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## A quantitative framework for assessing farmer attitudes towards drip irrigation in sugarcane in Telangana

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#### ABSTRACT

To develop and validate a standardized attitude scale towards drip irrigation among sugarcane farmers using a classical psychometric approach using Equal Appearing Interval Method (EAI). A 70-item pool was formed from literature and expert consultations, edited under established criteria, and screened for relevancy by 30 judges. Thirty-nine items advanced to Thurstone equal-appearing interval scaling and were judged by 80 responses. Median scale values (*S*) and interquartile ranges (*Q*) were computed and items were selected to uniformly cover the latent continuum with minimal ambiguity. Reliability was assessed via split-half (odd-even) on 20 non-sample farmers; content validity was ensured by multidisciplinary review. Fourteen statements were retained with *S* spanning 1.5–6.7 and *Q* spanning 1.1–3.7; split-half reliability was  $r = 0.822$  ( $p < 0.05$ ). Administration of the scale was employed with a five-point Likert response with polarity-adjusted scoring (0–56) enabling classification into five ordered attitude levels. The instrument provides statistically defensible measurement for assessment and evaluative use in programs promoting drip irrigation in sugarcane.

**Keywords:** Equal-appearing intervals, Thurstone scaling, Attitude measurement, Reliability, Validity, Likert scoring, Micro-irrigation, Sugarcane

### 1. Introduction

In India, irrigation accounts for a large share of fresh water use and more than 90 per cent of groundwater use (Edwards, 1957) [1]. Food security and a growing population have increased the demand on water resources (Thurstone *et al.*, 1929) [2]. The country has reached a point where the availability of fresh water is stable but the demand for water from diverse economic sectors is rapidly rising. In addition, excessive water consumption damages the environment by causing salinity to rise, deterioration, nutrient pollution and the loss of wetlands and floodplains (Likert, 1932) [3].

Drip irrigation is a precise and efficient method of watering crops that has gained popularity in sugarcane cultivation across Telangana. This system delivers water directly to the root zone of individual plants through a network of tubes, pipes and emitters. Drip irrigation offers several benefits for sugarcane farmers in the region.

Various studies reported that by 2025, one-third of the developing countries in the world will face severe water crisis. Present alarming situation demands scientific management of available water. Drip irrigation is a pragmatic advancement in irrigation science. Maharashtra is the leading state where 1.42 lakh ha area is under drip irrigation system followed by Karnataka. However, total drip irrigated area is less than one percent of the total irrigated area in India. There are several factors which have influenced the adoption and maintenance of drip irrigation; among them knowledge on drip irrigation system is very important one.

One of the primary reasons is the underlying attitude of farmers towards drip irrigation in sugarcane, which significantly influences their intentions and behaviours. Attitude is a complex psychological construct influenced by individual personality traits, socio-cultural factors, and educational exposure. It cannot be measured by a single variable but requires a comprehensive assessment through a standardized tool (Ajzen, 1991, Kumar & Bansal, 2021) [4].

Because adoption decisions are shaped by farmer attitudes, a psychometrically sound scale is required to obtain reliable and valid measurements suitable for statistical analysis and policy use. Level of attitude was operationally defined in this study as the degree of positive or negative feeling expressed by the sugarcane drip farmers towards drip irrigation system in sugarcane crop.

The level of attitude of the sugarcane drip farmers towards various operation practices and maintenance of drip irrigation system was measured with the help of an attitude scale especially constructed for the study. Attitude in the present study as defined by the Likert (1932) [3] is 'the best technique available for investigating the attitude of the individual about some psychological object on the psychological continuum.' Among the techniques available for investigating attitude, the method of equal appearing intervals or the Thurstone scale is used to develop an attitudes scale to measure attitude of sugarcane drip farmers.

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## 2. Methods

### 2.1 Study design and measurement framework

We implemented a classical test theory (CTT) scale-development design using the Thurstone method of Equal Appearing Interval (EAI) method to locate items on a latent favourableness–unfavourableness continuum. For each statement  $i$ , the median scale value  $S_i$  and dispersion  $Q_i$  were estimated from cumulative judgement proportions across seven ordered categories.

### 2.2 Item generation and content editing

An initial pool of 70 statements was compiled from research literature and practitioner inputs, then edited for clarity, polarity, and redundancy under standard criteria. Thirty judges conducted relevancy screening on a three-point scale (3 = most relevant, 2 = relevant, 1 =

irrelevant). Items exceeding the grand-mean sum were retained ( $n = 39$ ).

