DEVELOPMENT AND VALIDATION OF AN ATTITUDE SCALE FOR FARMERS TOWARDS WEATHER BASED AGRO-ADVISORY SERVICES

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ABSTRACT

Weather Based Agro-Advisory Services have been gaining momentum as a successful strategy to support agriculture in adapting to shifting climate and improving productivity, sustainability and resilience. These services combine weather forecasts with advisories based on the farm's situation in real-time, allowing farmers to make appropriate decisions for their crop planning, irrigation, pest and disease control and input use. The present study used an ex post facto research design, which evaluated the attitudes of farmers on WBAAS in Western Zone of Tamil Nadu which is very susceptible to climate variability. Based on Edwards' criteria, the attitude scale was developed and validated consisting of 26 items and administered to 300 farmers were selected in a 5-point Likert scale. The discriminating power of statements was tested by the t-value (critical ratio) method and the scale had high reliability according to the correlation coefficient (r = 0.85). The results showed that 27.00% of the farmers had a highly favourable attitude, while 59.00% had favourable attitude towards WBAAS. Farmers recognised that WBAAS could help to boost productivity and make better use of resources, as well as minimising weather-related risks. However, 14.00% of farmers had unfavourable attitudes because of issues like inaccuracies in forecasts, poor access and problems with interpretation. The results highlight the importance of improved precision, timeliness and localization of advisories and extension support and digital access. Overall, promoting awareness and capacity-building initiatives can significantly improve the adoption and effectiveness of WBAAS among farmers.

Key words – Adoption, attitude scale, climate change, crop productivity, farmers, weather based agro advisory services

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INTRODUCTION

In developing countries, agriculture needs to change in order to address the issues of food insecurity and climate change (FAO, 2010). Climate change has significantly impacted biological, ecological and geological systems and has become a serious threat to humankind. Agriculture is inherently sensitive to weather variability making timely and accurate weather information crucial for enhancing farm productivity, sustainability and resilience (Harrison *et al.*, 2016). The agriculture sector remains highly vulnerable to fluctuations in temperature, rainfall, humidity and extreme weather events such as droughts, floods and cyclones (Kumar *et al.*, 2018; Vijai *et al.*, 2023). It was expected that variations in weather parameters such as temperature and precipitation in marginal areas would cause an unpredictable decline within the region's production and productivity. In recent years, the increasing frequency and intensity of such climatic extremes largely attributed to climate change have posed significant challenges to agricultural systems worldwide (Hatfield *et al.*, 2020). In this context, the need for reliable location-specific and timely agro-advisory services has become more critical than ever before. Weather Based Agro-Advisory Services have emerged as an important tool to support farmers in adapting to climatic uncertainties (Dheebakaran *et al.*, 2019; Rahman *et al.*, 2021). These services provide actionable and need-based information including short and medium-range weather forecasts, crop management practices, pest and disease advisories, irrigation scheduling and contingency planning measures (Sarkar *et al.*, 2023; Hussain *et al.*, 2025). By integrating meteorological data with agronomic recommendations WBAAS enable farmers to make informed decisions regarding sowing, input application, harvesting and risk mitigation. Thus, they help in improving the efficiency of agricultural production, reducing cost of inputs, preventing loss and increasing security of livelihood (Gangopadhyay *et al.,* 2019).

Although WBAAS are delivered through multiple channels including mobile applications, SMS services, extension systems and digital platforms their utilization among farmers remains inconsistent and varies considerably. There are many factors that affect the adoption and usage of these services such as socio-economic characteristics, information availability, technological awareness and institutional support. Among all, one of the important factors influencing the adoption of WBAAS is the attitude of farmers towards such services (Doss and Asokhan, 2024). Attitude being a psychological variable denotes an individual's inclination towards responding positively or negatively towards innovation (Peterson and Thurstone, 1932; Fishman *et al.,* 2021). This is an important determinant affecting the perception, acceptance and behavioral intention of an individual which ultimately helps in adoption. The farmers attitudes towards WBAAS depend on their perceptions about the credibility, relevance, timeliness, accessibility and usefulness of the information available through it (Srishailam *et al.,* 2023). Therefore, understanding and accurately measuring farmers attitudes is essential for designing effective extension strategies and improving service delivery mechanisms.

Although numerous studies have explored the adoption behavior and impact of agro advisory services there exists a notable gap in terms of standardized and validated instruments to measure farmers attitudes specifically towards WBAAS (Kumar *et al.,* 2025; Mallick *et al.,* 2025; Paliwal *et al.,* 2026). The absence of a scientifically developed scale limits the ability of researchers and policymakers to capture the multidimensional nature of attitude, assess variations across different contexts and identify critical constraints affecting utilization. In this context, the present study aims to develop and standardize a reliable and valid attitude scale to measure farmers attitudes towards WBAAS. Despite the growing interest in WBAAS as a climate-smart agriculture approach, the existing literature mostly revolves around farmers adoption behavior while no attempt has been made to devise a context-specific scale to measure farmers attitudes toward WBAAS. Lack of a well-established measurement technique makes it impossible to compare and assess the attitude level of farmers under different farming situations.

