

A SCALE TO MEASURE PERCEPTION OF FARMERS TOWARDS WEATHER BASED AGRO-ADVISORY SERVICES

Atul Kumar¹, J. S. Manhas² and Banarsi Lal³

1 Ph.D. Scholar, Division of Agricultural Extension Education, Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Science Technology of Jammu -180009

2 Professor, Division of Agricultural Extension Education, Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Science and Technology of Jammu-180009

3 Chief-Scientist and Head, KVK, Reasi, Sher-e-Kashmir University of Agricultural Science and Technology of Jammu - 180009

Email : atulhp0206@gmail.com

ABSTRACT

A scale was constructed with Likert's summated rating technique to measure the perception of farmers towards weather based agro-advisory services. Initially, a list of 28 items regarding perception of farmers towards weather based agro-advisory services sent to 45 experts for their relevancy using google forms and personal follow up. Based on 25 experts' rating, the Relevancy Percentage (RP), Relevancy Weightage (RW) and Mean Relevancy Scores (MRS) were estimated. 22 items with RP > 70, RW > 0.70 and overall MRS > 2.12 were considered for item analysis regarding perception of the farmer towards agro-advisory services. These items were then administrated to 20 farmers for item analysis. The reliability of the scale was established through a Spearman-Brown coefficient was found to be 0.86 and Cronbach's alpha value was 0.81 regarding perception of the farmers towards agro-advisory services which show high reliability. The validity was ensured using Lawshe's Content Validity Ratio (CVR), with items below the CVR threshold of 0.49 removed. The final scale helps measure famers' perception towards AAS and can guide stakeholders in refining information dissemination strategies. The validity and reliability measures of the scales indicated the precision and consistency. This scale provides a valid and reliable tool for researchers, extension professionals and policymakers to evaluate and enhance the impact of agro-advisory services on farming communities.

Keywords: perception, agro-advisory services, validity, reliability, scale construction

INTRODUCTION

The weather and climate conditions in India have significant impact on the agricultural sector. These phenomena cannot be entirely controlled but can be adjusted as needed during crop cultivation. Otherwise, they may lead to complete crop failure, and, ultimately, a food crisis (Sharma, 2019). In this context, timely weather information allows farmers to organize their farm activities efficiently, helping to maximize yield and reduce crop losses (Das *et al.*, 2018). Weather forecasts help farmers make decisions about crop selection, variety, planting/harvesting dates, and investments in farm inputs including irrigation, fertilizer, pesticides and herbicides. Variability in rainfall during the crop season, including delayed monsoon start, excessive rains, and long dry spells, can impact crop growth and produce quality and quantity (Ramachandrappa *et al.*, 2018). Therefore, more reliable weather forecast agro advisory services extensively assist farmers in maximizing favorable weather conditions and reducing the effects of adverse outcomes. These advisory

services which are offer timely, location-specific weather information and farming recommendations are essential in helping farmers make informed decisions, particularly facing of climate variability. AAS is an ideal way to communicate and transmit technologies (Gandhi *et al.*, 2018). The Agromet division of the Indian Meteorological Department in Pune provides AAS twice a week based on Medium Range Weather Forecast (MRWF) through Agro Met field Units (AMFUs). Since then, AMFUs have regularly (on every Tuesday and Friday) disseminated weather forecasts and AAS to farmers in the district via various channels such as SMS, WhatsApp, Radio, Newspapers etc., (Ratiya *et al.*, 2022). Farmers' perceptions of weather based AAS play an important role in planning their agricultural practices, risk management strategies etc. Understanding how farmers perceive and utilize these advisories is essential. While perception scales exist (Kavad and Pandya, 2024; Praneeth *et al.*, 2024), none focus exclusively on weather based AAS in this regional context. Besides, researches based on studying perception of farmers towards weather based agro-advisory services

are very limited. Keeping in view the importance of weather based AAS in crop production, it is essential to construct and standardized a scale that studies the perception of farmers towards weather based agro-advisory services.

