022). A Study on Socio-Economic and Educational Status of Tea Tribe Community with Special Reference to Thowra Tea Estate, Dibrugarh, Assam. *Journal of Positive School Psychology*, *6*(3), 6768-6772.

RESEARCH ARTICLE

Journal of Extension Education
Vol. 35 No.1, 2023
DOI: https://doi.org/10.26725/JEE.2023.1.35.6977-6986

Usage of Selected Botanicals for Grain Flour Storage among Rural Households in Tamil Nadu

P. Sakthidevi and K. Manimozhi

ABSTRACT

Storage of processed grains is a very common and crucial practice for every family, especially those in rural areas of India. This study assessed the usage of botanicals for grain flour storage among the rural families of Tamil Nadu, India. A training intervention was planned and implemented on eco-friendly storage practices in Salem district of Tamil Nadu. A sample of 100 respondents were selected based on their willingness and availability to participate in the intervention programme in randomly selected villages of Salem District . The responses from the trainees before and after the training intervention programme provided insights into the extent of the adoption of eco-friendly storage practices. The assessment indicated a significant change in the knowledge, attitude, and practice (KAP) of rural households. All the respondents gained knowledge and awareness about eco-friendly storage techniques, and the adoption rate was around 50 percent after the training intervention. Participants also began using eco-friendly storage materials such as containers, particularly in stainless-steel. The study suggests that every state department of agriculture, district KVKs, rural development departments and other line departments should take simple steps to improve storage practices of food grains and flour using eco-friendly methods among consumers in their respective areas.

Keywords*: Knowledge; Attitude; Practice; Rural households; Food Grains; Flour; Storage; Tamil Nadu.*

INTRODUCTION

In order to feed nearly 1.5 billion people, India's food grain production must increase to 150 million tonnes by 2040. Thus, more work needs to be put into continuing the campaign to boost food grain output and reduce storage losses. The majority of the nation's food grains, perhaps 65–70% of them, are kept at the farm level in earthen pots, *Gummi*, *Bakhara*, *Kanaja*, *Kothi* and *Sanduka*. These locally built storage buildings are appropriate for keeping grains under conditions unique to their area (Mann, et al., 2016).

When it comes to food storage, both the pantry and the kitchen need a number of canisters and boxes for multiple food items. While plastic boxes are easily available and are comparatively economic, they do more harm than good. Apart from containing toxic elements like BPA, plastic boxes get easily stained and are not microwave friendly. They are also harmful for the

Department of Resource Management, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore – 641 043. India

Submitted: 26.03.2024 **Accepted:** 08.05.2024

environment as they cannot be easily recycled. There are many plastic-free alternatives for storing food ranging from cloth bags to silicone one (Pritt, et.al., 2018). Tamil Nadu is one of the states in India to have a large grain storage infrastructure, thanks to the National Co-operative Grain Storage Project launched in 2023, under which in every block, 2000-tonnes capacity storage godowns are being constructed.

It is imperative to implement comprehensive strategies that not only minimize the quantitative loss of grains but also safeguard the quality and nutritional value of rice. These strategies include improved storage facilities, enhanced pest management techniques and greater awareness about the economic and nutritional consequences of insect infestation in stored rice (Veena, 2015). Use Pitfall traps to check insect infestations on a regular basis and use ash, red soil or clay, common salt and chilli powder for grain storage are the suggested methods of grain storage at household level (Guru et al., 2022). Based on the review of literature, it was found that the existing researches had failed to focus on dissemination of the idea of food grain and grain flour storage using botanicals in the state. Hence, inculcating storage and preservation of grain flours using botanicals among the rural households is crucial. This practice empowers rural households by providing a practical, locally accessible means of improving food security and reducing environmental impact.

Accordingly this study was taken up to assess the usage of botanicals for grain flour storage among the rural families of Tamil Nadu, India. The respondents were participants of a training on eco-friendly storage practices conducted in Salem district of Tamil Nadu. This study would to knowledge dissemination and awareness about sustainable food storage practices using selected botanicals, potentially sparking further research and development in biopest management methods.