### 2.3 Judgement, scaling, and estimation of $S$ and $Q$

The 39 statements were arranged on a seven-category equal-appearing interval scale and administered to 80 usable responses from judges. For each statement,  $S$  and  $Q$  were computed via Thurstone–Chave formulae using cumulative proportions (cp) across categories. Items were ordered by  $S$  to ensure coverage of the continuum; among near-duplicates in  $S$ , the item with smaller  $Q$  (greater inter-judge agreement) was preferred.

### 2.4 Computation of scale values and $Q$ values

The scale values and  $Q$  values were computed for the 39 statements by applying the formula as suggested by Thurstone *et al.* (1929) [2] which is as follows.

$$S = l + \left[ \frac{0.50 - \sum P_b}{P_w} \right] \times i$$

$$S = l + \frac{0.50 - \sum P_b}{P_w} \times i$$

Where,

$S$  = median or scale value of the statement

$l$  = the lower limit of the interval in which the median falls

$\sum P_b$  = the sum of the proportions below the interval in which the median falls

$P_w$  = the proportion within the interval in which the median falls

$i$  = the width of the interval and is assumed to be equal to 1.0

$$Q = C_{75} - C_{25}$$

Where,

$$C_{75} = l + \left[ \frac{0.75 - \sum P_b}{P_w} \right] \times i$$

Where,

$$C_{75} = l + \frac{0.75 - \sum P_b}{P_w} \times i$$

$Q$  – Interquartile range

$C_{75}$  – the 75th centile,

Where,

$C_{75}$  = the 75th centile

$l$  = the lower limit of the interval in which the 75th centile falls

$\sum P_b$  = the sum of the proportions below the interval in which the 75th centile falls

$P_w$  = the proportion within the interval in which the 75th centile falls

$i$  = the width of the interval and is assumed to be equal to 1.0

$$C_{25} = l + \frac{0.25 - \sum P_b}{P_w} \times i$$

$$C_{25} = l + \left[ \frac{0.25 - \sum P_b}{P_w} \right] \times i$$

$C_{25}$  – the 25th centile,

Where,

$C_{25}$  = the 25th centile

$l$  = the lower limit of the interval in which the 25th centile falls

$\sum P_b$  = the sum of the proportions below the interval in which the 25th centile falls

$P_w$  = the proportion within the interval in which the 25th centile falls

$i$  = the width of the interval and is assumed to be equal to 1.0

When there is a good agreement among the subjects in judging the degree of favorableness of a statement,  $Q$  value will be small. A large

$Q$  value indicates disagreement among the judges as to the degree of attribute possessed by a statement and it is, therefore, taken as an indication that there is some ambiguity in the statement. Thurstone and Chave (1929) [2] regard large  $Q$  values primarily as an indication that a statement is ambiguous. It also may be due to the fact that the statement is interpreted in more than one way by the subjects. The scale and  $Q$  values for all the 39 statements were calculated by following the above procedure.

## 2.4 Final item selection

Fourteen statements satisfied spacing and low-ambiguity criteria and formed the final scale. Scale values (*S*) ranged 1.5–6.7 and *Q* ranged 1.1–3.7, indicating broad coverage with acceptable dispersion.

## 2.5 Reliability assessment

Internal consistency was examined using split-half (odd–even) reliability on 20 farmers from a non-sample area. Product-moment correlation yielded  $r = 0.822$  ( $p < 0.05$ ), evidencing satisfactory reliability for group comparisons.

## 2.6 Validity considerations

Content validity was supported through expert review spanning agronomy, agricultural extension, precision farming, and micro-irrigation. Discriminating differences in *S* across the retained

items provided further evidence of construct representation along the latent continuum.

## 2.7 Administration, scoring, and cut points

Respondents rate each statement on a five-point Likert scale (strongly agree → strongly disagree). Positive statements are scored 4–0 and negative statements 0–4. Total scores range 0–56. Using exclusive class-intervals, attitude levels are defined as 10–18 most unfavourable, 18–26 unfavourable, 26–34 moderately favourable, 34–42 high favourable, and 42–50 highly favourable.

## 3. Results

The final 14-item instrument comprises both favourable and unfavourable indicators.

