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A SCALE TO MEASURE THE PERCEPTION OF FARMERS ABOUT CLIMATE CHANGE

K. R. Khunt[1], N. B. Jadav[2], H. M. Movaliya[3]

1 Assistant Professor, Gujarat Natural Farming Science University, Halol-389350
2 Director of Extension Education, Junagadh Agricultural University, Junagadh-362001
3 Assistant Professor, Junagadh Agricultural University, Junagadh-362001
E-mail: krimpal.r.khunt@gmail.com

ABSTRACT

Perception is a process through which an individual becomes aware of objects and of events taking place around him. To develop and standardize a scale to measure farmers' perception of climate change and its impact on agriculture. The scale was developed using Likert's Summated Ratings method, following a rigorous process to ensure its validity and reliability. Initially, 80 items were gathered from various sources, including literature and expert consultations, and out of total, 60 statements were selected as non-ambiguous. These statements underwent a relevancy test with 50 experts, resulting in the selection of 30 items based on their relevancy percentage, mean relevancy weightage, and mean relevancy score. Further item analysis was conducted by administering these 30 statements to 30 farmers, segregating them into high and low perception groups. Using a t-test, 28 statements with 1.75 t-value were selected for the final scale. The scale's reliability was confirmed with a split-half method, yielding a reliability coefficient of 0.59. Content validity was verified through expert discussions. The final scale, consisting of 28 statements, assesses the perception of farmers on various climate change aspects such as crop productivity, weather patterns and adaptation strategies. It provides a valuable tool for understanding farmers' views on climate change, guiding agricultural policy and extension services aimed at improving climate resilience.

Keywords: *perception, climate change, standardize scale, reliability, validity*

INTRODUCTION

Climate change is widely regarded as one of the most critical threats to the survival of the human race in the 21st century. Ongoing debates often involve nations shifting blame onto one another for contributing more significantly to the problem. In India, the agriculture sector is expected to face severe and long-term consequences as a result of climate change.

The most important impact of the climate change can be observed in obvious terms of global temperature increase popularly known as global warming. There was a worldwide increase (0.4-0.7˚C) in temperature (Singh *et al.,* 2013). Ecologically, this represents a significant and alarming shift. Rising temperatures are triggering a range of serious issues, including the melting of glaciers, rising sea levels that threaten to submerge coastal areas, and altered rainfall patterns that increase the frequency of both droughts and floods. These changes also have profound impacts on human health and livelihoods. Agriculture, a cornerstone of India's economy, is particularly vulnerable, and its decline due to climate change poses a serious threat to the country's overall stability and development.

Climate change directly affects agriculture production as this sector is inherently sensitive to climatic conditions and is one of the most vulnerable sectors at the risk and impact of global climate change (Parry *et al.,* 2005; Vinaya & Gadde, 2025; Vinaya et al., 2016).

Rapid urbanization, industrialization, and economic growth have already placed a significant stress on India's ecological and social systems; climate change is making these systems even more vulnerable. The country is particularly vulnerable to climate impacts due to its large and expanding population, a 7,500-kilometer-long densely populated and low-lying coastline, and an economy that remains closely dependent on natural resources.

Negative impacts of climatic change are such as cereal productivity to decrease by 10-40 percent by 2100, greater loss expected in Rabi crops. Every 1˚C increase in temperature will reduce wheat production by 4-5 million tones and with increase in 2˚C temperature the yield of rice and wheat will decrease i.e. 8.5 and 12.2 quintal per hectare, respectively. Further increase in melting of glaciers in Himalayas will affect availability of irrigation in the Indo - Gangetic plains (Aggarwal, 2008). Thus, it is important to investigate the perception of farmers about perception of farmers about climate change. Perception of the farmers

is also changing as the climate is changing every day. As the temperature is increasing, rainfall is shifting and heavy climatic disaster is occurring. The perception of the farmers is changing. In this back drop, developing and standardizing a scale to measure perception of farmers about climate change is carried out.