The objectives of this study are:

- To study the socio economic profile of the respondents
- To assess the awareness level of the selected rural households on the use of botanicals for the preservation of food grains and grain flours
- To study the food grain flour storage practices among the selected rural households before and after the training and
- To analyze the impact of training on the storage period and storage methods of food grain flour.

METHODOLOGY

This study adopted a longitudinal research design to investigate the awareness created among rural households in Salem District of Tamil Nadu state, a district renowned for grain production and processing. Hence the impact study regarding eco-friendly storage methods for food grain flour was conducted before and after the training intervention in the study area.

Among the nine taluks in Salem District, Sankari *taluk* was randomly selected, which has 40 panchayats and a total population of 2,41,773 according to Census 2011. Devanakavandanur (N = 8,925) and Chinnakavundanur (N = 6,819) villages were selected due to their high population density.

Using Krejcie and Morgan's table for sample size determination, 100 rural households, interested in participating in intervention programmes were selected at random for the training, ensuring a representative cross-section of the population. Data were collected through structured interviews using an interview

schedule. The interview schedule encompassed key variables related to knowledge, attitude and practices, including awareness of eco-friendly storage methods, existing food grain and flour storage practices and factors influencing the adoption of eco-friendly methods. The training programme was conducted to sensitize participants on eco-friendly storage methods, which was done in 3 batches. The training curriculum was formulated based on the findings of a household survey and the test experiment conducted on the effectiveness of selected botanicals to prevent pest and insect attacks during the storage of food grain flour.

The pre-training evaluation was done just before the training programme and the training was planned based on the need assessment conducted as per Table 1. The post-training evaluation was done after one month from the training, as a minimum of one month is essential to knowledge retention for practicing of grain flour preservation and storage in the presence of 5 mentors to judge the quality of food grain flour. Quantitative data obtained from the survey were analyzed using descriptive statistics to assess the level of awareness and storage practices before and after training. Multiple choice questions related to preferential methods of grain flour storage and preservation, dos and don'ts in grain flour storage and preservations were asked to assess the knowledge level of the respondents.

Table 1: Course Content of the Training Programme

Days	Topic	Method / Audio-visual Aids Used
Day 1	Need for foods, food grains in diet, usage of food grains flour, production of food grains in India	Lecture method
Day 2	Importance of storage of food grains flour, storage methods and devices, safe storage techniques	Lectures and demonstration
Day 3	Reasons for losses during storage, types of loss, quality and quantity loss, ways to reduce the storage loss, improvements needed in storage methods and techniques, types of storage problems faced	Lectures, group discussion and pamphlet distribution
Day 4	Insects and pests that affect the storage, basic methods of storage, preparation of container for storage, measure to prevent the insects, pests and moulds	Lectures with group discussions and distribution of pamphlets
Day 5	Creating awareness of botanicals and other eco-friendly methods in food grain flour storage, advantages and use of botanicals in the form of pellets in storing food grains, practical methods of using the pellets in food grain storage.	Lectures cum demonstration, slide shows and booklets

With regard to attitude assessment, 5-point Likert scale was used consisting of statements related to willingness to learn, adopt and practice new preservation and storage practices. To assess practice, the actual practice of grain flour preservation and storage of the respondents were asked and crosschecked with standard procedure and high score was given to relatively similar practices and least for non-preferential practices. Based on the scores obtained, the level of knowledge, attitude and practices was classified into low, medium and high . Inferential statistics, such as chi-square test and logistic regression, were employed to establish associations between variables and factors affecting the adoption of eco-friendly storage practices. Special attention was given to the adoption of botanical mold for food grain flour storage, with a comprehensive analysis of reasons for its adoption or non-adoption.

The study also delved into the challenges and constraints faced by rural households, particularly in terms of time and cost considerations. Ethical considerations were rigorously observed, ensuring informed consent, confidentiality and voluntary participation of the study participants. The study acknowledges its limitations, including sample size and potential biases and suggests avenues for future research in this domain.

FINDINGS AND DISCUSSION

Socio Economic Profile of the Respondents

A majority of respondents (32%) was in the age group of 41-50 years, followed by 51-60 years (30%). There is a relatively lower representation of younger individuals. A significant proportion of respondents (33%) have completed their graduation, while a minimum of 12% have pursued post-graduation. Nearly half of the respondents (46%) have a monthly family income ranging from Rs. 18,001 to Rs. 37,000.