The current study attempts to fill this gap by devising a scale for measuring the attitude of farmers towards WBAAS. A key strength of this study is that the attitude scale was developed using established psychometric procedures ensuring its validity and reliability. The study contributes to the field of agricultural extension by employing a rigorous methodological approach and provides a scientifically validated tool for assessing farmer attitudes towards WBAAS. The findings can support policymakers, extension agencies and other stakeholders in designing effective advisory strategies and interventions to enhance the adoption of WBAAS and strengthen farmers adaptive capacity to climate variability.

MATERIALS AND METHODS

Construction of Attitude Scale: According to Robbins and Judge (2009), attitude is defined as an evaluative statement either favourable or unfavourable about objects, individuals or events representing a person’s feelings or predisposition. Understanding attitudes is particularly important for researchers and scientists as it helps reveal how individuals perceive and react to new technologies.

Assessing the farmers’ attitude is crucial for understanding their acceptance of WBAAS and identifying potential resistance, thereby enabling necessary refinements to improve adoption. The attitude scale used to evaluate farmers’ perceptions of WBAAS was developed using the summated rating method proposed by (Likert, 1932). The summated rating method was employed to develop the attitude scale as it is a commonly used technique in scale development (Desselle, 2005). This method captures different dimensions of a belief through a series of statements rather than relying on a single item thereby providing a more accurate reflection of actual behaviour (Thurstone, 1929; Reid, 2006). According to Kothari (2004), in a summated rating or Likert scale respondents are asked to indicate their level of agreement or disagreement with each statement along a five-point or seven-point continuum. To construct the attitude, scale the following procedures were followed:

Collection of statements: A statement is defined as anything that is said about a psychological object (Bardhan *et al.,* 2023; Mohanraj *et al.,* 2024). Initially a total of 60 items or statements were developed to assess farmers attitude towards WBAAS on an extensive review of relevant literature and expert opinions from the concerned discipline. These statements included a balanced combination of both positive and negative expressions. Using the criteria outlined by Edwards (1957), each item was carefully evaluated for clarity, relevance and distinctiveness. Based on this assessment redundant, vague and overlapping statements were either removed or revised. Consequently, a final set of 48 well-structured attitude statements including 30 positive and 18 negative statements was developed for the study.

Judges rating and item selection’: When evaluating the attitude toward WBAAS, not all of the statements collected may be equally pertinent. The initial set of 48 attitude statements was evaluated through item analysis using the judgments of 64 experts to determine their relevance and appropriateness. A panel of experts in the field of WBAAS was requested to assess each statement in terms of the clarity, relevance and ability to capture farmers attitudes regarding WBAAS. The judges were asked to rate each statement on a five-point continuum from "Strongly Agree" to "Strongly Disagree" in order to determine its relevance and screen for inclusion in the final scale. The judges were asked to score 5, 4, 3, 2 and 1 for each of the statements: Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (DA) and Strongly Disagree (SDA), while the scoring was reversed for negatively worded items. As a result, a respondent could receive a maximum score of 240 and a minimum score of 48.

Based on the judge's evaluation, the total scores were arranged in descending order and two criterion groups were formed: the top 25% (high group) and the bottom 25% (low group). The t-value of each statement was determined using these two groups as criterion groups.

Calculation of 't' value: By calculating the t-value (critical ratio) between the mean scores of the high and low groups, each statement's discriminating power was evaluated using the method suggested by Edwards (1957). Higher t-value items were considered to be more effective in distinguishing favourable from unfavourable attitudes. The final t value calculation was calculated by using the following formula:

$$t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\frac{S_H^2}{n_H} + \frac{S_L^2}{n_L}}}$$

Where,
$\bar{X}_H$ = Mean score on given statement of the high group
$\bar{X}_L$ = Mean score on given statement of the low group
S_H^2 = Variance of the high group
S_L^2 = Variance of the low group
n_H = Number of respondents in high group
n_L = Number of respondents in low group
t = The degree to which a specific statement differentiates between high and low groups

After calculating the t-value for all the statements using the specified formula, those statements with a t-value < 1.75 were selected, while those with a t-value ≤ 1.75 were discarded, following the guideline recommended by Edwards in 1957. The degree to which each attitude statement distinguishes between respondents with high and low scores on the WBAAS attitude scale is indicated by the "t" value.