**Table 1.** summarizes the retained items, direction, and their reported *S* and *Q* parameters.

| Item | Statement                                                                                    | Dir | <i>S</i> | <i>Q</i> |
|------|----------------------------------------------------------------------------------------------|-----|----------|----------|
| 1    | Drip irrigation in sugarcane does not create difficulty in intercultural operations.         | F   | 1.5      | 1.2      |
| 2    | Skilled personnel for reinstallation of drip systems are not easily available.               | U   | 1.5      | 1.1      |
| 3    | Maintenance of drip irrigation in sugarcane is not difficult for farmers.                    | F   | 1.9      | 1.3      |
| 4    | Ratoon cropping of sugarcane is not difficult with drip irrigation.                          | F   | 2.2      | 2.4      |
| 7    | Drip systems are durable only for a few years.                                               | U   | 3.0      | 2.5      |
| 9    | The initial investment for drip installation in sugarcane is not bearable for small farmers. | U   | 3.4      | 1.7      |
| 14   | Drip systems may sustain mechanical damage from rodents.                                     | U   | 3.9      | 3.2      |
| 15   | After-sales service from drip irrigation dealers is inadequate.                              | U   | 4.4      | 2.5      |
| 21   | Technical advisory services are essential for effective drip use.                            | F   | 5.2      | 1.3      |
| 27   | Farmers are inspired by successful drip users and success stories.                           | F   | 5.4      | 1.7      |
| 30   | Drip irrigation saves time and enables other productive work.                                | F   | 5.6      | 1.6      |
| 35   | Drip irrigation improves water-use efficiency in sugarcane fields.                           | F   | 6.0      | 1.4      |
| 38   | Adoption of drip irrigation increases the area brought under irrigation.                     | F   | 6.6      | 1.6      |
| 39   | Drip irrigation is the best method under water-scarcity conditions.                          | F   | 6.7      | 1.2      |

**Table 2.** Statement wise distribution of sorting by judges under each category along with ‘*S*’ and ‘*Q*’ values of statements

| S.No | Statement                                                                                                              |    | Unfavourable |       |       | Neutral | Favourable |       |      | Scale value | <i>Q</i> Value | Selected / Rejected |
|------|------------------------------------------------------------------------------------------------------------------------|----|--------------|-------|-------|---------|------------|-------|------|-------------|----------------|---------------------|
|      |                                                                                                                        |    | A            | B     | C     | D       | E          | F     | G    |             |                |                     |
| 1    | I strongly feel that drip irrigation system in sugarcane crop will not create difficulty in intercultural operations * | f  | 39           | 31    | 4     | 3       | 2          | 1     | 0    | 1.5         | 1.2            | Selected            |
|      |                                                                                                                        | p  | 0.488        | 0.388 | 0.05  | 0.0375  | 0.025      | 0.013 | 0    |             |                |                     |
|      |                                                                                                                        | cp | 0.488        | 0.875 | 0.925 | 0.9625  | 0.988      | 1     | 1    |             |                |                     |
| 2    | Skilled persons for reinstallation of drip system are not easily available*                                            | f  | 35           | 37    | 5     | 3       | 0          | 0     | 0    | 1.5         | 1.1            | Selected            |
|      |                                                                                                                        | p  | 0.438        | 0.463 | 0.063 | 0.0375  | 0          | 0     | 0    |             |                |                     |
|      |                                                                                                                        | cp | 0.438        | 0.9   | 0.963 | 1       | 1          | 1     | 1    |             |                |                     |
| 3    | I feel that maintenance of drip irrigation system in sugarcane crop is not more difficult to farmer *                  | f  | 14           | 60    | 2     | 2       | 1          | 1     | 0    | 1.9         | 1.3            | Selected            |
|      |                                                                                                                        | p  | 0.175        | 0.75  | 0.025 | 0.025   | 0.013      | 0.013 | 0    |             |                |                     |
|      |                                                                                                                        | cp | 0.175        | 0.925 | 0.95  | 0.975   | 0.988      | 1     | 1    |             |                |                     |
| 4    | I strongly feel for raising ratoon crop of sugarcane is not difficult with drip irrigation system *                    | f  | 23           | 24    | 8     | 17      | 4          | 4     | 0    | 2.2         | 2.4            | Selected            |
|      |                                                                                                                        | p  | 0.288        | 0.3   | 0.1   | 0.2125  | 0.05       | 0.05  | 0    |             |                |                     |
|      |                                                                                                                        | cp | 0.288        | 0.588 | 0.688 | 0.9     | 0.95       | 1     | 1    |             |                |                     |
| 5    | I feel that failure of drip system will leads to entire crop damage                                                    | f  | 21           | 19    | 8     | 10      | 10         | 4     | 8    | 2.7         | 3.2            | Rejected            |
|      |                                                                                                                        | p  | 0.263        | 0.238 | 0.1   | 0.125   | 0.125      | 0.05  | 0.1  |             |                |                     |
|      |                                                                                                                        | cp | 0.263        | 0.5   | 0.6   | 0.725   | 0.85       | 9     | 1    |             |                |                     |
| 6    | I feel it takes more time to irrigate the sugarcane field through drip irrigation system                               | f  | 16           | 16    | 16    | 12      | 8          | 8     | 4    | 3.0         | 2.8            | Rejected            |
|      |                                                                                                                        | p  | 0.2          | 0.2   | 0.2   | 0.15    | 0.1        | 0.1   | 0.05 |             |                |                     |
|      |                                                                                                                        | cp | 0.2          | 0.4   | 0.6   | 0.75    | 0.85       | 0.95  | 1    |             |                |                     |
| 7    | In my view drip system is durable only for few years*                                                                  | f  | 12           | 16    | 20    | 12      | 12         | 8     | 0    | 3.0         | 2.5            | Selected            |
|      |                                                                                                                        | p  | 0.15         | 0.2   | 0.25  | 0.15    | 0.15       | 0.1   | 0    |             |                |                     |
|      |                                                                                                                        | cp | 0.15         | 0.35  | 0.6   | 0.75    | 0.9        | 1     | 1    |             |                |                     |