A considerable portion of respondents (27%) had an income level of Rs. 12,001 to Rs. 18,000. Joint families were predominant, constituting 66% of the study respondents. Nuclear families make up 27% of the respondents. A majority of respondents (44%) had spent between Rs. 10,001 and Rs. 20,000 on food.

Storage Period of Food Grain Flour by Selected Rural Households Before and After the Training Programme

The storage period of the food grain flour was examined before and after the training period among the sample respondents and is given in Table 2.

Table 2: Distribution of the selected rural households based on storage period of food grains flour

Food grain flour	Storage period of the selected rural households (n=100)					
	Up to 3 months (%)		3 to 6 months (%)		Above 6 months (%)	
	Before training	After training	Before training	After training	Before training	After training
Bengal gram flour	65	39 (-26)	35	54 (19)	0	7 (+7)
Maida	60	39 (-21)	36	47 (+11)	4	14 (+10)
Rice flour	41	28 (-13)	59	65 (+6)	0	7 (+7)
Wheat flour	39	29 (-10)	61	62 (+1)	0	9 (+9)

Table 2 shows the distribution of the selected rural households based on storage period of food grains flour before and after training. Before training, a majority of households (65%) stored Bengal gram flour for up to 3 months. After training, this percentage decreased to 39%, as there is shift from storage up to 3 months to to 54% after training.

Similar to Bengal gram flour, there was a decrease in the percentage of households storing Maida for up to 3 months after training, from 60% to 39% for Maida as there is shift in the practice, the percentage of households storing Maida for 3 to 6 months increased from 36% before training to 47% after training. Regarding rice flour before training, 41% of households stored rice flour for up to 3 months. This percentage decreased to 28% after training as there was an increase in households storing rice flour for 3 to 6 months after training, from 59% before training to 65% after training. The percentage of households storing wheat flour for 3 to 6 months remained relatively stable before and after training, with 61% and 62% respectively. After training, 9% of households had stored wheat flour for more than 6 months, compared to none before training, which shows the impact of training programme This data underscores the potential for rural communities to embrace more eco-friendly food grain flour storage practices, contributing to a more sustainable approach to food preservation. A similar result was observed in the study made by Yang et al. (2021).

Container Used for Storing Food Grain Flour Before and After Training Programme

Table 3 brings out the distribution of selected rural households based on the container used for food grain flour before and after training.

Table 3: Distribution based on Container used for Food Grain Flour Storage

Food Grain Flour	Container used for Food Grain Flour Storage (n=100)							
	Usage of polythene bag (%)		Usage of plastic container (%)		Usage of stainless-steel container (%)		Usage of food grade plastic container (%)	
	Before training	After training	Before training	After training	Before training	After training	Before training	After training
Bengal gram flour	32	14 (-18)	33	18 (-15)	21	48 (+27)	14	20 (+6)
Maida	31	23(-8)	46	34 (-12)	13	29 (+16)	10	14 (+4)
Rice flour	14	4(-10)	47	26 (-21)	30	47 (+17)	9	23 (+14)
Wheat flour	31	14 (-17)	39	33 (-6)	23	42 (+19)	7	11 (+4)

The data presented in Table 3 showcases the significant shifts in container usage for storing food grain flours before and after the training programme by promoting eco-friendly storage methods. In storage of Bengal gram flour, before training, 32% of households used polythene bags. After training, this usage decreased to 14%. The usage of plastic containers decreased from 33%

before training to 18% after training. Usage of stainless-steel increased from 21% before training to 48% after training. The usage of food-grade plastic containers increased from 14% to 20% after training. In regard to storage of Maida, before training, the majority of households (46%) used plastic containers for storing Maida. After training, there was a decrease to 34%. Usage of polythene bags decreased from 31% to 23% after training. In storage of rice flour, stainless-steel containers saw a slight increase in usage after training, from 13% to 29%. The usage of food-grade plastic containers increased from 10% to 14% after training. Plastic container usage saw a decrease from 26% to 4% after training. Polythene bag usage also decreased significantly from 14% to 4% after training. Usage of food-grade plastic containers increased from 9% to 23% after training. In wheat flour storage, the before and after training data showed most commonly used storage option for wheat flour was plastic containers at 39%. After training, there was a decrease to 33%. Usage of polythene bags decreased from 31% to 14% after training. Stainless steel containers saw an increase in usage from 23% to 42% after training. Usage of food-grade plastic containers increased from 7% to 11% after training.