OBJECTIVE

To develop and standardize the scale to measure perception of farmer about climate change

METHODOLOGY

The measuring instrument was developed using the Summated Ratings method, introduced by Likert (1932). The competence scale was developed through the following stages: Item collection, Editing the statements, Relevancy test, Item analysis, Selection of statements for final scale, Reliability of scale, Content validity of the scale, Administering the scale. The Likert summated rating scale was used because it provides a reliable and standardized way to aggregate multiple statements into a single, internally consistent quantitative measure, improving the precision and validity of perception assessment.

For the measurement of relevancy test Relevancy Percentage (RP), Mean Relevancy Weightage (MRW) and Mean Relevancy Score (MRS) were calculated by using following formulas:

(A) Relevancy Percentage (RP) = It is the number of respondents who scored the statements as "most relevant" and "relevant", which is converted into percentage.

Where, FS = Frequency score of most relevant and relevant

(B) Mean Relevancy Weightage (MRW) = It is the ratio of actual score obtained to the maximum possible score (MPS) obtainable for each statement. It was calculated by using the following formulae:

Where,

MRR = Most relevance response

RR = Relevant response

LRR = Least relevance response

MPS = Maximum Possible Score = No. of judges responded 3 (503=150)

(C) Mean Relevancy Score (MRS) = It is the ratio of actual score obtained by each respondent to the number of judges responded for the variable.

Where,

MRR = Most relevance response

RR = Relevant response

LRR = Least relevance response

In the stage of Item analysis for the final selection of the scale statements the critical ratio was calculated by t-test. The 't' value is a measure of the extent to which a given statement differentiates the high group from the low group. The 't' value was calculated by using the formula suggested by Edwards (1957).

$$t = \frac{X_H - X_L}{\sqrt{\frac{S_H^2}{n_H} + \frac{S_L^2}{n_L}}}$$

Where,

X_H = the mean score on a given statement for the high group

X_L = the mean score on the same statement for the low group

S^2_H = the variance of the distribution of responses of high group to the statement

S^2_L = the variance of the distribution of responses of low group to the statement

n_H = number of subjects in the high group

n_L = number of subjects in the low group

A standard procedure followed as suggested by Harikrishna *et al.,* (2021), Nedhi Rani Sharma (2023), Patel Rathod *et al*., (2023); Rathod *et al*., (2023); Shah Rathod *et al*., (2023); Singh Rathod *et al*., (2023), Praneeth *et al*., (2024); Parikh *et al.* (2024); Fazely *et al.* (2024); Bhabhor *et al.* (2024); Pokiya *et al.* (2024); Ghasura *et al.* (2024); Vinaya & Gadde (2025); Vinaya et al. (2016).

RESULTS AND DISCUSSION

The procedure undergone for the development and standardization of a scale to measure the level of perception of farmers about climate change is described under the following heads:

(1) Item collection

A list of items and statements were collected on the

different perception associated with climate change from available literature in books, journals, magazines, newspaper, internet, etc. A tentative list of 80 statements was prepared after consulting with the researchers, extension experts and farmers.

(2) Editing the statements

The items and statements were carefully edited according to the criteria given by Likert, Bird, Edwards and Kilpatrick. Out of total, 60 statements were selected as they were found to be non-ambiguous and non-factual.

(3) Relevancy test

It was possible that all the collected statements may not be equally relevant in measuring the perception of farmers about climate change. So that, these statements were subjected to scrutiny by an expert panel to determine their relevancy and their screening for final inclusion in the scale. The judges include the experts from the different SAUs, State Departments and Extension Institutes who are from extension education disciplines. The statements were sent to 100 judges with necessary instructions to critically evaluate each statement for their relevancy. The judges were requested to assess each statement based on a three-point continuum *viz.,* most relevant, relevant and least relevant, respectively. Out of 100, only 55 responded in the time of one month, out of which five judges' responses were rejected due to incomplete and ambiguous responses. By summing up, the score given by 50 judges, the total score of all the 60 statements was calculated. From this, Relevancy Percentage (RP), Mean Relevancy Weightage (MRW) and Mean Relevancy Score (MRS) were calculated.

