

## A Scale to Analyze the Perception of Farmers towards Soil Testing

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### ABSTRACT

An attempt has been made to develop and standardize a scale to analyze the perception of farmers towards soil testing. The perception scale developed was found to be highly reliable (0.75) and valid (0.86). The scale consists of 16 statements and the response to each statement could be collected on a five-point continuum viz., strongly agree, agree, undecided, disagree and strongly disagree. The perception scale developed was administered to 32 farmers in Chikkaballapura district of Karnataka state during 2021-22. The results revealed that the majority of farmers (65.62%) had good to better perception towards soil testing, while 34.38 per cent of the farmers had poor perception towards soil testing.

*Keywords* : Perception & scale, Soil testing, Reliability, Validity

IN India, an intensive agriculture has resulted impressive growth in food grain production by adoption of improved varieties, application of fertilizers and assured irrigation. Fertilizers contribute about 50.00 per cent of the increased yield as a component of improved technology. India is the largest producer and consumer of fertilizers in the world after China and USA. It accounts for 12.20 per cent of the world's production of nitrogenous and phosphatic nutrients and 12.60 per cent of the world's consumption of N, P and K nutrients (Anonymous, 2016). Soil is one of the elements required for farming as it provides nutrients to the plants. Soil health plays a vital role to ensure sustainable agricultural production. Soil nutrient management is very important for sustainable development of agriculture.

Soil testing programme was started in India in the year 1955-56 with the setting up of 16 Soil Testing Laboratories (STLs) under 'Determination of Soil Fertility and Fertilizers Use' programme. The Central and State governments took many steps to sustain soil health for maximizing crop production. Soil testing programme was implemented through National Mission for Sustainable Agriculture (NMSA) and

Rashtriya Krishi Vikas Yojana (RKVY) (Anonymous, 2012). The Government of India launched the Soil Health Card (SHC) scheme in February 2015 for protecting soil health and promoting sustainable agriculture.

Soil testing is important to: (a) optimize crop production, (b) protect the environment from contamination by runoff and leaching of excess fertilizers, (c) aid in the diagnosis of plant culture problems, (d) improve the nutritional balance of the growing media and (e) save money and conserve energy by applying only the amount of fertilizer needed. Pre-plant media analyses provide an indication of potential nutrient deficiencies, pH imbalance or excess soluble salts. There is no scale to analyze the perception of farmers towards soil testing, hence the present research study was carried out to develop and standardize a scale to analyze the perception of farmers towards soil testing with the following specific objectives,

1. To develop and standardize a scale to analyze the perception of farmers towards soil testing
2. To measure perception of farmers towards soil testing

## METHODOLOGY

The present study was carried out during 2021-22 for developing and standardizing a scale to analyse the perception of farmers towards soil testing. The developed scale was used to analyze the perception of farmers towards soil testing in Chikkaballapura taluk of Karnataka state. Thirty-two farmers were personally interviewed for the purpose. Based on the cumulated score, the respondents were categorized as poor, good and better levels of perception considering mean (74.56) and half standard deviation (11.22) as a measure of check.

## RESULTS AND DISCUSSION

### Development of Scale to Analyse the Perception of Farmers towards Soil Testing

Perception of farmers towards soil testing is operationally defined in the present study as the 'process of interpretation and awareness regarding soil testing by the farmers in different farming (assured, protected and rainfed) situations'. The method of summated rating scale suggested by Likert (1932) and Edwards (1969) were followed in the development of the perception scale by following five stages *viz.*, (1) collection and editing of perception statements, (2) relevancy test, (3) item analysis, (4) reliability; and (5) validity.

*Collection and Editing of Perception Statements* : The first step in the construction of perception scale was to collect statements pertaining to the perception of farmers towards soil testing. A tentative list of 54 statements pertaining to the perception of farmers towards soil testing were collected through extensive review of literature and by consulting agronomists and soil scientists. These, 54 statements were edited as per the 14 criteria enunciated by Edwards (1969) and Thurstone and Chave (1929). As a consequence, 20 statements were eliminated. The remaining 34 perception statements were included for the study.