The overall findings underscore the effectiveness of the training programme in enhancing awareness and encouraging rural households to adopt more sustainable food grain flour storage practices, emphasizing both quality preservation and environmental responsibility.

Assessment of Knowledge, Attitude and Practice Before and After Intervention Programme on Use of Eco-friendly Botanicals to Extend the Shelf Life of Food Grains and Grain Flour

Table 4 brings out the findings on botanicals and eco-friendly methods used for the food grain and grain flour by the selected rural households.

Table 4: Assessment of Knowledge, Attitude and Practice of the selected rural households on Storage Period and Storage Methods of Food Grains and Grain Flours

(n=100)

Assessment Criteria	Scores obtained by the rural households in KAP assessment (%)		
	Level	Before training	After training
Knowledge of grain storage period	Low Medium High	81 19 -	- 3 97
Knowledge of storage method	Low Medium High	75 23 2	- - 100
Knowledge of grain flour storage period	Low Medium High	86 12 2	- - 100

Assessment Criteria	Scores obtained by the rural households in KAP assessment (%)		
	Level	Before training	After training
Knowledge on Grain flour storage method	Low Medium High	64 34 2	- - 100
Attitude towards adopting preservation and storage methods taught	Low Medium High	91 9 -	- - 100
Practice of grain and grain flour storage period	Low Medium High	89 10 1	- - 100
Practice of grain and grain flour storage method	Low Medium High	80 12 8	- - 100

The results of training assessment showed 100 per cent of attainment in knowledge, attitude and practice on grain storage method, grain flour storage period, attitude towards adopting preservation and storage methods taught, practice of grain, grain flour storage period extension and storage methods. Regarding grain storage period, a majority (97 per cent) of rural households showed improvement in knowledge level. This success of the training could be attributed to the training module and other training quality parameters.

Knowledge Gained on Use of Eco-friendly Botanicals to Extend the Shelf Life of Food Grain Flour.

The Table 5 brings out the knowledge gained on the storage methods using botanicals among the selected rural households. The respondents were trained on method of use of botanicals in storage and preservation of grain flours to increase the shelf life. Pre and post knowledge gain was tabulated and presented.

Table 5: Knowledge gained on Use of Eco-Friendly Botanicals to Extend the Shelf Life of Food Grain Flour

Botanicals	Before Training (%) (n=100)	After Training (%) (n 100)
Bay leaf	51	100
Cloves	36	100
Custard apple seeds	38	100
Garlic skin	29	100
Neem leaf	87	100
Nochi	56	100
Pongamia	49	100

Botanicals	Before Training (%) (n=100)	After Training (%) (n 100)
Red chilli	82	100
Red soil	89	100
Tulsi	64	100
Turmeric	78	100

Table 5 shows the knowledge gained on usage of botanicals to improve the shelf life of grain flours. Before training a majority (89%) of the respondents was aware of usage of red soil in preservation followed by neem leaf (87%), red chilli (82%), turmeric (78%), t*ulsi* (64%), *nochi* (56%), bay leaf (51%), *Pongamia* (49%), custard apple seeds (38%), cloves (36%) and garlic skin (29%). Post training intervention findings showed, 100 percent gain in knowledge about all the selected botanicals through training on preservation of selected grain flours. As the botanicals had a very high relevance with day-to-day life in one or other use; remembrance and recall of gained knowledge was possible by the respondents.

Impact of Intervention in Food Grains and Grain Flours Storage Period and Storage Methods followed by the Selected Rural Households Before and After Training

Table 6 shows the impact of training in food grains and grain flour storage period and storage methods followed by the selected rural households before and after training. The results of paired T-test of the variables taken such as practices of storage period of food grain, grain flours, storage method of good grain and grain flours showed significant shift in the scores obtained from before to after training at 1% significant level.This indicates that the training had a noticeable impact on the storage practices for these specific types of flour and duration categories.

