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Adoption Behavior among Farmers of Tamil Nadu towards District Agro-meteorology Unit (DAMU) Agro Advisory Services in Agriculture and Allied Sectors

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Authors' contributions

This work was carried out in collaboration among all authors. Author KA investigated the research, did analysis and wrote original draft of the manuscript. Author NAKAH did study conceptualization, performed research methodology, reviewed and edited the manuscript as well as supervised the study. Author SN did study conceptualization, reviewed and edited the manuscript. Author SNK did study interpretation and reviewed the manuscript. Author GSR did data analysis. All authors read and approved the final manuscript.

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ABSTRACT

An ex post facto research was undertaken during 2022 to assess farmers' adoption of District Agro-Meteorology Unit (DAMU) Agro Advisory Services (AAS) in Cuddalore, Ramnad, and Aruppukottai districts of Tamil Nadu with sample size of 180. Data was collected using a standardized questionnaire. DAMU offers specialized weather information to support local agricultural activities. The study revealed that 70 per cent of farmers fall into the "Medium" adoption category adopting weather-based timing for planting, harvesting, and irrigation. The respondents fully adopt the practice of scheduling sowing time using weather-based farm advisories (77.78%), 62.22 per cent adopt the practice of scheduling harvesting operations, illustrating a substantial majority using this approach to enhance efficiency and yield during crop harvesting and 56.67 per cent fully adopt the practice of scheduling supplementary irrigation. The farmers attributes *viz*., education status, annual income, extension agency contact, extension participation, mass media participation, information seeking behaviour, knowledge level and perception had shown a positive and significant correlation with the dependent variable adoption of DAMU services at one per cent level of significance. The study revealed that traits like media engagement, scientific thinking and information seeking are closely tied to DAMU AAS adoption, along with extension involvement, knowledge, and perception, contributing to a notable 68.30% variance in adoption.

Keywords: District agro-meteorology unit; weather forecasts; agro advisories; adoption; farmers.

1. INTRODUCTION

Weather prediction is crucial for Indian farming due to its high agricultural involvement. Crop success depends on weather elements like temperature, rain, wind, humidity, and hail. Seasons and weather greatly affect agriculture and the growth of crops, fruits, and vegetables. Unlike many other economic sectors, the output of agriculture is closely tied to the weather. Precise weather prediction plays a vital role in mitigating agricultural losses, potentially reducing crop damage by approximately 8%, as outlined in the research conducted by Lakshmi et al*.* [1]. Since 1945, the India Meteorological Department (IMD) has been providing weather services to farmers across different levels (national, state, and district) to assist them in their daily agricultural decisions. The leading initiative, Gramin Krishi Mausam Sewa (GKMS), offers weather-related support for farmers' decision-making. The District Agro-meteorology Unit (DAMU) program has expanded to block levels, addressing farmers' specific weather needs. These resources have been embraced by farmers and effectively integrated into their daily agricultural practices. Jagriti et al*.* [2] stated that under aegis of NICRA, Agromet Advisories are provided to the farmers through its 121 Krishi Vigyan Kendra located in India. The Agro-DSS (Decision Support System) software, operating through 329 district units (130 Agromet Field Units and 199 DAMU) established by IMD, provides daily weather advice to districts and over 3100 blocks twice a week. According to Patel et al*.* [3] findings, a majority of farmers implemented KVK's advice for their daily agricultural practices.

The introduction of DAMU in nine districts of Tamil Nadu is a praiseworthy effort to offer advice to farmers at the block level. The advisory bulletins, created by Krishi Vigyan Kendra, are valuable sources of information for important crops in the region, shared every Tuesday and Friday. The use of the (Decision Support System) DSS alongside experts like Subject Matter Specialists and KVK scientists ensures the advisories are accurate and current. By providing the bulletin in both English and regional languages, it reaches a broader range of farmers. Disseminating these bulletins through multiple channels such as WhatsApp, newspapers, short message service (SMS), and others, helps farmers access the information they're comfortable with. Involving NGOs aids in reaching remote areas with limited internet access. Overall, DAMU implementation and advisory bulletin distribution are crucial steps to enhance farming practices and the lives of Tamil

Nadu's farmers. Continued support and enhancements in these efforts will play a significant role in boosting and sustaining the agricultural sector's progress in the region.