*Relevancy Analysis* : Thirty-four statements were sent to 85 experts / judges in the field of Agricultural Extension, Agronomy, Soil Science and Agricultural Economics to critically evaluate the relevancy of each

statement *viz.*, Most Relevant (MR), Relevant (R), Somewhat Relevant (SWR), Less Relevant (LR) and Not Relevant (NR) with the assigned score of 5, 4, 3, 2 and 1, respectively. The experts / judges were also requested to make necessary modifications and additions or deletion of perception statements, if they desired so. A total of 55 judges / experts returned duly completed questionnaires and the perception statements were considered for further processing. From the data gathered, 'relevancy percentage (RP)', 'relevancy weightage' and 'mean relevancy score (MRS)' were worked out for all the 34 statements. Using these criteria's, individual perception statements were screened for relevancies using the following formulae.

i) *Relevancy Percentage (RP)*: It was obtained by using the following formula

$$R.P. = \frac{(MR \times 5) + (R \times 4) + (SWR \times 3) + (LR \times 2) + (NR \times 1)}{\text{Maximum possible score}} \times 100$$

ii) *Relevancy Weightage (RW)*: It was obtained by using the following formula

$$R.W. = \frac{(MR \times 5) + (R \times 4) + (SWR \times 3) + (LR \times 2) + (NR \times 1)}{\text{Maximum possible score}}$$

iii) *Mean Relevancy Score (MRS)*: It was worked out using the following formula

$$R.W.S = \frac{(MR \times 5) + (R \times 4) + (SWR \times 3) + (LR \times 2) + (NR \times 1)}{\text{Number of judges responded}} \times 100$$

Accordingly, statements having relevancy weightage of more than 0.80 *i.e.*, 'relevancy percentage' of 80 per cent and above and mean relevancy score of 4.00 and above were considered for final selection. Accordingly, 22 perception statements were retained after relevancy test and these statements were suitably modified and written as per the comments of the judges, wherever applicable (Table 1).

*Item Analysis* : Twenty-two perception statements were subjected to item analysis to delineate the items

TABLE 1  
Selected statements based on the Relevancy percentage, Relevancy weightage  
and Mean relevancy score (n=55)

Statements	RP	RW	MRS
Soil testing is a valuable tool for farm development as it determines the inputs required for efficient and economic production	94.54	0.94	4.72
Soil testing helps to ensure the application of required fertilizers to meet the requirements of the crop while taking advantage of the nutrients already present in the soil.	84.50	0.84	4.22
Soil tests needs to be done once in every 2-3 years for most of the crops.	89.09	0.89	4.45
Applying fertilizers without knowing the actual nutrient requirements of the crop might lead to over-fertilization and soil degradation.	91.27	0.91	4.56
One should avoid sampling in dead furrows, wet spots, areas near main bund, trees, manure heaps and irrigation channels	83.63	0.84	4.18
Soil testing is the first step towards proper soil fertility management.	89.09	0.89	4.45
Sampling at several locations in a zig-zag pattern ensures homogeneity	83.27	0.83	4.16
Soil samples need to be collected by making 'V' shaped cut and removing thick slices of soil from top to bottom of exposed face	92.72	0.92	4.63
Awareness campaigns on benefits of soil testing helps the farmers to go for soil testing	89.45	0.89	4.47
Training on Integrated nutrient management influence farmers to follow soil testing recommendations	87.63	0.88	4.38
Adoption of soil test recommendations helps to get good crop yield and higher returns	88.00	0.88	4.40
Soil testing is like blood test to human beings	84.00	0.84	4.20
Soil testing can be helpful and effective only if the recommendations are followed by farmers on a regular basis.	85.81	0.86	4.29
Soil testing helps in practicing farming in scientific way.	90.18	0.90	4.50
Soil testing need to be done before a crop is to be grown, which makes the best indicator of fertilizer requirements for that crop	80.72	0.81	4.03
Problematic soils can be reclaimed by using suitable reclamation activities with the help of soil testing results	82.54	0.83	4.21
Soil testing is waste of time and money	84.36	0.84	4.21
Benefits of Soil testing motivate other famers to take up Soil testing	87.63	0.88	4.38
Fertilizer prices are increasing over the years and it is clever to adopt the soil testing recommendations to cope up with the inevitable changes.	81.81	0.81	4.09
The cost of soil testing is relatively inexpensive when compared to the costs of the fertilizers applied without soil testing	85.09	0.85	4.25
Higher tolerance to disease and pest damage is the additional benefits of soil testing	82.18	0.82	4.10
Soil testing is useful to adopt integrated nutrient management practices. in the crops	90.18	0.90	4.50