Table 6: Impact of intervention in food grains and grain flours storage period and storage methods followed by the selected rural households

Areas of impact assessment	Mean scores		SD	t value
	Before training	After training		
Storage period of food grains	15.44	26	0.883	0.000*
Storage period of grain flours	4.16	8.15	0.368	0.000*
Storage method of food grains	16.80	52	5.9	0.000*
Storage method of grain flours	4.24	8.33	4.09	0.000*

** Significant at 1% level*

Socio Economic Factors Associated with Training Impact

The association between socio economic factors and training impact was assessed and the findings are presented in Table 7.

Table 7: Association between Socio Economic Factors and Training Impact

Socio Economic Variable	ANOVA values of areas of training impact			
	Grain storage period	Grain storage method	Grain flour storge period	Grain flour storage method
Education	0.000*	0.000*	0.146	0.685
Age	0.000*	0.000*	0.717	0.717
Income	0.000*	0.000*	0.000*	0.000*
Type of family	0.000*	0.000*	0.000*	0.000*
Amount spent on purchase of raw materials for food	0.000*	0.000*	0.000*	0.000*

** Significant at 1% level*

Table 7 explains the association between socio economic factors and training impact to identify the socio economic factors which influenced adoption through training impact. Variables such as income, type of family and amount spent on purchase of raw materials for food were having association with training impact on all the aspects such as grain storage period, grain storage method, grain flour storage period and grain flour storage method, as the selected rural households economical, family and diet budget influences the attitude to adopt the grain and grain flour preservation and storage technology for the benefit of their families. Education and age showed significant association in terms of grain storage period and storage method of grain. Because higher the education, better the rate of adoption due to better understanding about the importance of change.

Hence it could be assumed that family commitment of rural households influences the adoption rate. If a technology is considered as beneficial for the welfare of family, women are likely to adopt.

CONCLUSION

The study reflects the outcome of a training programme aimed at promoting eco-friendly storage methods for food grain flour among rural households in Salem district. The impact of the training programme was evident in several key aspects such as improvement in storage practices. The positive impact on botanical adoption, container choices and overall participant satisfaction underscores the importance of such initiatives in promoting sustainability and responsible practices. This study offers valuable insights for future efforts to encourage eco-conscious behaviors in food grain flour storage among rural communities. It is also suggested that according to Sustainable Development Goals (SDGs), among the 17 proposed areas, the 12th goal is on 'Responsible consumption and production' and hence every state department of agriculture, district KVKs, rural development departments and other line departments should take appropriate steps to improve storage practices of food grains and flours using eco-friendly methods among consumers in their respective areas.

REFERENCES

Census. (2011). Chinnakavundanur population - Salem, Tamil Nadu. https://www.census2011.co.in/data/village/633942-chinnakavundanur-tamil-nadu.html

Guru, P. N., Sharma, T., Akanksha, Singla, Amit, Paschapur, & Gupta, J. P. (2022). Strategies and techniques for safe storage of food grains and scientific methodologies to reduce the post-harvest losses, *Just Agriculture Multidisciplinary e-newsletter*, *2*(5), 10.

Mann, S., Dixit, A. K., Tushir, S., & Bashir, A. A. (2016). Traditional grain storage practices in India: SWOT analysis, *Proceedings of the 10th International Conference on Controlled Atmosphere and Fumigation in Stored Products*, 500 - 503.

Pritt, L. A., Stoddard-Dare, P. A., DeRigne, L., & Hodge, D. R. (2018). Barriers confronting food pantry clients: lack of kitchen supplies: A pilot study. *Social Work & Christianity*, *45*(2), 68-85.

Veena, T., Arlene Christina, G.D. & Bided, C. (2015). Insect Detection Methods. *International Journal of Tropical Agriculture*, *33*, 979–985.

Yang, X., Han, H., Li, B., Zhang, D., Zhang, Z., & Xie, Y. (2021). Fumigant toxicity and physiological effects of spearmint (*Mentha spicata*, Lamiaceae) essential oil and its major constituents against *Reticulitermes dabieshanensis*. *Industrial Crops and Products*, *171*, 113894.