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| S.No | Statement                                                                                                                                          |    | Unfavourable |      |       | Neutral | Favourable |       |       | Scale value | Q Value | Selected / Rejected |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------|----|--------------|------|-------|---------|------------|-------|-------|-------------|---------|---------------------|
|      |                                                                                                                                                    |    | A            | B    | C     | D       | E          | F     | G     |             |         |                     |
| 8    | I observed that handling of drip system in sugarcane crop is very complex procedure                                                                | f  | 24           | 8    | 9     | 15      | 12         | 4     | 8     | 3.4         | 3.8     | Rejected            |
|      |                                                                                                                                                    | p  | 0.3          | 0.1  | 0.113 | 0.1875  | 0.15       | 0.05  | 0.1   |             |         |                     |
|      |                                                                                                                                                    | cp | 0.3          | 0.4  | 0.513 | 0.7     | 0.85       | 0.9   | 1     |             |         |                     |
| 9    | I feel that initial investment for installation of drip system in sugarcane crop is not bearable by small farmer *                                 | f  | 4            | 8    | 28    | 20      | 12         | 4     | 4     | 3.4         | 1.7     | Selected            |
|      |                                                                                                                                                    | p  | 0.05         | 0.1  | 0.35  | 0.25    | 0.15       | 0.05  | 0.05  |             |         |                     |
|      |                                                                                                                                                    | cp | 0.05         | 0.15 | 0.5   | 0.75    | 0.9        | 0.95  | 1     |             |         |                     |
| 10   | I observed that adoption of drip system in sugarcane crop reduced the chance of getting work to the labour                                         | f  | 16           | 12   | 12    | 20      | 8          | 4     | 8     | 3.5         | 2.7     | Rejected            |
|      |                                                                                                                                                    | p  | 0.2          | 0.15 | 0.15  | 0.25    | 0.1        | 0.05  | 0.1   |             |         |                     |
|      |                                                                                                                                                    | cp | 0.2          | 0.35 | 0.5   | 0.75    | 0.85       | 0.9   | 1     |             |         |                     |
| 11   | I feel that the cleaning of drip system is not so easy                                                                                             | f  | 12           | 16   | 12    | 12      | 12         | 8     | 8     | 3.5         | 3.2     | Rejected            |
|      |                                                                                                                                                    | p  | 0.15         | 0.2  | 0.15  | 0.15    | 0.15       | 0.1   | 0.1   |             |         |                     |
|      |                                                                                                                                                    | cp | 0.15         | 0.35 | 0.5   | 0.65    | 0.8        | 0.9   | 1     |             |         |                     |
| 12   | I feel that with limited knowledge on drip system it is difficult to run in sugarcane crop                                                         | f  | 8            | 8    | 20    | 12      | 12         | 16    | 4     | 3.8         | 3.8     | Rejected            |
|      |                                                                                                                                                    | p  | 0.1          | 0.1  | 0.25  | 0.15    | 0.15       | 0.2   | 0.05  |             |         |                     |
|      |                                                                                                                                                    | cp | 0.1          | 0.2  | 0.45  | 0.6     | 0.75       | 0.95  | 1     |             |         |                     |
| 13   | I feel subsidy provided by the government for drip system is not adequate                                                                          | f  | 16           | 12   | 8     | 16      | 12         | 4     | 12    | 3.8         | 3.3     | Rejected            |
|      |                                                                                                                                                    | p  | 0.2          | 0.15 | 0.1   | 0.2     | 0.15       | 0.05  | 0.15  |             |         |                     |
|      |                                                                                                                                                    | cp | 0.2          | 0.35 | 0.45  | 0.65    | 0.8        | 0.85  | 1     |             |         |                     |
| 14   | In my view there may be mechanical damage to the drip system through rodents *                                                                     | f  | 20           | 12   | 0     | 20      | 12         | 8     | 8     | 3.9         | 3.2     | Selected            |
|      |                                                                                                                                                    | p  | 0.25         | 0.15 | 0     | 0.25    | 0.15       | 0.1   | 0.1   |             |         |                     |
|      |                                                                                                                                                    | cp | 0.25         | 0.4  | 0.4   | 0.65    | 0.8        | 0.9   | 1     |             |         |                     |
| 15   | I feel that there is no good after sales services from the drip irrigation dealers*                                                                | f  | 4            | 12   | 12    | 18      | 16         | 10    | 8     | 4.4         | 2.5     | Selected            |
|      |                                                                                                                                                    | p  | 0.05         | 0.15 | 0.15  | 0.225   | 0.2        | 0.125 | 0.1   |             |         |                     |
|      |                                                                                                                                                    | cp | 0.05         | 0.2  | 0.35  | 0.575   | 0.775      | 0.9   | 1     |             |         |                     |