Standardization of the scale: To ensure that the developed scale accurately measures farmers attitudes towards WBAAS and yields consistent and dependable results, the process of standardization was undertaken. Standardization refers to establishing the reliability and validity of the scale, thereby confirming its scientific soundness and applicability.

Reliability of scale: According to Ray and Mondal (2011), reliability as the accuracy or precision of a measurement or score. As stated by Kumar *et al.* (2015), a test is considered reliable if it consistently gives the same results when applied on the same sample. The finalized set of 26 statements designed to assess farmers attitudes towards WBAAS was administered to a non-sample group of 30 farmers using a five-point continuum scale. To evaluate the reliability of the attitude scale, the same group of farmers were re-tested after an interval of 15 days using the same instrument. The test-retest method yielded a correlation coefficient (r) of 0.85, which was significant ($p \leq 0.01$) suggesting. The scale is highly reliable and consistently measures attitudes of the farmers towards WBAAS.

Validity of scale: The responses were obtained from 30 expert judges to assess the content validity of the attitude scale pertaining to WBAAS. The minimum score of 2.5 on the average was set for accepting each item in the in a 5-point Likert scale. Those items having a score higher than 2.5 on the average were accepted as valid items and used in the scale. The average score of the whole scale turned out to be 3.42, which suggests that the constructed attitude scale is content valid. Exploratory factor analysis (EFA) has been carried out in order to find the factor structure of the attitude scale comprising 26 items. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity were used to evaluate the suitability of the data for factor analysis. The KMO value of 0.71 showed the adequate sampling adequacy, whereas Bartlett's Test of Sphericity has shown the statistical significance ($\chi^2 = 1458.32$, $p \leq 0.001$). Thus, the data satisfied the assumptions required for exploratory factor analysis. Confirmatory Factor Analysis (CFA) and Validity Testing: CFA was carried out on the 26-item attitude scale to validate its measurement model. The measurement model fit the data well based on the following model fit statistics ($\chi^2/df = 3.90$, Comparative Fit Index (CFI) = 0.92, Tucker-Lewis Index (TLI) = 0.94, Root Mean Square Error of Approximation (RMSEA) = 0.06 and Standardized Root Mean Square Residual (SRMR) = 0.07). Construct validity was proved by standardized factor loadings that were higher than 0.50. Convergent validity was achieved through Composite Reliability (CR) values more than 0.70 and Average Variance Extracted (AVE) values of more than 0.50 for the selected constructs. Discriminant validity was proven since the square root of the AVE of each construct was higher than the correlation among constructs as per Fornell-Larcker criterion and all the HTMT ratios were less than 0.85.

Scoring procedure: The attitude scale items were constructed on a psychological five-point continuum, i.e. Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (DA) and Strongly Disagree (SDA), each item having its own numerical score of 5, 4, 3, 2 and 1 respectively, to measure farmers attitude towards WBAAS. The overall attitude score of each respondent was computed by summing the scores obtained for all the items in the scale (Mukherjee *et al.*, 2018).

Research location: The study was carried out in the Western Zone of Tamil Nadu. The study area is purposively selected because the Western Zone of Tamil Nadu is characterized by agricultural prominence and climatic diversity. This region plays a crucial role in the state's agricultural output and cultivating a variety of crops. With its varying climatic conditions, including hot and dry weather during certain seasons, the Western Zone faces unique challenges that impact crop growth and productivity. The Western Zone comprises of revenue districts of Erode, Coimbatore, Tiruppur, Theni, Karur (part), Namakkal (part), Dindigul, Perambalur and Ariyalur (part). Erode, Coimbatore, Tiruppur districts are purposively selected for the study (Fig. 1).