RESEARCH ARTICLE

Journal of Extension Education
Vol. 35 No.1, 2023
DOI: https://doi.org/10.26725/JEE.2023.1.35.6987-6992

Attitude of Undergraduate Students of Agriculture towards Online Mode of Learning

Shely Mary Koshy, Dhanusha Balakrishnan, C. Varaprasad and K. Natarajan

ABSTRACT

The COVID-19 pandemic had prompted higher institutions around the globe to relocate traditional classes to online classes. Due to the pandemic, students were compelled to use online platforms that the university provided, such as Microsoft Teams, Google Meet and Zoom, to resume their studies. This study aims to evaluate the attitude of undergraduate students of agriculture in using these new platforms for online mode of learning so that in future, academicians and the Government can design online learning platforms that will enhance the learning of students . The results of this study show that distance learning is still in the development stage, and although traditional classrooms appeared to be indispensable, the positive attitudes and willingness of the majority of students to engage in distance learning classes in the post-COVID19 pandemic indicate that there is an immense potential future for e-learning platforms in higher education institutions.

Keywords: *COVID-19 Pandemic; Online platforms; Learning; Attitude scale*

INTRODUCTION

Agriculture being the back bone of India has numerous opportunities for students who pursue it as a profession. The professional education provided is the base for students to build their future. The mode of knowledge acquisition and learning of skills were transferred from the faculty to the students, primarily by means of traditional medium, which is the classroom method of education. The COVID 19 pandemic however, has put every academic institution in dilemma, thereby challenging the whole traditional mode of learning.

ICT for the students of undergraduate students of agriculture , until the COVID 19 was limited to emailing and looking up for satisfying the needs of assignments and projects. The *'Digital India'* dream envisaged by the Prime Minister of India, took a faster turn through the meaningful adoption of ICT by the academic institutions, when the world stood still evaluating the next best option (Mohanta et al., 2017)

The sudden shift from the face to face to distant learning mode left many of the students unprepared for the unfamiliar mode of education, chosen and suggested by the Government and Educational Institutes.

According to the United Nations Educational, Scientific and Cultural Organization the pandemic had interrupted the learning of more than one billion students in 129 countries

Karunya Institute of Technology and Sciences, Karunya Nagar, Coimbatore-641114. India.

Submitted: 09.01.2024 **Accepted:** 06.05.2024

worldwide (Sundaresan et al., 2020). The pandemic directly influenced the mental status of the students as they were prohibited in getting involved in any social activity outside their home. This has in turn aggravated the stress level and the student's performance. Moreover, the students had to attend classes at a stretch through the online medium. Hence, the present study aims to throw light on the attitude of students towards online mode of learning so that the appropriate measures can be taken while designing a curriculum integrated with technology for the future.

METHODOLOGY

The current study was conducted using an *ex-post facto* research design. It was carried out during 2020-21 academic year among 220 undergraduate students in Agriculture belonging to Karunya Institute of Technology and Sciences, a private institution in Coimbatore. With the help of an online interview schedule generated through Google forms, two hundred and twenty students were interviewed using a pre-tested structured interview schedule developed to identify and prioritize the problems faced by students for attending online classes. Age, gender, location, state, experience, device, internet source, and attitude toward online classes were all collected. The data collected were analysed using statistical tools such as frequency, percentage, mean and standard deviation. The chronological age was operationalized as the actual age of the respondent during the time of investigation. The number of years obtained by the respondent is rounded to the next whole number in the study. The total responses were then divided to three group based on the mean and standard deviation. The formula mean ± SD was used to categorize the variable into three category. The attitude of students towards the online classes was explored with the help of an attitude scale developed by Jyothi and Vijayabhinandhana (2021) with slight modifications.

FINDINGS AND DISCUSSION

Profile of the Respondents

The profile of the respondents was assessed and the results are presented in Table 1.