| 16   | I believe that drip is beneficial only where ground water is available in sufficient quantity                                                      | f  | 8            | 8    | 9     | 13      | 15         | 19    | 8     | 4.6         | 2.9     | Rejected            |
|      |                                                                                                                                                    | p  | 0.1          | 0.1  | 0.113 | 0.1625  | 0.188      | 0.238 | 0.1   |             |         |                     |
|      |                                                                                                                                                    | cp | 0.1          | 0.2  | 0.313 | 0.475   | 0.663      | 0.9   | 1     |             |         |                     |
| 17   | I strongly feel that water management is easier by adopting drip irrigation system in sugarcane crop than surface irrigation                       | f  | 8            | 4    | 4     | 16      | 24         | 12    | 12    | 4.8         | 2.1     | Rejected            |
|      |                                                                                                                                                    | p  | 0.1          | 0.05 | 0.05  | 0.2     | 0.3        | 0.15  | 0.15  |             |         |                     |
|      |                                                                                                                                                    | cp | 0.1          | 0.15 | 0.2   | 0.4     | 0.7        | 0.85  | 1     |             |         |                     |
| 18   | I feel that there is no need to make irrigation channels in drip system in sugarcane crop                                                          | f  | 12           | 8    | 4     | 12      | 12         | 20    | 12    | 4.8         | 3.6     | Rejected            |
|      |                                                                                                                                                    | p  | 0.15         | 0.1  | 0.05  | 0.15    | 0.15       | 0.25  | 0.15  |             |         |                     |
|      |                                                                                                                                                    | cp | 0.15         | 0.25 | 0.3   | 0.45    | 0.6        | 0.85  | 1     |             |         |                     |
| 19   | I feel that my soil is suitable for drip system for sugarcane crop                                                                                 | f  | 4            | 8    | 8     | 16      | 16         | 20    | 8     | 4.8         | 2.4     | Rejected            |
|      |                                                                                                                                                    | p  | 0.05         | 0.1  | 0.1   | 0.2     | 0.2        | 0.25  | 0.1   |             |         |                     |
|      |                                                                                                                                                    | cp | 0.05         | 0.15 | 0.25  | 0.45    | 0.65       | 0.9   | 1     |             |         |                     |
| 20   | I observed that drip system should be suitable to the soil nature and condition of the soil                                                        | f  | 4            | 8    | 8     | 14      | 13         | 23    | 10    | 5.0         | 1.7     | Rejected            |
|      |                                                                                                                                                    | p  | 0.05         | 0.1  | 0.1   | 0.175   | 0.163      | 0.288 | 0.125 |             |         |                     |
|      |                                                                                                                                                    | cp | 0.05         | 0.15 | 0.25  | 0.425   | 0.588      | 0.875 | 1     |             |         |                     |
| 21   | I opine that technical advisory services are essential for drip system*                                                                            | f  | 0            | 4    | 8     | 16      | 20         | 16    | 16    | 5.2         | 1.3     | Selected            |
|      |                                                                                                                                                    | p  | 0            | 0.05 | 0.1   | 0.2     | 0.25       | 0.2   | 0.2   |             |         |                     |
|      |                                                                                                                                                    | cp | 0            | 0.05 | 0.15  | 0.35    | 0.6        | 0.8   | 1     |             |         |                     |
| 22   | I feel micro irrigation training programmes conducted, provide adequate knowledge and expertise in farmer to install drip system in sugarcane crop | f  | 4            | 0    | 0     | 8       | 40         | 16    | 12    | 5.2         | 2.3     | Rejected            |
|      |                                                                                                                                                    | p  | 0.05         | 0    | 0     | 0.1     | 0.5        | 0.2   | 0.15  |             |         |                     |
|      |                                                                                                                                                    | cp | 0.05         | 0.05 | 0.05  | 0.15    | 0.65       | 0.85  | 1     |             |         |                     |
| 23   | I feel that drip system in sugarcane crop develops self-reliance among farmers                                                                     | f  | 0            | 0    | 8     | 16      | 24         | 20    | 12    | 5.2         | 1.9     | Rejected            |
|      |                                                                                                                                                    | p  | 0            | 0    | 0.1   | 0.2     | 0.3        | 0.25  | 0.15  |             |         |                     |
|      |                                                                                                                                                    | cp | 0            | 0    | 0.1   | 0.3     | 0.6        | 0.85  | 1     |             |         |                     |
| 24   | In my view drip irrigation technology is a good technology in motivating other farmers to adopt the same                                           | f  | 0            | 4    | 4     | 12      | 24         | 20    | 16    | 5.3         | 1.8     | Rejected            |
|      |                                                                                                                                                    | p  | 0            | 0.05 | 0.05  | 0.15    | 0.3        | 0.25  | 0.2   |             |         |                     |
|      |                                                                                                                                                    | cp | 0            | 0.05 | 0.1   | 0.25    | 0.55       | 0.8   | 1     |             |         |                     |