This study was undertaken through a field survey to evaluate the adoption behaviour of farmers regarding the DAMU Agro Advisory Service in Tamil Nadu. The main goal was to understand how farmers use and connect with DAMU, which is crucial for farming in the district. Talking directly to farmers helped gather their thoughts and experiences, which gave a clear idea of how effective DAMU is and how it affects their farming. The study involved 180 farmers, exploring their views on weather advice for different timeframes. Ultimately, the research aims to make DAMUs even better at helping and empowering farmers in Tamil Nadu.

2. METHODOLOGY

The present study was conducted during 2022 in Tamil Nadu focused on purposeful selection of three districts based on their land types: Cuddalore (Wet land), Ramnad (Coastal area) and Aruppukottai (Dry land). Nine blocks, including Vridhachalam, Kammapuram and Melbhuvanagiri from Cuddalore district; Thiruvadanai, Pogalur and Mandabam from Ramnad district; and Aruppukottai, Rajapalayam and Karaipatti from Virudhunagar district were purposefully chosen for the study based on the highest number of registered farmers with the DAMU out of all 46 blocks across the three selected districts. From each selected block, two villages were chosen based on the maximum number of farmers covered under DAMU, ensuring a diverse representation of agricultural practices and challenges in different land types within the specified regions. The study utilized an ex post-facto research design and employed a random sampling technique to select a sample of 180 registered farmers. Data on farmers' adoption of various topics were collected using a standardized questionnaire. To assess their adoption behaviour towards Agromet Advisory Services, a structured interview schedule was designed with relevant statements and the farmers' adoption towards DAMU was evaluated. The data was presented in frequency and percentage formats to understand the level of farmer's adoption about DAMU services involving the viewpoints of 180 farmers on weather-based AAS. The interview questions were about how weather advice can assist farmers in choosing planting time, crops and caring for animals. The study investigated how following AAS impacts the decisions of farmers in making their regular farming activities. The farmers' responses were measured on a three-point continuum, consisting of full adoption, partial adoption, and not adoption. The participants were requested to rank the statements based on their adoption behaviour. In this study, both regression and correlation analysis tools were used to explore the relationship between various factors and the adoption of DAMU agro advisory services by farmers.

Descriptive statistics, including frequency, percentage, and tabular analysis, were used to evaluate the views of farmers regarding the agro advisory services provided by the DAMU.

3. RESULTS AND DISCUSSION

The Table 1 presents the distribution of respondents based on their levels of adoption. Out of the total 180 respondents, it's evident that around 70 per cent, fall into the "Medium" adoption category, signifying a moderate level of adoption. About 18.89 per cent are classified as "High" adopters, showcasing a significant portion embracing the practice to a greater extent. On the other hand, 11.11 per cent are categorized as "Low" adopters, indicating a lower level of adoption. This breakdown provides insights into how respondents vary in their willingness to adopt a particular variable or practice. According to Lakshmi et al*.* [1], most of the people surveyed (about 72 per cent) had completely adopt the farming advice provided based on weather conditions. This shows that the project has been quite successful.

The Table 2 presents how farmers are adopting different agricultural practices based on weather-based advisories: some practices, like scheduling sowing time and harvesting operations, are being fully adopted by a majority, while others, such as selecting crop varieties, show a mix of partial adoption and non-adoption among respondents.