Table 1. Profile Characteristics of the Respondents

Category	Frequency	Percentage	
Age			
17-18 Years	120	54.5	Range =17-21 Mean =18.40 SD=0.90
18-19 Years	95	43.2	
20-22 Years	5	2.3	
Gender			
Male	108	49.1	Range =1-2 SD =0.50
Female	112	50.9	
Place			

Category	Frequency	Percentage	
Village	96	43.6	Range = 1-4 Mean = 2.00 SD= 1.12
Block/Taluka	69	31.4	
District Headquarters	13	5.9	
State Capital/City	42	19.1	
State			
Andhra Pradesh	8	3.6	Range =1-5 Mean = 4.5 SD= 0.98
Karnataka	2	0.9	
Kerala	25	11.4	
Puducherry	5	2.3	
Tamil Nadu	180	81.8	
Experience			
Low (1-2 Years)	109	50	Range =1-10 Mean =3.39 SD=2.30
Medium (3 Years)	27	12	
High (3-10 Year)	84	38	
Device			
Computer	8	3.6	Range =1-6 Mean =2.23 SD=1.74
Laptop	127	57.7	
Smart Phone	83	37.7	
Tab/ipad	2	0.9	
Source of Internet			
Hotspot from Smart Phone	67	30.5	Range =1-3 Mean =3.39 SD=2.30
Mobile network	103	46.8	
WiFi Router	50	22.7	
Attitude towards online classes			
Low (<103)	82	37.3	Range =20-244 Mean =130 SD=64.00
Medium (104-157)	53	24.1	
High (>158)	85	38.6	

Table 1 presents the profile characteristics of the students. Majority of the students belonged to the age category of 17-18 years (54.50%). Among the respondents, female respondents (50.9%) were more than the male respondents (49.1%). Seventy-five percentage of the respondents hailed from Villages and Block followed by State Capital and District Head quarter. More than half of the students were native to Tamil Nadu followed by Kerala, Andra Pradesh and Puducherry. Among the respondents, majority of the students (50%) reported that they had a low previous experience in using ICT tools, where as 38% of respondents stated that they have a high experience in using ICT tools followed by respondents with medium level of experience (12%) that is 3 years. Laptop was the ICT tool utilized by more than half of the students for learning, followed by smart phones. Respondents using Computers and iPad were less than 5%. The source of internet connection for attending the online classes was found to be mobile network (46.8%), followed by hotspot from mobile (30.5%) and Wi-Fi router (22.7%).

Overall Attitude of Students towards Online Classes

The overall attitude of undergraduate students of agriculture was ascertained and is presented in Table 2.

Table 2: Overall Attitude of the Students towards Online Classes (n=220)

Category	Score	Frequency	Per cent
Less favourable	22-103	82	37.3
Favourable	104-157	53	24.1
Most favourable	158-224	85	38.6
		220	100

The attitude of students towards the online classes was explored with the help of an attitude scale developed by Jyothi and Vijayabhinandhana (2021). The scale consisted of 20 statements with 11 positive statements and 9 negative statements. The scale was administered to the 220 respondents. The results showed that 62.7% of the students had favourable to most favourable attitude towards online classes and only 37.3% students were less favourable towards the online classes. The favourable attitude of the students could be attributed towards their positive viewpoint and acceptance of the situation they were in. Moreover, the availability of the ICT tools and the internet connectivity could also have enhanced their positive attitude. A study conducted by Javier (2020) on the attitude towards online learning revealed that a general optimistic outlook and a reasonable level of technical competency influence the positive attitude. Some of the studies also point out that student characteristics along with the self-efficacy of internet, the experience in using computer, and speed of internet could be regarded as important factors influencing online learning in developing countries (Bhuasiri, et.al.2012).

Association of Attitude Scores of Students with Predictor Variables

The association of the attitude of the students with their personal characteristics is presented in Table 3.

Table 3: Correlation Coefficient of Attitude of Graduates with Six Predictor Variables.

Variables	Coefficient of correlation (r) n=220
Age:	-0.567**
Gender	-0.104
Place	-0.092

Variables	Coefficient of correlation (r) n=220
Device	0.464**
Experience in ICTs	-0.163*
Online support from institution	0.016
** *Significant at 1% level* * *Significant at 5% level*	

The correlation between the attitude and independent variables showed that type of devices used had a positive correlation whereas age and experience in using ICT were negatively correlated. The positive correlation of devices towards the attitude can be attributed towards the experiences of students in using the devices for various personal and professional needs. A substantial factor of attitudes toward e-learning is students' skills in technologies (Rhema et al.,2014). Thakkar and Joshi (2017), had reported that the students having access to technology were more favourable towards E-learning. A study by Ismaili (2021) had also shown that the technological availability and accessibility had positive correlation towards the attitude of students towards e-learning. The independent variables age and experience in ICT were negatively correlated with the attitude towards e-learning and this can be attributed to the anxiety of students on how the novel medium of teaching is going to reflect or affect their future.

