Research Tool

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Attitude Scale for Assessing Farmers' Attitude toward Drip Irrigation

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HIGHLIGHTS

- The Drip Irrigation Technology Scale with 30 items was constructed with 0.65 reliability coefficient value.
- Positive and negative aspects were included as major dimensions.
- The final items were selected based on critical ratio i.e. having t value greater than 1.75.

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ABSTRACT

Due to the unavailability of an appropriate scale regarding farmers' attitude toward drip irrigation technology, the need to develop a scale was acknowledged and an attempt was made to construct a Likert's Summated Rating scale. A total of 72 items were collected with the help of literature review and were screened during 2024 based on 14-point criteria suggested by Edward (1957). A total of fifty-nine assertions were chosen, and data were collected through Google form which was sent to seventy-four specialists through email and by visiting to the professors and scientists in the university. A set of statements were eliminated and the remaining ones were chosen for item analysis based on the answers provided by the 30 experts and then it was administered to 30 farmers of Fatehabad district in Haryana. The scale's reliability was tested using the odd-even method, and the reliability coefficient was 0.806. The content validity was used to assess the scale's validity. In the end, the finalized scale had 30 items (18 positive and 12 negative).

INTRODUCTION

Among the irrigation methods that are available to farmers, drip irrigation is an innovative approach that addresses a variety of issues faced by the farmers in their fields. This system is becoming increasingly popular in regions where water is in little quantity and where high-value crops are cropped in protected structures. Water is gradually delivered to the plant's root zone through drip irrigation, which is an efficient and productive irrigation technique. It has been determined by several studies that drip irrigation can conserve 35 to 65 per cent of the water available. (Shaik & Mistry, 2018). Drip irrigation is a type of micro irrigation used for judicious use of water, especially in fruit and vegetable crops. It also has a water use efficiency of about 80-90 per cent (Swetha et al., 2019). The drip irrigation system emerged in 1964 in Israel with the advent of plastic materials, which allowed for the creation of flexible tubing and more precise emitters.

The current research aims to develop a scale for assessing farmers' attitude who have adopted drip irrigation and those who have not. A farmer's attitude involves various procedures in adopting novel technology and is an outcome of the constant collaboration of personal factors and extension climate (Boora et al., 2022). However, because of the complexity of the attitude phenomena, it can be difficult for psychologists and researchers to precisely describe and measure the attitude construct (Dillard, 1993). Long-term development strategies are avoided in a lot of attitude-based studies. Researchers frequently modify a standardised scale that already exists to use in their present studies (Meena & Singh, 2013) or gather a set of statements from the literature review and ask the respondents to rate their agreement

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on a Likert scale (Ward et al., 2016; Singh et al., 2021). Looking into the significance of farmers' attitude toward technology and bridging the research gap, an attempt was made to construct an equally reliable and valid standardized tool that can be used in future research to assess farmers' attitude toward Drip Irrigation Technology.

METHODOLOGY

Attitude is "the degree of positive or negative effect associated with some psychological object" (Thurstone, 1946). For developing a scale, the Likert's approach, which uses a summated rating scale, is widely recognised and accepted worldwide. Likert's summated rating scale procedure was applied step-by-step in this research to develop the standardised scale (Likert, 1932). A preliminary list of the statements was put together with proper consideration for their application or suitability in the region or area of the study. As we know, to create a legitimate and trustworthy scale, item selection isa very crucial part. So, initially, a list of 72 statements was collected and then screened as Edward (1957) suggested in his14-point criteria. After that, the test of relevancy was carried out on remaining statements in which the chosen items were sent to experts for their expert assessment of the statement's relevancy (Kumar et al., 2015; Kumar et al., 2021; Gupta et al., 2022; Panigarhi et al., 2024). To test the relevancy and complexity of the selected statements, A three-pointer scale (Most relevant, Relevant and Least relevant) consist of 59 statements were sent to 74 judges. A total of 43 statements were regarded as relevant based on the rating of 30 judges who responded and these items were used further for the critical ratio (t value) estimation. The statements with acritical ratio (t value) of 1.75 or higher were finally selected for the scale. The split-half method/odd-even method was performed to determine the reliability of this scale. The content validity test approach was used to determine the validity of this scale.

RESULTS

Data in Table 1 depicts the calculated t-value of the 30 finally selected items. The items involve both positive and negative aspects of drip irrigation technology in specific context. Selection of relevant statements for the scale was made after the relevancy test.