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| S.No | Statement                                                                                                         |    | Unfavourable |      |      | Neutral | Favourable |       |       | Scale value | Q Value | Selected / Rejected |
|------|-------------------------------------------------------------------------------------------------------------------|----|--------------|------|------|---------|------------|-------|-------|-------------|---------|---------------------|
|      |                                                                                                                   |    | A            | B    | C    | D       | E          | F     | G     |             |         |                     |
| 25   | I opine that sugarcane drip farmers have got strong belief in getting higher yields                               | f  | 0            | 4    | 4    | 8       | 32         | 16    | 16    | 5.3         | 1.6     | Rejected            |
|      |                                                                                                                   | p  | 0            | 0.05 | 0.05 | 0.1     | 0.4        | 0.2   | 0.2   |             |         |                     |
|      |                                                                                                                   | cp | 0            | 0.05 | 0.1  | 0.2     | 0.6        | 0.8   | 1     |             |         |                     |
| 26   | I observed that there is saving of chemicals by using the drip irrigation system in sugarcane crop                | f  | 0            | 4    | 4    | 20      | 16         | 24    | 12    | 5.3         | 2.1     | Rejected            |
|      |                                                                                                                   | p  | 0            | 0.05 | 0.05 | 0.25    | 0.2        | 0.3   | 0.15  |             |         |                     |
|      |                                                                                                                   | cp | 0            | 0.05 | 0.1  | 0.35    | 0.55       | 0.85  | 1     |             |         |                     |
| 27   | I strongly feel farmers are inspired by successful drip farmers/ success stories*                                 | f  | 0            | 0    | 4    | 12      | 26         | 21    | 17    | 5.4         | 1.7     | Selected            |
|      |                                                                                                                   | p  | 0            | 0    | 0.05 | 0.15    | 0.325      | 0.263 | 0.213 |             |         |                     |
|      |                                                                                                                   | cp | 0            | 0    | 0.05 | 0.2     | 0.525      | 0.788 | 1     |             |         |                     |
| 28   | I observed that there is increase in yield through drip irrigation system in sugarcane crop                       | f  | 0            | 4    | 8    | 4       | 28         | 20    | 16    | 5.4         | 2.7     | Rejected            |
|      |                                                                                                                   | p  | 0            | 0.05 | 0.1  | 0.05    | 0.35       | 0.25  | 0.2   |             |         |                     |
|      |                                                                                                                   | cp | 0            | 0.05 | 0.15 | 0.2     | 0.55       | 0.8   | 1     |             |         |                     |
| 29   | I feel that feedback from the existing drip farmers helped the fellow farmers to set up a drip in sugarcane field | f  | 0            | 0    | 8    | 16      | 16         | 24    | 16    | 5.5         | 2.1     | Rejected            |
|      |                                                                                                                   | p  | 0            | 0    | 0.1  | 0.2     | 0.2        | 0.3   | 0.2   |             |         |                     |
|      |                                                                                                                   | cp | 0            | 0    | 0.1  | 0.3     | 0.5        | 0.8   | 1     |             |         |                     |
| 30   | I strongly feel drip system would enable me to do other works as it saves time*                                   | f  | 0            | 4    | 4    | 12      | 20         | 32    | 8     | 5.6         | 1.6     | Selected            |
|      |                                                                                                                   | p  | 0            | 0.05 | 0.05 | 0.15    | 0.25       | 0.4   | 0.1   |             |         |                     |
|      |                                                                                                                   | cp | 0            | 0.05 | 0.1  | 0.25    | 0.5        | 0.9   | 1     |             |         |                     |
| 31   | I feel drip irrigation system improves the quality of the produce                                                 | f  | 0            | 0    | 8    | 7       | 23         | 20    | 22    | 5.6         | 2.0     | Rejected            |
|      |                                                                                                                   | p  | 0            | 0    | 0.1  | 0.0875  | 0.288      | 0.25  | 0.275 |             |         |                     |
|      |                                                                                                                   | cp | 0            | 0    | 0.1  | 0.1875  | 0.475      | 0.725 | 1     |             |         |                     |