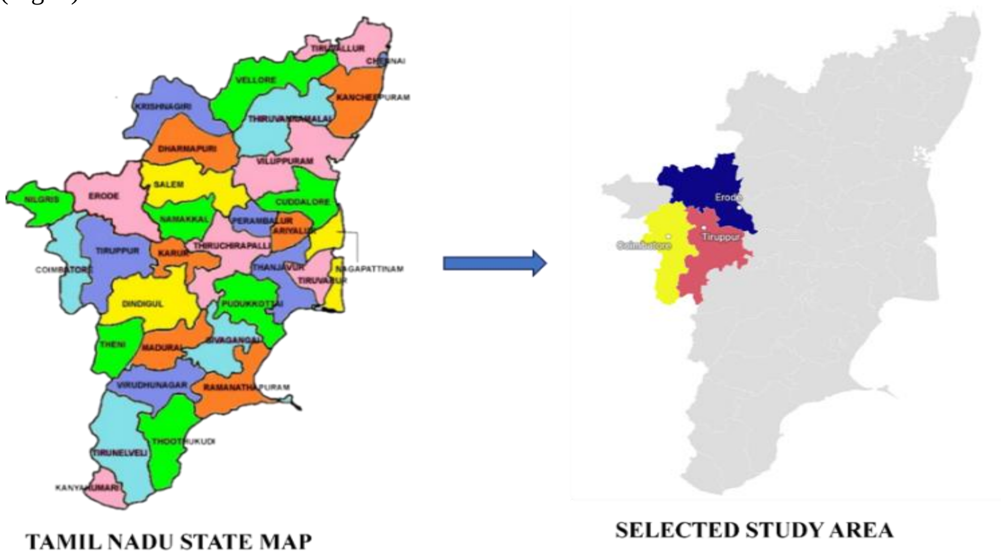


Fig. 1 Map depicting area selected for the present study

Research design: The study was conducted using an ex post facto research design, which is appropriate for examining existing phenomena where the variables are already established and cannot be manipulated by the researcher (Rohwer, 2022). This design was considered suitable as the primary objective was to assess farmers attitudes towards WBAAS on their prior exposure, experience and adoption levels. No direct control over the variables was exercised in the study.

Sampling procedure: The present study was conducted in the Western Zone of Tamil Nadu, where WBAAS are widely disseminated. Three districts from this zone were selected for the study based on the prevalence and accessibility of WBAAS among farmers. A list of farmers receiving or exposed to WBAAS in the selected districts was obtained from relevant sources such as the Agro Climate and Research Centre, Tamil Nadu Agricultural University. From this sampling frame, respondents were selected using the simple random sampling technique to ensure equal chance of selection for all individuals. A total sample size of 300 farmers was fixed for the study. Accordingly, 100 farmers were randomly selected from each of the three selected districts, making the sample representative of the study. Therefore, the final sample consisted of 300 farmers selected through simple random sampling. Simple random sampling technique was used in order to reduce any selection bias from the targeted beneficiaries of WBAAS services. But the sampling frame comprised only those farmers who had been using WBAAS services; hence, the results may apply only to this population and not to all the farmers in the study area.

Data collection: Data were collected from 300 farmers across three selected districts in the Western Zone of Tamil Nadu using a structured interview schedule. The interview schedule was specifically designed to assess farmers attitudes towards WBAAS. Responses were recorded on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Prior to the main survey, the schedule was pre-tested in a non-sample area to ensure clarity, content validity and reliability.

Data analysis: The value of CR (critical ratio or t-value) was obtained for each statement about farmers attitudes. Critical ratio method was used to find out discriminating power of each statement in respect of mean score of respondents belonging to high attitudinal and low attitudinal groups. Respondents were arranged in descending order according to their attitudes and the top and bottom groups were selected for analysis. Critical ratio value of each statement was obtained to find out its significance in discriminating between the two groups. Statements whose values of t-statistics were high and statistically significant had good discriminating power; otherwise, those were discarded from further analysis. Thus, reliable and valid statements were selected for measuring farmers attitudes towards WBAAS.

Construction of Attitude Scale: After completing item collection, item analysis and relevancy testing (including relevance percentage, relevancy weightage and mean relevancy score), the 't' values were calculated for all the statements to finalize the attitude scale (Bhati *et al.,* 2023; Akour *et al.,* 2024). The calculated 't' values for each item are presented in Table 1. The statements which possess the highest 't' value are selected. Based on this analysis, the final attitude scale was constructed by selecting 26 statements with 't' values ≥ 1.75 from the 48 statements subjected to item analysis.

Table 1. Calculated t-values of the statements on the Attitude of farmers towards Weather based agro advisory services