CONCLUSION

The recent COVID-19 pandemic has showed us that online mode of learning is the need of the hour. As the frequency of occurrence of natural disasters and pandemic is becoming higher, incorporation of online mode of learning in the regular agricultural curriculum can bring in a positive attitude among the undergraduate students. From the findings of the study, it could be inferred that before introducing it into the regular curriculum, there is a need to ensure that all the students undergoing this mode of learning need to be equipped with devices such as laptops and assured of internet accessibility. As longer hours of learning through online mode aggravates boredom, learning should be made interactive through sessions like quiz, group discussion games and the like. The negative attitude of the students could be changed by projecting positive sides of the online learning . The faculty and the institutional authorities have a major role to play in effecting this change in attitude.

REFERENCES

Bhuasiri, W., Xaymoungkhoun, O., Zo, H., Rho, J. J., & Ciganek, A. P. (2012). Critical success factors for e-learning in developing countries: A comparative analysis between ICT experts and faculty. *Computers & Education*, *58*(2), 843-855. https://doi.org/10.1016/j.compedu.2011.10.010

Javier, C. (2020). The shift towards new teaching modality: Examining the attitude and technological competence among language teachers teaching Filipino. *Asian English for Specific Purposes Journal*., *16*(2.1),210-244.

Jyothi, V. & Vijayabhinandana, B. (2022). A Scale to Measure the Attitude of Students towards Online Learning. *Indian Research Journal of Extension. Education*., *21* (2&3), 37-42.

Ismaili, Y. (2021). Evaluation of students' attitude toward distance learning during the pandemic (COVID-19): a case study of ELTE university. *On the horizon*, *29*(1), 17-30 https://doi.org/10.1108/OTH-09-2020-0032

Mohanta, G., Debasish, S. S., & Nanda, S. K. (2017). A study on growth and prospect of digital India campaign. *Saudi Journal of Business and*

Management Studies, *2*(7), 727-731. DOI: 10.21276/sjbms

Rhema, A., & Iwona M. (2014) "Analysis of student attitudes towards e-learning: The case of engineering students in Libya. *Issues in Informing Science and Information Technology*, *11*, 169-190.

Sundarasen, S., Chinna K., Kamaludin, K., Nurunnabi, M., Baloch, G. M., Khoshaim, H. B., Hossain, S.F. A. & Sukayt, A. (2020). Psychological Impact of COVID-19 and Lockdown among University Students in Malaysia: Implications and Policy Recommendations. *International Journal of Environmental Research and Public Health*, *17*(17):6206. https://doi.org/10.3390/ijerph17176206

Thakkar, S. & Joshi, H. (2017). Students attitude towards e-learning. *International Journal on Advance Engineering and Research Development*, *4*(11): 209-213.

Editorial Policies of JEE

Peer Review Process

Papers submitted to JEE (only through online at www.extensioneducation.org) will be assessed for publication based on its originality of its contribution to the field of extension education, soundness of its theory and methodology, coherence of analysis and the paper's ability to effectively communicate to its readers.

As of now, JEE uses Single-blinded review, where names of the reviewers are hidden from the author, but reviewers know the identity of the author(s).

After initial assessment by the Chief Editor, the submitted manuscript will move to the stage of rigorous peer review, where researchers/academics in the relevant field will go through the manuscript and advise the Chief Editor on its suitability to publish in JEE and consequent revision by the author(s), if required. Every article published in JEE has been through peer review for its quality and relevance assessed by independent peers.

Open Access Policy

JEE provides immediate open access to its content on the principle that making research freely available to the public supports a greater global exchange of knowledge.

Archiving

This journal utilizes the LOCKSS system to create a distributed archiving system among participating libraries and permits those libraries to create permanent archives of the journal for purposes of preservation and restoration.

EES

EXTENSION EDUCATION SOCIETY

Thannambikkai 98650 10414