based on the extent to which they can differentiate the respondent having better perception from the respondent with poor perception regarding soil testing. A sample of 32 farmers in Chikkaballapura taluk and district of Karnataka state were selected for the study. The respondents were asked to indicate their degree of agreement or disagreement with each of the 22 perception statements on a five-point continuum ranging from 'strongly agree' to 'strongly disagree'. Based upon the total scores, the respondents were arranged in descending order. The top 25 per cent of the respondents with their total scores were considered as the high group and the bottom 25 per cent as the low group. These two groups provided criterion groups in terms of evaluating the individual statements. Thus, out of 32 farmers to whom the perception statements were administered for item analysis, eight respondents with highest and eight respondents with lowest perception scores were used as criterion groups to evaluate individual items. The critical ratio, that is, the 't' value which analyses the extent to which a given statement differentiates between the better and poor groups of respondents for each statement, was calculated by using the following formula:

$$t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\frac{\sum X_H^2 - \frac{(\sum X_H)^2}{n} \times \sum X_L^2 - \frac{(\sum X_L)^2}{n}}{n(n-1)}}$$

Where,

$\bar{X}_H$  = The mean score on given statement of the high group

$\bar{X}_L$  = The mean score on given statement of the low group

$\sum X_H^2$  = Sum of squares of the individual score on a given statement for high group

$\sum X_L^2$  = Sum of squares of the individual score on a given statement for low group

n = Number of respondents in each group

$\sum$  = Summation

t = The extent to which a given statement differentiates between the high and low groups.

After computing the 't' value for all the 22 items, sixteen perception statements with 't' value equal to or greater than 1.69 were finally selected and included in the final perception scale (Table 2).

*Reliability* : Reliability refers to precision of the scale constructed for any purpose. A test will be *reliable* when it gives the same repeated result under the same conditions. In any social science research, a newly constructed scale has to be tested for its reliability before it is used. The split-half method was employed to test the reliability of the perception scale.

TABLE 2

Selection of statements based on the 't' value for the final scale

(n=32)

Perception statements	t value
Soil testing is a valuable tool for farm development as it determines the inputs required for efficient and economic production	3.25 **
Soil testing helps to ensure the application of required fertilizers to meet the requirements of the crop while taking advantage of the nutrients already present in the soil.	1.59 <sup>NS</sup>
Soil tests needs to be done once in every 2-3 years for most of the crops.	3.62 **
Applying the fertilizers without knowing the actual requirement of the crop might lead to over-fertilization and soil degradation.	3.99 **
One should avoid sampling in dead furrows, wet spots, areas near main bund, trees, manure heaps and irrigation channels	2.23 *
Soil testing is the first step towards proper soil fertility management.	3.42 **
Sampling at several locations in a zig-zag pattern ensures homogeneity	3.88 **
Soil samples need to be collected by making 'V' shaped cut and removing thick slices of soil from top to bottom of exposed face	3.69 **

Perception statements	t value
Awareness campaigns on benefits of soil testing helps the farmers to go for soil testing	4.04 **
Training on Integrated nutrient management influence farmers to follow soil testing recommendations	4.20 **
Adoption of soil test recommendations helps to get good crop yield and higher returns	4.13 **
Soil testing is like blood test to human beings	3.55 **
Soil testing can be helpful and effective only if the recommendations are followed by farmers on a regular basis.	3.43 **
Soil testing helps in practicing farming in scientific way.	3.91 **
Soil testing need to be done before a crop is to be grown, makes it the best indicator of fertilizer requirements for that crop	1.54 NS
Problematic soils can be reclaimed by using suitable reclamation activities with the help of soil testing results	1.41 NS
Soil testing is waste of time and money	3.61 **
Benefits of Soil testing motivate other famers to take up Soil testing	3.04 **
Fertilizer prices are increasing over the years and it is clever to adopt the soil testing to cope up with the inevitable changes.	1.36 NS
The cost of soil testing is relatively inexpensive when compared to the costs of the fertilizers applied without soil testing	1.48 NS
Higher tolerance to disease and pest damage is the additional benefits of soil testing	1.42 NS
Soil testing is useful to adopt integrated nutrient management practices in the crops.	3.86 **

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

The value of correlation coefficient was 0.61 and this was further corrected by using Spearman Brown formula to obtain the reliability coefficient of the whole set. The 'r' value of the scale was 0.75, which was significant at one per cent level indicating the high reliability of the scale. It was concluded that the perception scale constructed was reliable.

a) Half test reliability formula :

$$r_{1/2} = \frac{N(\sum XY) - (\sum X)(\sum Y)}{\sqrt{(N\sum X^2 - (\sum X)^2)(N\sum Y^2 - (\sum Y)^2)}}$$