S. No.	Statements	Nature of the statement	't' value	Significance
1.	WBAAS are available to farmers in a timely manner	Positive	2.62	Significant
2.	Farmers sometimes question the practical applicability of weather advisories in real farming conditions	Negative	1.61	Not significant
3.	Scientific WBAAS provide more accurate information than traditional weather prediction methods	Positive	3.48	Significant
4.	Weather forecast information is more location specific, rather than generalised	Positive	2.91	Significant
5.	Climate change has reduced the accuracy and reliability of weather-based agro-advisories	Negative	1.56	Not significant
6.	WBAAS assist farmers in selecting suitable crop cultivars for the sowing season	Positive	2.37	Significant
7.	The inputs and plant protection chemicals recommended in weather-based agro-advisory bulletins are not readily available in the market	Negative	1.92	Significant
8.	The clarity, adequacy and usefulness of weather-based agro-advisory messages influence their adoption	Positive	3.12	Significant
9.	Farmers frequently recommend weather-based agro-advisories to their peers	Positive	2.09	Significant
10.	Farmers express willingness to pay for weather advisory services if they find the information accurate and beneficial	Positive	1.58	Not significant
11.	WBAAS help farmers apply fertilizers more efficiently	Positive	3.46	Significant
12.	Farmers actively encourage others to use weather-based agro-advisories for better farm management	Positive	1.17	Not significant
13.	The use of WBAAS increases crop yield	Positive	2.86	Significant
14.	Some farmers struggle with weather-based advisories as they often align with their farming schedules	Negative	2.46	Significant
15.	WBAAS help reduce the incidence of pests and diseases	Positive	3.22	Significant
16.	Lack of literacy hinders farmers ability to understand agro-advisories	Negative	2.15	Significant
17.	Weather-based agro-advisory services provide valuable information that helps farmers plan their farm operations in advance	Positive	1.64	Not significant
18.	Farmers commonly trust the accuracy of the information provided in weather-based agro-advisories	Positive	1.59	Not significant
19.	Farmers sometimes question the feasibility of implementing advisory recommendations	Negative	1.07	Not significant
20.	Social interactions among farmers improve as they share knowledge gained through weather-based advisories	Positive	2.85	Significant

21.	Small-scale farmers find it difficult to afford the implementation of advisory recommendations	Negative	1.41	Not significant
22.	Some weather advisory services do not fully address farmers' the specific needs of all farmers	Positive	1.63	Not significant
23.	Failure to use weather advisory services leads to inefficient farm input use	Negative	2.17	Significant
24.	Small-scale farmers often face greater difficulty in accessing the benefits of weather-based agro-advisories compared to large-scale farmers	Negative	1.36	Not significant
25.	Farmers are less likely to prefer weather advisory services that do not align with their cropping patterns and field conditions	Negative	1.28	Not significant
26.	The role of weather advisory services in mitigating climate change effects is widely acknowledged	Positive	2.32	Significant
27.	The use of WBAAS reduces farmers dependence on extension personnel for weather-related information	Positive	3.76	Significant
28.	Farmers struggle to recognize the adaptability of weather-based agro-advisories to their field conditions	Negative	1.16	Not significant
29.	Some farmers face challenges in accessing weather-based agro-advisory services limiting their benefits	Positive	0.76	Not significant
30.	Farmers are not fully convinced about the suitability of weather-based agro-advisory recommendations due to their crop-specific nature	Negative	1.98	Significant
31.	Farmers are increasingly becoming aware of WBAAS	Positive	4.13	Significant
32.	Poor mobile network or internet connectivity creates difficulties in accessing weather-based advisories, especially in remote areas	Negative	2.14	Significant
33.	Farmers gain enhanced knowledge and awareness of climate-smart agriculture through weather-based advisories	Positive	1.32	Not significant
34.	Some farmers feel advisories do not adequately address smallholder needs	Negative	-1.29	Not significant
35.	Temperature forecasts help farmers take necessary measures beforehand to protect crops from cold, frost and heat injury	Positive	3.94	Significant
36.	Climate change does not improve the consistency of agro-advisory services	Negative	0.73	Not significant
37.	Delayed weather-based agro-advisory messages reduce their usefulness	Negative	2.59	Significant
38.	Sustainable farming practices are encouraged through weather-based advisories	Positive	2.68	Significant
39.	WBAAS promote the adoption of innovative agricultural technologies	Positive	3.15	Significant
40.	Some farmers perceive weather advisories as inaccurate or unreliable	Negative	-0.53	Not significant
41.	Weather advisory information is easy to access and apply in farm operations	Positive	1.27	Not significant
42.	Weather forecasting information improves crop productivity	Positive	3.78	Significant
43.	WBAAS help increase farmers income	Positive	4.28	Significant
44.	Weather advisory services enhance farmers technical knowledge	Positive	0.96	Not significant
45.	The frequency of weather forecasting updates is sufficient to support farm planning	Positive	1.48	Not significant
46.	Farmers modify their farming practices based on weather advisory information	Positive	3.04	Significant
47.	Accurate weather forecasting information helps farmers prevent potential crop failures	Positive	1.69	Not significant
48.	Some farmers find weather advisories difficult to understand due to unclear communication	Negative	0.83	Not significant