Using the criterion, the statements were screened for their relevancy. The statements having relevancy percentage > 70, mean relevancy weightage > 0.70 and mean relevancy score > 2 were selected for final selection of statements. By this process 30 statements were selected and modified and rewritten as per the comments of the experts.

(4) Item analysis

Item analysis is an important step as per the Likert technique of construction of valid and reliable scale. It was essential to delineate the items based on the extent to which they can differentiate the respondents with high perception than the respondents with low perception about climate change. A schedule consisting of 30 statements was prepared and used for personally interviewing a sample of 30 farmers from non-sampled area. The responses for the statements were obtained on a five-point continuum *viz.,* Strongly agree, Agree, Undecided, Disagree and Strongly disagree with scores of 5, 4, 3, 2 and 1, respectively. For negative statements, the scoring pattern was reversed. The respondents' perception score was calculated by sum up the scores assigned to all the statements. For item analysis, the respondents were arranged in ascending order based on perception score. Twenty-five percent of the respondents with highest total scores and 25 per cent with lowest total score were selected. These two groups provided the criterion groups in terms of evaluating the individual statements as suggested by Edwards. Thus, out of 30 farmers to whom the items were administered for the item analysis, 8 farmers with highest and 8 farmers with lowest scores were used as a criterion group to evaluate individual item. The critical ratio was calculated by t-test.

(5) Selection of statements for final scale

After computing "t" value for all the items, 28 statements with highest "t" value equal or greater than 1.75 were selected. The thumb rule of rejecting the items with 't' value less than 1.75 was followed. As per the thumb rule, selection of items (i.e. statements) to be retained in the scale was based on the highest discriminating values, besides eliminating those with poor discriminating ability and questionable validity.

Thus, 28 statements were retained in the final scale based on the following criteria:

(1) The 't' value should be more than 1.75

(2) The statement should present a new idea *i.e.* the idea not overlapping with that expressed with other statement

(3) The statement should be simply worded and brief.

(6) Reliability of scale

A scale is reliable when it consistently produces the same results when applied to the same sample. In this study, split-half method of testing reliability was used. The 20 statements were divided into two halves with ten odds numbered in one half and other ten even numbered statements in the other part. These were administered to 20 farmers. Each of the two halves of statements was treated as a separate scale and then these two subscales were correlated. To test the reliability of the scale, the SPSS Statistics 22 version Software was used and the reliability coefficient was calculated on performing the analysis. Co-efficient of correlation (reliability co-efficient) between the two sets of scores was found to be significant (r = 0.59). The reliability co-efficient thus obtained, indicated that internal consistency of the scale developed for the study was high.

(7) Content validity of the scale

The validity of the scale was examined for content validity by determining how well contents were selected by discussing it with specialists of extension and academicians

of Junagadh Agricultural University. The content of the scale was realized applicable to measure perception of farmers about climate change as an occupation by the experts. Thus, the present scale satisfied the content validity.

(8) Administering the scale

The final perception scale consisting 28 statements was administered on the sample of farmers to measure their level of perception about climate change. They were asked to express their reaction in terms of their agreement or disagreement with each item by selecting one of five response categories viz. strongly agree, agree, undecided, disagree and strongly disagree. For positive statements scores of 5, 4, 3, 2 and 1 were given for strongly agree, agree, undecided, disagree and strongly disagree responses respectively. The scoring was reverse in case of negative statements. The total score was calculated by summing up the scores obtained for each statement per farmers. The maximum score that could be obtained for a farmer was 140 and minimum was 28. The higher the score, respondents had high level of perception about climate change.