| 32   | I observed that it is difficult to move entire drip system from one field to other field                          | f  | 0            | 0    | 8    | 8       | 20         | 24    | 20    | 5.7         | 1.8     | Rejected            |
|      |                                                                                                                   | p  | 0            | 0    | 0.1  | 0.1     | 0.25       | 0.3   | 0.25  |             |         |                     |
|      |                                                                                                                   | cp | 0            | 0    | 0.1  | 0.2     | 0.45       | 0.75  | 1     |             |         |                     |
| 33   | I observed that problem of weeds in sugarcane crop reduced with use of drip system                                | f  | 4            | 0    | 4    | 8       | 16         | 28    | 20    | 5.8         | 1.8     | Rejected            |
|      |                                                                                                                   | p  | 0.05         | 0    | 0.05 | 0.1     | 0.2        | 0.35  | 0.25  |             |         |                     |
|      |                                                                                                                   | cp | 0.05         | 0.05 | 0.1  | 0.2     | 0.4        | 0.75  | 1     |             |         |                     |
| 34   | I observed that sugarcane plant growth and yield increased through the drip system                                | f  | 0            | 0    | 4    | 8       | 20         | 28    | 20    | 5.9         | 1.6     | Rejected            |
|      |                                                                                                                   | p  | 0            | 0    | 0.05 | 0.1     | 0.25       | 0.35  | 0.25  |             |         |                     |
|      |                                                                                                                   | cp | 0            | 0    | 0.05 | 0.15    | 0.4        | 0.75  | 1     |             |         |                     |
| 35   | I observed that improved water use efficiency by using drip irrigation technology in my sugarcane field*          | f  | 0            | 0    | 4    | 4       | 20         | 32    | 20    | 6.0         | 1.4     | Selected            |
|      |                                                                                                                   | p  | 0            | 0    | 0.05 | 0.05    | 0.25       | 0.4   | 0.25  |             |         |                     |
|      |                                                                                                                   | cp | 0            | 0    | 0.05 | 0.1     | 0.35       | 0.75  | 1     |             |         |                     |
| 36   | I feel drip irrigation system in my sugarcane crop saves labour, time and water                                   | f  | 0            | 4    | 8    | 8       | 12         | 16    | 32    | 6.0         | 2.4     | Rejected            |
|      |                                                                                                                   | p  | 0            | 0.05 | 0.1  | 0.1     | 0.15       | 0.2   | 0.4   |             |         |                     |
|      |                                                                                                                   | cp | 0            | 0.05 | 0.15 | 0.25    | 0.4        | 0.6   | 1     |             |         |                     |
| 37   | I opine that drip system is a good option in sugarcane crop in the present scenario of agriculture                | f  | 0            | 8    | 4    | 4       | 12         | 20    | 32    | 6.1         | 2.0     | Rejected            |
|      |                                                                                                                   | p  | 0            | 0.1  | 0.05 | 0.05    | 0.15       | 0.25  | 0.4   |             |         |                     |
|      |                                                                                                                   | cp | 0            | 0.1  | 0.15 | 0.2     | 0.35       | 0.6   | 1     |             |         |                     |
| 38   | I observed that adoption of drip irrigation technology increases additional area under irrigation*                | f  | 0            | 0    | 4    | 4       | 16         | 24    | 32    | 6.6         | 1.6     | Selected            |
|      |                                                                                                                   | p  | 0            | 0    | 0.05 | 0.05    | 0.2        | 0.3   | 0.4   |             |         |                     |
|      |                                                                                                                   | cp | 0            | 0    | 0.05 | 0.1     | 0.3        | 0.6   | 1     |             |         |                     |
| 39   | I observed that the drip irrigation technology is the best method in water scarcity condition*                    | f  | 0            | 0    | 0    | 4       | 8          | 21    | 47    | 6.7         | 1.2     | Selected            |
|      |                                                                                                                   | p  | 0            | 0    | 0    | 0.05    | 0.1        | 0.263 | 0.588 |             |         |                     |
|      |                                                                                                                   | cp | 0            | 0    | 0    | 0.05    | 0.15       | 0.413 | 1     |             |         |                     |