More than three fourth of the respondents (77.78%) fully adopt the practice of scheduling sowing time using weather-based farm advisories, indicating a strong acceptance of this method for optimizing agricultural activities while 62.22 per cent of respondents fully adopt the practice of scheduling harvesting operations using weather-based information, illustrating a

Table 1. Distribution of respondents according to their overall adoption of farmers towards DAMU service

(n=180)

Category	Frequency	Percentage (%)
Low	20	11.11
Medium	126	70.00
High	34	18.89
Total	**180**	**100**

Table 2. Aspect wise farmers' adoption level about DAMU Agro Advisory Services by farmers

(n=180)

S. No.	Statements	Full Adoption		Partial Adoption		Non-Adoption	
		F	%	F	%	F	%
1.	Scheduling of sowing time based on the weather-based farm advisories	140	77.78	37	20.55	3	1.67
2.	Selection of crops based on the weather-based farm advisories	33	18.33	100	55.56	47	26.11
3.	Selection of varieties based on the weather-based farm advisories	38	21.11	102	56.67	40	22.22
4.	Scheduling of supplementary irrigation based on the weather-based farm advisories	102	56.67	60	33.33	18	10.00
5.	Nutrient management practices	39	21.67	74	41.11	67	37.22
6.	Scheduling of plant protection measures based on the weather-based farm advisories	59	32.78	80	44.44	41	22.78
7.	Monitoring the crop for incidence of pest and disease based on the farm advisories	47	26.11	93	51.67	40	22.22
8.	Inter-cultivation operations based on the weather-based farm advisory	37	20.56	110	61.11	33	18.33
9.	Scheduling of harvesting operations based on the weather-based information	112	62.22	51	28.33	17	9.45
10.	Health and nutritional and care of livestock based on the weather-based advisory services	26	14.44	88	48.89	66	36.67

*(*F- Frequency, %- Percentage)*

substantial majority using this approach to enhance efficiency and yield during crop harvesting and 56.67 per cent of respondents fully adopt the practice of scheduling supplementary irrigation based on weather-based farm advisories, highlighting a significant proportion embracing this method to optimize their irrigation practices in agriculture in turn saving water and labour cost.

More than half (61.11 %) of respondents partially adopt the practice of inter-cultivation operations using weather-based farm advisories, indicating a significant group of farmers incorporating this approach to some extent for adjusting cultivation tasks based on weather conditions while 56.67 per cent of respondents partially adopt the practice of selecting crop varieties using weather-based farm advisories, suggesting a substantial proportion of farmers incorporating this method to some degree for making informal decisions about suitable crop choices based on weather conditions and 55.56 per cent of respondents partially adopt the practice of

Table 3. Simple Correlation coefficient between the selected independent variables and level of adoption about DAMU Agro Advisory service by farmers

(n=180)

S. No.	Variable	Correlation Coefficient
1.	Age (X_1)	-0.069^{NS}
2.	Education status (X_2)	**0.277****
3.	Occupation (X_3)	0.039^{NS}
4.	Annual Income (X_4)	**0.206****
5.	Farming experience (X_5)	0.103^{NS}
6.	Social participation (X_6)	0.035^{NS}
7.	Extension agency contact (X_7)	**0.288****
8.	Source of weather information (X_8)	0.163*
9.	Extension participation (X_9)	**0.321****
10.	Mass media participation (X_{10})	**0.504****
11.	Scientific orientation (X_{11})	-0.272**
12.	Trainings undergone (X_{12})	0.098^{NS}
13.	Information seeking behaviour (X_{13})	**0.380****
14.	Knowledge level (X_{14})	**0.269****
15.	Perception (X_{15})	**0.366****

***=Significant at 1 % level; *=Significant at 5% level; NS= Non-Significant*

selecting crops using weather-based farm advisories, indicating a significant group of farmers using this approach to some extent for making informed decisions about which crops to cultivate based on weather conditions. Under the non-adoption category 37.22 per cent of respondents do not adopt nutrient management practices, highlighting a significant portion of farmers are not utilizing these methods to optimize the use of nutrients in their agricultural activities and 36.67 per cent of respondents do not adopt the practice of using weather-based advisory services for health, nutrition, and care of livestock, indicating a notable portion of farmers are not leveraging these services to manage their livestock based on weather conditions. Further 26.11 per cent of respondents do not adopt the practice of selecting crops based on weather-based farm advisories, indicating a significant group of farmers who are not using this approach to make crop decisions informed by weather conditions.