OBJECTIVE

To construct and standardize a scale to measure the perception of farmers towards weather based agro-advisory services

METHODOLOGY

Perception is a cognitive process by which individuals organize, interpret, and understand their surroundings and environment which also includes impressions formed by objects, events, and people (Kavad and Pandya, 2024). The Summated Ratings method by Likert (1932) was used in the development of the measuring instrument. Based on review of literature, 45 items regarding perception of the farmers towards weather based AAS were collected and edited based on criteria suggested by Edwards (1957). After editing, 28 items were retained for scale construction under perception of the farmer towards agro advisory services. The items were distributed to 35 experts in the field of extension education, Agronomy and Agrometeorology specialists for critical evaluation through mail and personal contacts. The experts were requested to give their responses on a three-point continuum *viz.*, highly relevant, relevant and irrelevant with scores 3, 2 and 1, respectively. 25 experts responded in time and their relevancy score was ascertained by adding the scores on rating scale. From this data relevancy percentage, relevancy weightage and mean relevancy scores were calculated for all the items.

Relevancy percentage was calculated by summing up the scores of most relevant, relevant and irrelevant categories, which were converted into percentage. Further, relevancy weightage (RW) was calculated by applying the following formula, which was applied by Praneeth *et al.* (2024).

$$RW = \frac{MR+R+IR}{MPS}$$

Moreover, Mean Relevancy Score (MRS) was obtained by the following formula,

$$MRS = \frac{MR+R+IR}{N}$$

Whereas, MR= Most Relevant (3), R= Relevant (2), IR= Irrelevant (1), MPS= Maximum Possible Score (25x3=75), N= Number of Judges (25)

Using these three criteria, the items were screened for their relevancy. Accordingly, items having relevancy

percentage > 70, relevancy weightage > 0.70 and mean relevancy score > 2.12 were considered for final selection of statements. By this process, 22 statements were isolated in the first stage, which were modified and rewritten according to the judges' suggestions. The relevancy percentage, relevancy weightage and mean relevancy score of 22 statements are given in Table 1.

Item Analysis

It was essential to delineate the items based on the extent to which they can differentiate the respondent with high perception than the respondent with low perception of weather based AAS. For this purpose, item analysis was carried out on the statements selected in the first stage. A schedule consisting of 22 statements was prepared and used for personally interviewing a sample of 20 farmers' from non-sampled area. The responses for the statements were taken on a five-point continuum, *viz.*, strongly agree (5), agree (4), undecided (3), disagree (2), and strongly disagree (1), with scores indicated in parenthesis for positive items and vice-versa for negative items. The perception score of the respondent was obtained summing up the scores of all statements.

Reliability

Reliability is the ability of a test instrument to generate consistent results from one set of measures to another. According to Kerlinger (1964) "Reliability is the accuracy or precision of a measuring instrument". Spearman-brown coefficient and Cronbach's alpha (α) were used for testing reliability. The split-half method was used to examine the reliability of scales, which were divided into two halves based on odd or even number of elements and administered to 20 farmers. Pearson's Product Moment Correlation coefficient was determined. The procedure is as followed by Patel *et al.* (2022); Patel and Vinaya (2022).

Validity

Content validity is the representativeness or sampling adequacy of the content- substance, the matter and the topics of a measuring instrument (Praneeth *et al.*, 2024). When selecting perception items, content validity was ensured. Due care was taken in selecting and formulating the items to comprehensively cover all the relevant aspects of perception of the farmers towards agro advisory services. For ensuring a good degree of validity, content validity ratio was used (Ansari and Khan, 2023; Sheema *et al.*, 2024 Singh *et al.* 2024; Machapathr *et al.*, 2024; Patil *et al.*, 2024).

Lawshe's Content Validity Ratio (CVR) evaluates the content validity of individual item in test or scales. In 1975,

it was introduced by Lawshe. The CVR evaluates whether each item is essential to measure the assessed concept. To calculate the CVR, a panel of 15 experts rated each item as either “essential” or “not essential” for the test. The scoring assigns ‘1’ for “essential” and “0” for “not essential” (Ansari and Khan, 2023).

The CVR is calculated by the following formula,

$$CVR = (ne - (N/2)) / (N/2)$$

Where:

ne = number of experts who rated the items as “essential”

N = total number of experts

For example, the content validity ratio (CVR) of the sixth item is:

$$CVR = (13 - (15/2)) / (15/2) = 0.73$$

As per Lawshe, a minimum CVR value of 0.49 or

above is selected and the items having CVR value below 0.49 are eliminated, if there are 15 experts involved in the validation process.