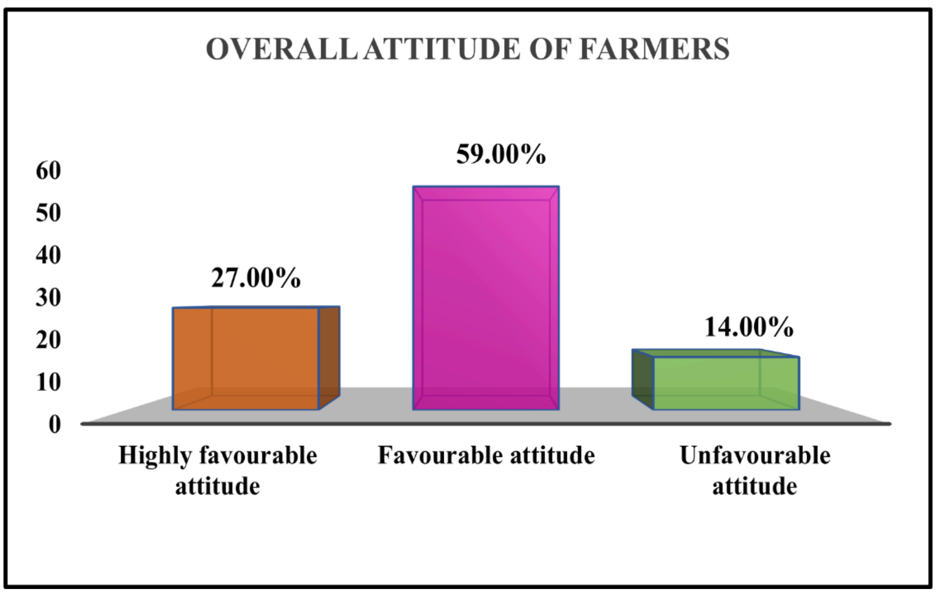
Statement-wise distribution of farmer's responses towards attitude on Weather Based Agro Advisory Services: The statement-wise analysis of farmers attitudes towards WBAAS was carried out using a five-point continuum scale comprising strongly agree, agree, undecided, disagree and strongly disagree. This section presents the frequency and percentage distribution of responses for each of the 26 selected statements. In this regard, the data provide a complete insight into farmers attitudes on how useful, advantageous, difficult and applicable on WBAAS. This information can be very helpful for recognizing the advantages and weaknesses of farmers attitudes, which will help to develop relevant strategies and policies for better use of WBAAS. From the distribution of responses to 26 attitudinal questions, one can see that farmers hold positive attitudes toward WBAAS. A number of farmers strongly agreed or agreed with questions regarding the importance and effectiveness of WBAAS.

Overall distribution of farmers based on their attitude towards Weather Based Agro Advisory Services: To gain a broader understanding of farmers attitude levels the respondents were classified into three categories namely highly favorable, favorable and unfavorable based on their total attitude scores. The classification was carried out using the mean and standard deviation (mean ± SD) values. The results of the overall attitude of the farmers towards WBAAS are given in Table 2, Fig. 2.

Table 2. Overall attitude of farmers on Weather Based Agro Advisory Services

S. No.	Attitude category	No. of farmers	Percentage (%)
1.	Highly favourable attitude	81	27.00
2.	Favourable attitude	177	59.00
3.	Unfavourable attitude	42	14.00
Total		**300**	**100.00**

Fig. 2 Overall attitude of farmers on Weather Based Agro Advisory Services



RESULTS

From the Table 3, it is evident that 57.33% of the farmers strongly agreed and 32.33% agreed to the timely and accessible nature of WBAAS. More than half 55.00% of the respondents strongly agreed while 26.33% agreed that scientific WBAAS were more accurate than traditional methods. The findings also indicated that 52.67% of the farmers strongly agreed while 20.67% agreed that the weather forecast information was location-specific rather than general in nature.

Furthermore, 44.67% of the farmers strongly agreed and 24.00% agreed that WBAAS enabled them to select suitable crop cultivars for particular sowing season. Only, 6.67% of the farmers strongly agreed while only 10.67% of the farmers agreed that procurement of the inputs and pesticides recommended in the agricultural advisory circulars was tough or not easily available in the market. In addition, the majority 33.67% of the farmers strongly agreed and 31.33% agreed on how clear, adequate and useful weather based advisory messages affected the adoption of these messages. The results indicated that 38.33% of the farmers strongly agreed and 32.67% agreed that they frequently recommended WBAAS to their peers.