From Table 3, it is inferred that, out of fifteen variables considered for the study, eight variables *i.e.*, education status (X_2), annual income (X_4), extension agency contact (X_7), extension participation (X_9), mass media participation (X_{10}), information seeking behaviour (X_{13}), knowledge level (X_{14}) and perception (X_{15}) had shown a positive and significant correlation with the dependent variable adoption of DAMU agro advisory services at one per cent level of significance. Source of weather information (X_8) had shown a significant and positive association with the dependent variable adoption of DAMU AAS at five per cent significant level.

Age (X_1) had shown a non-significant and negative correlation with the dependent variable adoption of DAMU services because age goes on their perception is decreasing automatically so it will lead to lower adoption of AAS given by DAMU. Scientific orientation (X_{11}) had shown a significant and negative association with the dependent variable adoption of DAMU as people with a strong focus on scientific thinking might doubt or question new things like DAMU. So, they could be less likely to quickly accept and use it, which leads to the negative association. The variables namely age (X_1), occupation (X_3), farming experience (X_5), social participation (X_6) and trainings undergone (X_{12}) showed a non-significant relationship with the adoption of DAMU services by farmers.

Multiple regression analysis was carried out to evaluate the contribution of profile characteristics, knowledge and perception of the farmers with the adoption of DAMU AAS. Mwangi et al*.* [4] indicated that perception of farmers towards a new technology is a key precondition for adoption to occur. The findings of the multiple regression analysis are tabulated and presented in Table 4. Das et al*.* [5] stated that socio-economic factors like age, sex, and education have an impact on adoption of Information Technology.

Table 4. Multiple regression analysis of independent variables with the adoption of DAMU agro advisory service by farmers

(n=180)

S. No.	Variables	Partial Regression Coefficient 'B'	Standard Error 'SE'	't' Value
1.	Age (X_1)	-0.024	0.044	-0.550^{NS}
2.	Education status (X_2)	0.541	0.490	1.104^{NS}
3.	Occupation (X_3)	0.031	1.074	0.029^{NS}
4.	Annual Income (X_4)	-0.604	0.842	-0.717^{NS}
5.	Farming experience (X_5)	0.075	0.041	1.838^{NS}
6.	Social participation (X_6)	-1.129	0.645	-1.751^{NS}
7.	Extension agency contact (X_7)	0.138	0.209	0.660*
8.	Source of information (X_8)	-0.360	0.249	1.449^{NS}
9.	Extension participation (X_9)	0.500	0.209	2.389*
10.	Mass media participation (X_{10})	0.810	0.159	**5.089****
11.	Scientific orientation (X_{11})	0.781	0.222	**3.514****
12.	Trainings undergone (X_{12})	0.058	0.114	0.510^{NS}
13.	Information seeking behaviour (X_{13})	0.234	0.087	**2.686****
14.	Knowledge level (X_{14})	0.214	0.107	2.006*
15.	Perception (X_{15})	0.352	0.171	2.054*

*R2=0.683; F=9.58; **=Significant at 1 % level; *=Significant at 5% level; NS= Non-Significant*

The regression results revealed from that among the all respondents of DAMU agro advisory service; the association and contribution of profile characteristics, knowledge and perception of the farmers with the adoption of DAMU shows that, mass media participation, scientific orientation and information seeking behaviour had positive and significant relationship at one per cent level of significance. Extension agency contact, extension participation, knowledge and perception exhibited positive and significance relationship at five per cent level of significance. Li et al. [4] stated that a positive attitude toward technology also significantly influences technology adoption behaviors. The study also indicated that all the selected fifteen characteristics acted as cause to bring 68.30 per cent variation in adoption of DAMU service. Djido et al*.* [6] on their study found significant statistical differences between adopters and non-adopters of different (Climate Smart Agriculture) CSA farm management practices for most of the covariates included in the vector farmers' personal characteristics (e.g., age, farming experience, education).