RESULTS AND DISCUSSION

For the standardization of the scale, reliability and validity were calculated. The split half method was used for assessing internal consistency of the scale. The half test reliability coefficient was calculated by using Cronbach’s Alpha. The Alpha value of odd number items was found 0.81 and for even number items was 0.70. The value of correlation coefficient was 0.75 (Table 2) for the perception of the farmers towards weather based AAS, and this was further corrected using Spearman’s Brown formula, yielding the set’s overall reliability coefficient which was 0.86. Gupta et al., (2022); Singh et al., (2021); Ansari et al., (2024) followed Spearman-Brown coefficient for testing the reliability. Data analysis was done with Statistical Package for Social sciences (SPSS) 16.

Table 1: Selection of the items based on judges (n=25): Relevancy Percentage (RP), Relevancy Weightage (RW) and Mean Relevancy Score (MRS)

Sr. No.	Items	RP	RW	MRS
1	AAS helps the farmers in selection of cultivars of crops during a particular sowing season	0.81	81.33	2.44
2	Weather based AAS helped in scheduling the sowing/ transplanting time	0.92	92.00	2.76
3	AAS helps in judicious application of fertilizers by the farmers	0.78	78.66	2.36
4	Rainfall forecasts help the farmers by providing information regarding water availability period for the crops	0.80	80.00	2.40
5	Weather based AAS is more beneficial under irrigated condition	0.89	89.33	3.00
6	Agro-advisory bulletin provides timely information about the intercultural operations like weeding and hoeing	0.74	74.66	2.24
7	Weather based AAS helps in timely disease management	0.76	76.00	2.28
8	AAS help in judicious use and better efficacy of pesticides	0.84	84.00	2.52
9	Weather based AAS help to maintain soil fertility status	0.86	86.66	2.60
10	AAS helps in reducing the farm losses	0.77	77.33	2.32
11	AAS helps in scheduling the harvesting and post-harvest operations	0.74	74.66	2.24
12	There has been an increase in the crop productivity as a result of application of weather based AAS	0.81	81.33	2.44
13	Overall income has increased through weather based agro-advisory services	0.77	77.33	2.32
14	Weather based AAS helps in crop contingency planning	0.78	78.66	2.36
15	Agro-advisory bulletins provide adequate information about field crops	0.80	80.00	2.40
16	Scientific weather based AAS are more accurate than traditional methods	0.85	85.33	2.56
17	AAS can be more useful to the farmers if provided in vernacular (<i>Dogri and Urdu</i>)	0.77	77.33	2.32
18	Temperature forecasts helps the farmers to take necessary measures before-hand to save the crops from cold, frost and heat injury	0.80	80.00	2.40
19	Weather based AAS is not risk management tool in agriculture	0.76	76.00	2.28
20	Farmers are not interested in knowing the economic benefits of the weather based AAS	0.89	89.33	3.00
21	Weather based AAS helps in mitigating the ill effects of climate change	0.73	73.33	2.20
22	Weather forecast information is more location specific, rather than generalised	0.78	78.66	2.36

Table 2: Reliability statistics of perception scale for measuring the perception of farmers towards weather based agro-advisory services

Reliability Statistics			Farmers perception towards AAS
Cronbach's Alpha	Odd number items	α value N of items	0.81 11 ^a
	Even number items	α value N of items	0.70 11 ^b
	Total N of items		22
Correlation between forms			0.75
Spearman-brown coefficient	Equal Length		0.86
	Unequal Length		0.86

a= Items with odd numbers; b = Items with even numbers

In the judgement, 6 items out of 28 instrument items were eliminated. These items were removed either because their content validity ratio (CVR) was below 0.49, based on the Lawshe table value corresponding to study's 15 experts or because they were merged with retained items based on the content experts' recommendations (Ansari and Khan, 2023). Table 3 presents instrument items along with the CVR calculation method. The remaining items were refined according to panel members' suggestions during the evaluation to enhance clarity.