Table 3. Statement wise distribution of farmers on attitude towards Weather Based Agro Advisory Services

S. No.	Statement	SA	A	UD	DA	SDA
1.	WBAAS are available to farmers in a timely manner	172 (57.33)	97 (32.33)	21 (7.00)	8 (2.67)	2 (0.67)
2.	Scientific WBAAS provide more accurate information than traditional weather prediction methods	165 (55.00)	79 (26.33)	43 (14.33)	8 (2.67)	5 (1.67)
3.	Weather forecast information is more location specific, rather than generalised	158 (52.67)	62 (20.67)	38 (12.66)	23 (7.67)	19 (6.33)
4.	WBAAS assist farmers in selecting suitable crop cultivars for the sowing season	134 (44.67)	72 (24.00)	54 (18.00)	25 (8.33)	15 (5.00)
5.	The inputs and plant protection chemicals recommended in weather-based agro-advisory bulletins are not readily available in the market	20 (6.67)	32 (10.67)	48 (16.00)	96 (32.00)	104 (34.66)
6.	The clarity, adequacy and usefulness of weather-based agro-advisory messages influence their adoption	101 (33.67)	94 (31.33)	39 (13.00)	39 (13.00)	27 (9.00)
7.	Farmers frequently recommend weather-based agro-advisories to their peers	115 (38.33)	98 (32.67)	26 (8.67)	38 (12.67)	23 (7.66)
8.	WBAAS help farmers apply fertilizers more efficiently	119 (39.67)	92 (30.67)	37 (12.33)	32 (10.67)	20 (6.66)
9.	The use of WBAAS increases crop yield	102 (34.00)	97 (32.33)	45 (15.00)	38 (12.67)	18 (6.00)
10.	Some farmers struggle with weather-based advisories as they often align with their farming schedules	18 (6.00)	35 (11.67)	51 (17.00)	96 (32.00)	100 (33.33)
11.	WBAAS help reduce the incidence of pests and diseases	186 (62.00)	37 (12.33)	32 (10.67)	28 (9.33)	17 (5.67)
12.	Lack of literacy hinders farmers ability to understand agro-advisories	24 (8.00)	37 (12.33)	44 (14.67)	98 (32.67)	97 (32.33)
13.	Social interactions among farmers improve as they share knowledge gained through weather-based advisories	103 (34.33)	86 (28.67)	51 (17.00)	35 (11.67)	25 (8.33)
14.	Failure to use weather advisory services leads to inefficient farm input use	23 (7.67)	37 (12.33)	55 (18.33)	87 (29.00)	98 (32.67)
15.	The role of weather advisory services in mitigating climate change effects is widely acknowledged	113 (37.67)	85 (28.33)	43 (14.33)	42 (14.00)	17 (5.67)
16.	The use of WBAAS reduces farmers dependence on extension personnel for weather-related information	115 (38.33)	75 (25.00)	44 (14.67)	39 (13.00)	27 (9.00)
17.	Farmers are not fully convinced about the suitability of weather-based agro-advisory recommendations due to their crop-specific nature	28 (9.33)	51 (17.00)	59 (19.67)	89 (29.67)	73 (24.33)
18.	Farmers are increasingly becoming aware of WBAAS	105 (35.00)	70 (23.33)	53 (17.67)	46 (15.33)	26 (8.67)
19.	Poor mobile network or internet connectivity creates difficulties in accessing weather-based advisories, especially in remote areas	34 (11.33)	38 (12.67)	35 (11.67)	91 (30.33)	102 (34.00)

20.	Temperature forecasts help farmers take necessary measures beforehand to protect crops from cold, frost and heat injury	111 (37.00)	99 (33.00)	39 (13.00)	28 (9.33)	23 (7.67)
21.	Delayed weather-based agro-advisory messages reduce their usefulness	32 (10.67)	41 (13.67)	54 (18.00)	81 (27.00)	92 (30.66)
22.	Sustainable farming practices are encouraged through weather-based advisories	108 (36.00)	90 (30.00)	56 (18.67)	25 (8.33)	21 (7.00)
23.	WBAAS promote the adoption of innovative agricultural technologies	122 (40.67)	78 (26.00)	50 (16.67)	32 (10.66)	18 (6.00)
24.	Weather forecasting information improves crop productivity	110 (36.67)	85 (28.33)	46 (15.33)	38 (12.67)	21 (7.00)
25.	WBAAS help increase farmers income	125 (41.67)	89 (29.67)	33 (11.00)	37 (12.33)	16 (5.33)
26.	Farmers modify their farming practices based on weather advisory information	158 (52.67)	67 (22.33)	32 (10.67)	24 (8.00)	19 (6.33)

SA - Strongly Agree; **A** - Agree; **UD** - Undecided; **DA** - Disagree; **SDA** - Strongly Disagree
Values given in parenthesis () indicates percentage of total

Additionally, 34.00% of the farmers agreed strongly and 32.33% agreed that the use of WBAAS is linked to higher yields of crops, while 36.67% strongly agreed and 28.33% agreed that it enhances crop productivity. Apart from this, 39.67% strongly agree that advisories help in ensuring proper use of fertilizers, whereas 62.00% strongly agree that advisories could help reduce the number of pests and diseases. The results indicated that 34.33% of the farmers strongly agreed and 28.67% agreed that social interactions among farmers improved as they shared knowledge gained through WBAAS. Approximately, 37.67% of the farmers strongly agreed and 28.33% agreed that there is recognition of the importance of weather advisory services in addressing the impact of climate change. The results revealed that 38.33% of the farmers strongly agreed and 25.00% agreed that the adoption of WBAAS has reduced their reliance on extension agents for weather-related information.