Relevancy test

From 74 experts, 31 replied within the time frame, 1 response from expert were excluded in the study because of its unclear nature. Finally, responses provided by 30 experts were considered for calculating the Mean Relevancy Score, Relevancy Percentage and Relevancy weightage. In the item analysis, we included 43 expert statements with mean relevancy scores greater than 2.5, relevancy weightage greater than 60, and relevancy percentage greater than 0.60. Additionally, the repetitive and duplicate statements were rechecked and rewritten as per the experts' suggestions.

$$\text{Mean Relevancy Score (MRS)} = \frac{MRR \times 3 + RR \times 2 + LRR \times 1}{\text{Number of judges}}$$

MRR- Most Relevant Response, RR- Relevant Response, LRR- Least Relevant Response

No. of judges = 30

$$\text{Relevancy Weightage (RW)} = \frac{MRR \times 3 + RR \times 2 + LRR \times 1}{MPS}$$

MPS = Maximum Possible Score (No. of Judges × 3=30 × 3=90)

$$\text{Relevancy Percentage (RP)} = \frac{FS}{\text{Number of respondents}} \times 100$$

FS=Score of Most Relevant & Relevant response frequency.

Item analysis

For constructing a reliable and valid scale, the item analysis is essential as suggested by likert's scaling technique. It is essential to classify the items based on their degree of differentiation, i.e., to what extent one item differs from another in terms of more favourable and less favourable respondents. Item analysis was performed on 43 items taken after first stage. These 43 chosen statements were included in the interview schedule used for surveying the 30 adopters of drip irrigation technology from a non-sampled region, i.e. Fatehabad district of Haryana state. The responses from farmers were taken on five-point continuum as strongly agree, agree, undecided, disagree and strongly disagree with scores 5, 4, 3, 2, 1 respectively. The final standardised scale after having item analysis will also have this five-point continuum stated above. The performance score was counted and arranged in ascending order for item analysis. Nearly twenty-five percent of respondents (eight statements) having highest score and about twenty-five percent (eight statements) having lowest score were selected. Both the clusters i.e. highest and lowest score formed as criterion groups to evaluate individual items as suggested by Edwards (1957). After analysing the t-test, the critical ratio was tabulated. The value of critical ratio was used to measure the degree of differentiation of items from higher cluster in comparison to the lower one. The t-test formula was suggested by Edwards (1969).

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

X_H = mean score of the item of higher cluster

X_L= mean score of the item of lower cluster

S_H^2 = variance of higher cluster to the item

S_L^2 = variance of lower cluster to the item

n_H = no. of subjects in higher cluster

n_L = no. of subjects in lower cluster

Then, the critical ratio or t value is calculated for the remaining items and those having t value <1.75 were discarded as per the rule suggested by Bird (1940). After referring to the above-written rule of the selection procedure, 30 statements were taken, as these items have highest discriminating values besides eliminating those with poor discriminating and question able validity. As a result, the attitude scale was ultimately composed of 30 items (18 positive and 12 negative).

Table 1. Final statements to measure farmers' attitude with "t" value

S.No.	Attitude statements	MRS	RP	RW	t-value
1.	Drip irrigation technology can increase area under irrigation approximately by 70%	2.59	62.53	0.65	2.25
2.	It is economically beneficial for farmers	2.63	63.76	0.66	2.61
3.	It is not viable for illiterate farmers	2.51	60.23	0.56	3.71
4.	This technology protects the plant from problem of frost	3.52	81.97	0.88	1.77
5.	This technology results in insufficient root development.	3.35	79.70	0.84	2.30
6.	Labour cost got decreased when field is irrigated by drip irrigation technology	3.14	74.02	0.79	3.10
7.	It's difficult to find replacement parts in local market.	3.59	72.89	0.90	1.90
8.	The method of fertigation saves the ample amount of fertilizer	3.31	76.54	0.83	1.77
9.	With a drip system, measuring the amount of water is easier than with other techniques.	3.10	67.21	0.78	2.89
10.	The production from drip irrigation technology might not rise significantly.	2.96	67.66	0.74	1.79
11.	Where there is a shortage of water, this technology is the most effective approach.	3.12	78.07	0.78	2.08
12.	Physical condition and structure of soil are disturbed by continuous use of drip technology of irrigation	3.21	77.23	0.81	3.09
13.	Drip irrigation is beneficial only in areas where there is a reliable & adequate supply of groundwater.	3.42	81.77	0.86	2.21
14.	The cost of installing drip irrigation systems is initially too high for a marginal farmer.	3.40	79.55	0.85	1.94
15.	The use of drip irrigation technology helps in conserving water resources.	3.45	89.06	0.87	2.22
16.	Drip irrigation method increases the yield of fruits and vegetables.	3.26	78.98	0.82	2.30
17.	Handling a Drip set is an extremely difficult process.	3.10	69.68	0.78	2.61
18.	Drip irrigation technology reduces soil erosion	3.52	81.11	0.88	1.90
19.	With the use of this technique, the root zone of the plant is kept moist	3.10	69.11	0.78	2.19
20.	It can be used to boost crop intensity	3.35	77.11	0.84	2.21
21.	Facilities for credit and subsidies are sufficient for drip irrigation technology	2.87	74.44	0.72	1.77
22.	Using drip irrigation technology, a high rate of water application is achieved	2.96	79.75	0.74	2.10
23.	For arid regions, drip irrigation method works well	2.84	67.43	0,71	2.87
24.	It helps in eliminating surface runoff of water.	2.96	75.83	0.74	2.10
25.	Through this technology, efficient water application can be achieved.	3.21	79.23	0.81	2.70
26.	Drip irrigation technology increase the fertilizer use efficiency	3.63	85.89	0.81	2.70
27.	It helps in preserving nutrient into the root zone of plants	3.49	89.93	0.88	2.26
28.	Salt is gathered near crop root zone by continuous use of drip irrigation	3.33	87.61	0.84	2.78
29.	The time in water application is generally long in case of drip irrigation	3.45	79.30	0.87	2.96
30.	There is less chance of water loss in form of evaporation when the field is irrigated through Drip Irrigation System	3.31	84.54	0.83	3.58