The F value was significantly noted as 9.58 at one per cent level of significance and so the prediction equation can be fitted for the adoption of DAMU AAS by farmers. The fitted regression equation is given below.

$Y = 23.05 - 0.024X_1 + 0.541X_2 + 0.031X_3 – 0.604X_4 + 0.075X_5 – 1.129X_6 + 0.138*X_7 – 0.360X_8 + 0.500*X_9 + 0.810**X_{10} + 0.781**X_{11} + 0.058X_{12} + 0.234**X_{13} + 0.214*X_{14} + 0.352*X_{15}$

It could be concluded from Table 4, that one unit increase in the value of variables viz., extension agency contact (X_7), extension participation (X_9), mass media participation (X_{10}), scientific orientation (X_{11}), information seeking behaviour (X_{13}), knowledge level (X_{14}) and perception (X_{15}) of DAMU services might result in 0.138, 0.500, 0.810, 0.781, 0.234, 0.214 and 0.352 units of increase in adoption of DAMU services by farmers. Mandleni et al*.* [7] found that having access to credit and agricultural guidance positively affected the adoption of conservation agriculture (CA) methods. On the other hand, being between 28 and 37 years old and having higher training levels were associated with lower adoption of CA practices. Sharma et al*.* [8] inferred that factor like age, education level, farm size, family type, household size, farming experience, use of technology during production and income have no influence on the adoption of GKMS.

Having contact with extension agencies significantly enhances the likelihood of adopting DAMU AAS, likely because these agencies provide guidance and information that help individuals understand the benefits of DAMU services, motivating their adoption. Actively participating in extension activities significantly increases the probability of adopting DAMU

services, as engagement with these activities likely imparts valuable knowledge and encouragement, leading individuals to see the value in adopting and using DAMU AAS.

Engaging with mass media significantly boosts the likelihood of adopting DAMU services, possibly because exposure to media coverage creates awareness and interest, motivating individuals to embrace the adoption of DAMU services for their perceived benefits. Having a scientific orientation significantly increases the probability of adopting DAMU AAS, as individuals with this mindset tend to evaluate evidence and benefits critically, making them more inclined to recognize and adopt the advantages of DAMU services. Actively seeking information significantly heightens the rate of adopting DAMU services, as the desire to gather relevant knowledge empowers individuals to better understand and appreciate the benefits, encouraging them to adopt and use DAMU services. A higher knowledge level significantly enhance adoption of DAMU AAS, as better understanding empowers individuals to see the value and benefits of using these services, encouraging their adoption. Having a positive perception significantly increases the attitude of DAMU services, as people's favourable views and beliefs about these services encourage them to see the advantages and embrace their adoption. Johnson et al. [9] indicated that there was no statistically significant difference found between Moderate and High adopters' use of any information source.

4. CONCLUSION

The study indicated that weather-based advisory services play a crucial role in supporting farmers' agricultural practices by adopting weather-based advisory services provided by District Agro-meteorology Unit (DAMU). The results showed that a significant number of farmers are adopting various practices based on weather advices, like scheduling planting and harvesting times. Education, engagement with extension agencies, mass media exposure, having a scientific mindset, seeking information, knowledge level, and positive perception are important factors that positively influence farmers' adoption of agro advisory services. It's clear that these services are valuable and can greatly benefit farmers, helping them make better decisions for their farming activities. The study recommends continued support for such services to enhance agricultural practices and livelihoods in the region. Shankar et al. [10] indicated in their study that major suggestion expressed by the farmers that details were on improving infrastructure, like installing rain gauges, observatories and other weather tools at village level [11].

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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