Where,

$\sum X$  = Sum of the scores of the odd number items

$\sum Y$  = Sum of the scores of the even number items

$\sum X^2$  = Sum of the squares of the odd number items

$\sum Y^2$  = Sum of the squares of the even number items

b) Whole test reliability formula :

$$r_{1/1} = \frac{2r_{1/2}}{1 + r_{1/2}}$$

Where,

$r_{1/2}$  = Half test reliability

**Validity** : It refers to how well a scale analyses what it is purported to measure. The data was subjected to statistical validity, which was found to be 0.86 for scale which is greater than the standard requirement of 0.700. Hence, the validity coefficient was also found to be appropriate and suitable for the tool developed. Thus, the developed scale to analyze the perception of farmers towards soil testing was feasible and appropriate.

#### Administration of the Perception Scale and method of Scoring

The final scale consists of 16 statements (Table 3) for determining the perception of farmers towards soil testing. The response could be collected on a five-point continuum, namely, strongly agree, agree, undecided, disagree and strongly disagree with assigned score of 5, 4, 3, 2 and 1, respectively. The perception score of a respondent could be calculated

TABLE 3  
Scale to analyse the perception of farmers towards soil testing

Perception statements	SA	A	UD	DA	SDA
Soil testing is a valuable tool for farm development as it determines the inputs required for efficient and economic production					
Soil tests needs to be done once in every 2-3 years for most of the crops.					
Applying the fertilizers without knowing the actual nutrient needs of the soil might lead to over-fertilization and soil degradation.					
One should avoid sampling in dead furrows, wet spots, areas near main bund, trees, manure heaps and irrigation channels					
Soil testing is the first step towards proper soil fertility management.					
Sampling at several locations in a zig-zag pattern ensures homogeneity					
Soil samples need to be collected by making 'V' shaped cut and removing thick slices of soil from top to bottom of exposed face					
Awareness campaigns on benefits of soil testing helps the farmers to go for soil testing					
Training on Integrated nutrient management influence farmers to follow soil testing recommendations					
Following soil test recommendations helps to get good crop yield and higher returns					
Soil testing is like blood test to human beings					
Soil testing can be helpful and effective only if the recommendations are followed by farmers on a regular basis.					
Soil testing helps in practicing farming in scientific way.					
Soil testing is waste of time and money					
Benefits of Soil testing motivate other famers to take up Soil testing					
Soil testing is useful to adopt integrated nutrient management practices in the crops.					

SA-Strongly Agree, A-Agree, UD-Uncecided, DA- Disagree, SDA- Strongly Disagree

by adding up the scores obtained by him / her on all the 16 statements. The perception score of this scale ranges from a minimum of 16 score to a maximum of 80 score. Based on the mean and half standard deviation, the respondents could be categorized into

three perception categories, *viz.*, poor, good and better. Higher score on this scale indicates that the respondent has better perception towards soil testing and the lower perception score indicates that the respondent has poor perception towards soil testing.

TABLE 4

Perception of farmers towards soil testing  
(n=32)

Perception categories	Farmers		Mean	Standard deviation
	No.	Per cent		
Poor	11	34.38		
Good	9	28.12	74.56	11.22
Better	12	37.50		
Total	32	100.00		

#### Perception of Farmers towards Soil Testing

The perception scale developed was administered to 32 farmers in Chikkaballapura taluk of Karnataka state during 2021-22. The figures arrived in Table 4 revealed that a larger proportion of the farmers had better perception towards soil testing (37.50 %), whereas 34.38 per cent of the farmers had poor perception and 28.12 per cent of the farmers had good perception towards soil testing. It could be inferred that a majority of the farmers (65.62 %) had good to better perception towards soil testing. Soil testing is

the most important practice to manage fertilizer application and crop production. Without soil testing, it is difficult to ensure the right application of fertilizers for the crop to obtain optimum yield. The respondents have realised the benefits of soil testing, hence a majority of the them (65.62 %) had good to better perception towards soil testing. The above findings are in line with the findings reported by Darshan *et al.* (2019) and Meghajit Sharma Shijagurumayum *et al.* (2022).

The perception scale developed is found to be reliable and valid, hence it can be used to analyze the perception of farmers towards soil testing. The perception scale when administered to the farmers revealed that majority of the farmers (65.62 %) had good to better perception towards soil testing. This is an indication of how soil testing is an important practice to be adopted by majority of farmers.

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