The results also revealed that 41.67% of the farmers strongly agreed and 29.67% agreed that their income improved through the use of weather advisory information. Similarly, 40.67% strongly agreed that advisory services promote the use of advanced agricultural technologies through innovation. Awareness of WBAAS among farmers had significantly increased with 35.00% of the farmers strongly agreed and 23.33% agreed. The findings showed that 36.00% strongly agreed while 30.00% agreed that WBAAS contributed towards sustainable agricultural activities. Furthermore, 40.67% of the farmers strongly agreed and 26.00% agreed that the introduction of WBAAS has contributed to the increase in adoption of innovative agricultural technology. Additionally, 37.00% strongly agreed that the forecasting of temperature aided them in taking necessary precautions for extreme weather occurrences. The results revealed that 52.67% of the farmers strongly agreed and 22.33% agreed that they modified their farming practices based on weather advisory information.

A majority of farmers 59.00% were found to have a favorable attitude, followed by 27.00% exhibiting a highly favorable attitude while only 14.00% of the respondents fell under the unfavorable category. The high proportion of farmers in the favorable and highly favorable categories (a combined 86.00%) clearly indicates a strong acceptance and positive perception of WBAAS.

DISCUSSION

These findings may be due to the respondent's positive perception of WBAAS and their notion that such advisories are beneficial for decision-making related to farming. Farmers seemed to believe that these weather-based advisories could assist them in mitigating risks associated with weather, making optimal utilization of farm inputs and crop management practices. Such positive perceptions may be because of the increasing understanding about the usefulness of such weather-based advisory services in agriculture (Suckall and Soares, 2022; Nepal *et al.*, 2024). The positive attitude is also because of the farmers increased faith in the value and significance of weather based advisory systems amid the rising unpredictability of the climatic conditions (Elias *et al.*, 2019). Regular exposure to such WBAAS through extension agencies and digital communication channels may be another factor for developing positive perceptions about such services. On the contrary, the relatively low number of respondents with negative attitudes indicates that there were still some farmers who expressed their concerns about the accuracy, reliability and comprehensibility of the weather advisory service (Guido *et al.,* 2021). Only a small proportion of farmers expressed doubts about the usefulness of the service and also few farmers considered advisories as being hard to match with the farming schedule and unsuitable recommendations (Raja and Naika, 2023).

The predominance of favorable and highly favorable attitudes indicates that WBAAS have gained considerable acceptance among farmers as a reliable source of information for farm decision-making. This positive attitude may be attributed to the increasing awareness of the usefulness of weather advisories in minimizing weather-related production risks, improving resource-use efficiency, enhancing crop productivity and supporting climate-resilient agriculture (Zuma-Netshiukhwi *et al.,* 2016; Singh *et al.,* 2018; Kumar *et al.,* 2022; Lakshmi *et al.,* 2023). Regular dissemination of timely, location-specific advisories through extension agencies, mobile applications and other digital communication platforms may have further strengthened farmers trust in WBAAS (Wehde and Nowlin, 2023). Although only a small proportion of respondents exhibited an unfavorable attitude their concerns may be associated with perceived limitations in the accuracy, reliability and practical applicability of the advisory information. Furthermore, the higher proportion of farmers with favorable rather than highly favorable attitudes suggests that there is scope to enhance farmers confidence and sustained utilization of WBAAS through improved advisory quality, targeted awareness campaigns, capacity-building programmes and strengthened extension support (Vedeld *et al.,* 2020; Rohit *et al.,* 2024; Ojo *et al.,* 2025). The educational status influenced farmers attitudes with better-educated farmers exhibiting a more favorable attitude towards WBAAS than less-educated farmers.

Overall, the WBAAS has achieved a considerable level of acceptance among farmers but targeted interventions are required to enhance usability and inclusiveness thereby promoting wider adoption and maximizing its impact on agricultural sustainability and climate resilience.

Conclusion: This study has evaluated the farmers attitudes towards WBAAS through a standardized and validated scale among the farming community in the Western Zone of Tamil Nadu. According to the findings obtained from this evaluation, it was observed that most of the farmers had very favourable attitudes towards the WBAAS, which signifies that they recognize the utility of these services in farm management and risk mitigation due to adverse weather conditions. However, a few of the farmers had unfavourable attitudes towards the services, mainly because of forecast errors and inaccessibility of relevant information about them.

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