Table 3: Calculating of CVR for all instrument items

Items	*N _e	**CVR	Interpretation
1	12	0.60	Remained
2	13	0.73	Remained
3	11	0.46	Eliminated
4	14	0.86	Remained
5	10	0.33	Eliminated
6	13	0.73	Remained
7	12	0.60	Remained
8	13	0.73	Remained
9	11	0.46	Eliminated
10	13	0.73	Remained
11	12	0.60	Remained
12	12	0.60	Remained
13	13	0.73	Remained
14	5	-0.33	Eliminated
15	12	0.60	Remained
16	12	0.60	Remained
17	13	0.73	Remained
18	7	-0.06	Eliminated
19	13	0.73	Remained
20	12	0.60	Remained
21	15	1.00	Remained
22	12	0.60	Remained
23	13	0.73	Remained
24	13	0.73	Remained
25	14	0.86	Remained
26	9	0.20	Eliminated
27	13	0.73	Remained
28	14	0.86	Remained

NOTE: * Number of experts evaluated the item essential, **CVR or Content Validity Ratio = $(N_e - N/2) / (N/2)$ with 15 person at the expert panel (N=15), the items with the CVR bigger than 0.49 remained at the instrument and the rest eliminated.

Table 4: Final scale for measuring the perception of farmers towards weather based agro-advisory services

Sr. No.	Items	SA	A	UD	DA	SDA
1	AAS helps the farmers in selection of cultivars of crops during a particular sowing season					
2	Weather based AAS helped in scheduling the sowing/ transplanting time					
3	AAS helps in judicious application of fertilizers by the farmers					
4	Rainfall forecasts help the farmers by providing information regarding water availability period for the crops					
5	Weather based AAS is more beneficial under irrigated condition					
6	Agro-advisory bulletin provides timely information about the intercultural operations like weeding and hoeing					
7	Weather based AAS helps in timely disease management					
8	AAS help in judicious use and better efficacy of pesticides					
9	Weather based AAS help to maintain soil fertility status					
10	AAS helps in reducing the farm losses					
11	AAS helps in scheduling the harvesting and post-harvest operations					
12	There has been an increase in the crop productivity as a result of application of weather based AAS					

Sr. No.	Items	SA	A	UD	DA	SDA
13	Overall income has increased through weather based agro-advisory services					
14	Weather based AAS helps in crop contingency planning					
15	Agro-advisory bulletins provide adequate information about field crops					
16	Scientific weather based AAS are more accurate than traditional methods					
17	AAS can be more useful to the farmers if provided in vernacular (<i>Dogri and Urdu</i>)					
18	Temperature forecasts helps the farmers to take necessary measures before-hand to save the crops from cold, frost and heat injury					
19	Weather based AAS is not risk management tool in agriculture(-)					
20	Farmers are not interested in knowing the economic benefits of the weather based AAS(-)					
21	Weather based AAS helps in mitigating the ill effects of climate change					
22	Weather forecast information is more location specific, rather than generalised					

SA = Strongly Agree, A = Agree, UD = Undecided, DA = disagree, SDA = Strongly Disagree. (-) = Negative items

Administration of the scale

The final constructed scale (Table 4) containing 22 items can be administrated to study the perception of farmers towards agro advisory services on a five-point scale: 5 for strongly agree (SA), 4 for agree (A), 3 for undecided (UD), 2 for disagree (DA), and 1 for strongly disagree (SDA) and the reverse scoring pattern for negative items. The highest and lowest possible scores range from 110 to 22, respectively.

CONCLUSION

A scale was systematically developed to measure the perception of farmers towards weather based agro-advisory services using standardized procedures. Item analysis, along with reliability and validity testing, confirmed the appropriateness of the selected items. The finalized scale demonstrated a high degree of establishing its suitability for future research and extension purposes. In the context of increasing climate variability and the critical need for timely and location-specific agricultural information, such a scale can be an effective tool for evaluating and enhancing the outreach and impact of weather-based advisories. The researchers will gain insight into the major factors influencing farmers' perceptions of weather based agro-advisory services by using this standardized tool. Furthermore, policymakers, administrators and other stakeholders will benefit from the findings derived from this research tool as they work to promote and popularize weather based agro-advisory services.

RECOMMENDATION/POLICY IMPLICATION

The scale may be applied in similar agro-climatic regions for perception analysis. Extension professionals can use it to identify perception gaps and adjust strategies accordingly. Policymakers can prioritize improvements in AAS outreach on findings.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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