Reliability of the scale

Reliability is the accuracy or precision with which a measurement is taken. Split & Half method was used to measure reliability of this scale (Shelar et al., 2022; Vavilala et al., 2024). The items were divided into two groups i.e., one with odd numbers and one with even numbers, and administered to 30 respondents. Two sets of scores were used to obtain reliability. The Pearson's product moment correlation was 0.65, further verified by Spearman's Brown formula, and the reliability coefficient was found 0.71. The Cronbach alpha value yielded 0.806. This shows that the standardised attitude scale has a good internal consistency, as indicated by the coefficient of reliability.

Table 2. Scale's reliability

Cronbach alpha value of both sets	Set A	Value	0.756
		N of items	15[a]
	Set B	Value	0.857
		N of items	15[b]
		Total N of items	30
Correlation between both sets			0.656
Spearman brown coefficient		Equal length	0.716
		Unequal length	0.716

[a]Odd number of items, [b]Even number of items

Validity of the scale

Validity refers to the accuracy of a measure, or the extent to which a test measures what it claims to measure. Validity of this scale is secured by using the content validity. When the content of a single item or set of items accurately denotes the content that is needed to be measured, content validity is ensured. Thirty experts assessed each of the updated statement during the scale's development, and their suggestions were incorporated into the final product. This implies that this research tool is valid for measuring what it is meant to be measured and we can say that this scale possesses content validity.

DISCUSSION

Many studies have been conducted in drip irrigation technology focusing on knowledge, adoption and perception aspects related to farmers. However, they were also important aspects, but there is still little discussion about how the farmers think or perceive the technology they are practicing. The current study aimed to develop and standardize a scale to measure the attitude of farmers toward drip irrigation technology. Initially a pool of 72 statements were made by going through different scientific review of literature and expert advice from professionals. Based on the 14-point criteria suggested by Edwards, 59 statements were selected from 72 statements. After performing the relevancy test, 43 statements were selected for item analysis. As we know item analysis is very crucial step in the development of scale as it classifies the statements based on the degree of differentiation. Those 43 statements were further tested in item analysis in the non-sampling area of our study. Responses were collected from 30 farmers on a five-point continuum. The 't' value of 30 items was found equal to and greater than 1.75 that is regarded as significant at 5 per cent level of significance (Bird, 1940). In research methodology reliability and validity are two crucial tools that is used to standardise a developed scale (Panigarhi et al., 2024). When a scale provides the same measurement in comparable circumstances, it is considered as reliable. Split halves method was used to measure the reliability of this scale. The extent to which a scale assesses every facet of the subject, idea, or behaviour that it is intended to measure is known as content validity. The scale was created with the assistance of thirty specialists who provided expert guidance. They also examined all of the updated statements and all suggestions were incorporated into the scale. Thus, the current scale's content validity was fulfilled and finally the standardised scale is developed, validated and tested on the representative sample.

CONCLUSION

The concept of drip irrigation technology is gaining attraction or becoming familiar to farmers day by day in water deficit zones of our country, and the attitude of farmers toward this technology is critical for its success. The present research tool aims to help scholars, lawmakers, and anyone who wants to know farmers' attitude regarding drip irrigation in a particular area. They may be able to perform baseline surveys with the use of this scale in order to make policy judgments on water-saving irrigation technologies. With a reliability coefficient of 0.806, the developed tool is considered extremely consistent and can be used under varied circumstances.

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