Table: 1 List of final selected statements with RP, MRW, MRS and t- value for the scale to measure perception of farmers about climate change

Sr. No.	Statements	RP	MRW	MRS	t value
1	Climate change has made the agriculture sector more susceptible.	0.90	89.57	2.69	3.03
2	Climate change is currently the most pressing problem.	0.85	85.42	2.56	2.92
3	Climate change causes the temperature to rise every year.	0.84	84.03	2.52	2.86
4	Agriculture productivity has been impacted by the frequency and severity of dry periods.	0.78	77.76	2.33	2.62
5	Human activities are to blame for climate change.	0.85	85.40	2.56	2.99
6	Climate change has made livestock husbandry more susceptible.	0.80	79.86	2.40	2.50
7	Weed and insect pest invasions are becoming more common these days.	0.79	79.20	2.38	1.96
8	Crop disease is becoming more common these days than it was in the past.	0.78	78.43	2.25	2.92
9	Climate change is caused by both natural and human-induced changes in the environment.	0.82	81.92	2.46	3.15
10	Rainfall irregularities have grown commonplace.	0.83	83.33	2.50	2.92
11	Rainfall is irregular and inconsistent, which has an impact on crop production.	0.81	80.56	2.42	2.62
12	Farming is hampered by extreme cold, severe winds, and dense fog.	0.80	79.86	2.40	2.86
13	Heat stress caused by rising temperatures is proven to be detrimental to crops.	0.84	83.51	2.51	2.92
14	Climate change has affected the production of several crops.	0.76	76.05	2.03	2.99
15	Due to the general declining ground water table, crop cultivation has become more expensive.	0.79	79.40	2.38	2.50
16	Extreme weather events cause a larger loss of nutrients into waterways.	0.85	84.72	2.60	2.88
17	The farming community is unaware to the impacts of climate change.	0.80	79.86	2.45	1.88
18	As a result of climate change, deforestation has gotten increasingly severe.	0.81	81.25	2.44	2.88
19	Farmers are using a variety of adaptation and mitigation measures to deal with the negative effects of climate change.	0.85	85.40	2.56	2.88
20	Farmers' livelihood patterns are shifting due to changing climatic circumstances.	0.72	71.98	2.08	1.88
21	Farmers' lives have become more challenging as a result of climate change.	0.84	83.51	2.51	2.86
22	The biodiversity of hills is threatened by climate change.	0.78	78.43	2.25	2.62
23	Due to climate change, determining when to begin planting and harvesting activities has become more complex.	0.85	85.40	2.56	2.86
24	Climate change has a detrimental impact on farmers' marketing behaviour.	0.80	79.86	2.40	2.92
25	Climate change has little effect on agricultural product transportation.	0.77	77.08	2.31	2.50
26	Due to high rainfall, soil erosion is increasing day by day.	0.82	81.92	2.46	1.96
27	Farmers' crop seasons and cropping techniques are changing as a result of climate change.	0.81	81.25	2.44	2.88
28	Losses caused by climate change are widening the gap between prosperous and poor farmers.	0.84	84.03	2.52	2.86

RP= Relevancy Percentage**, MRW=** Mean Relevancy Weightage**, MRS=** Mean Relevancy Score

CONCLUSION

A final scale consisting of 28 statements was developed and standardized to assess farmers' perceptions of climate change. The scale's accuracy and consistency were evaluated using established procedures, ensuring its validity and reliability. It has been rigorously validated for effectively measuring farmers' perception level. Researchers can use this scale to measure the perception of farmers about climate change. It provides a valuable tool for understanding farmers' views on climate change, guiding agricultural policy and extension services aimed at improving climate resilience.

IMPLICATIONS

(1) The scale offers a reliable tool for assessing how farmers perceive climate change and its impacts on agriculture.

(2) The scale can inform the development of climate change adaptation policies and extension programs that are better aligned with farmers' perceptions and needs. By identifying the areas where farmers feel most vulnerable (e.g., changing rainfall patterns, extreme weather events), policymakers and extension services can tailor their communication strategies, outreach efforts, and training programs to address the most pressing issues in agriculture.

(3) The study highlights the importance of understanding farmers' views on how climate change affects crop production, livestock husbandry, and other agricultural activities.

(4) By revealing gaps in farmers' understanding of climate change, the scale can help direct educational and awareness programs to where they are most needed. With a clearer picture of how farmers perceive climate change, extension services can provide more relevant and practical advice on adapting farming practices to changing climatic conditions, such as crop diversification, water conservation, and soil health management.

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CONFLICT OF INTEREST

This is to declare that there is "No conflict of interest" among researchers.

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