\* - Bolded statements are selected for the final scale

(continued on next page)

Statements with scale and Q values distributed in 7 categories across the continuum

|        |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| S      | 1.5 | 1.5 | 1.9 | 2.2 | 2.7 | 3.0 | 3.0 | 3.4 | 3.4 | 3.5 | 3.5 | 3.8 | 3.8 | 3.9 | 4.4 | 4.6 | 4.8 | 4.8 | 4.8 | 5.0 | 5.2 | 5.2 | 5.2 | 5.3 | 5.3 | 5.3 | 5.4 | 5.4 | 5.5 | 5.6 | 5.6 | 5.7 | 5.8 | 5.9 | 6.0 | 6.0 | 6.1 | 6.6 | 6.7 |
| S. No. | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  | 21  | 22  | 23  | 24  | 25  | 26  | 27  | 28  | 29  | 30  | 31  | 32  | 33  | 34  | 35  | 36  | 37  | 38  | 39  |
| Q      | 1.2 | 1.1 | 1.3 | 2.4 | 3.2 | 2.8 | 2.5 | 3.8 | 1.7 | 2.7 | 3.2 | 3.8 | 3.3 | 3.2 | 2.5 | 2.9 | 2.1 | 3.6 | 2.4 | 1.7 | 1.3 | 2.3 | 1.9 | 1.8 | 2.1 | 2.1 | 1.7 | 2.7 | 2.1 | 1.6 | 2.0 | 1.8 | 1.8 | 1.6 | 1.4 | 2.4 | 2.0 | 1.6 | 1.2 |

Statements selected for the final scale distributed across the continuum with scale and Q values

|               |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Scale value   | 1.5 | 1.5 | 1.9 | 2.2 | 3.0 | 3.4 | 3.9 | 4.4 | 5.2 | 5.4 | 5.6 | 6.0 | 6.6 | 6.7 |
| Statement No. | S1  | S2  | S3  | S4  | S5  | S6  | S7  | S8  | S9  | S10 | S11 | S12 | S13 | S14 |
| Q value       | 1.2 | 1.1 | 1.3 | 2.4 | 2.5 | 1.7 | 3.2 | 2.5 | 1.3 | 1.7 | 1.6 | 1.4 | 1.6 | 1.2 |

S- Scale value

S.No. – Statement No.

Q- Q value

#### 4. Discussion

The observed reliability ( $r = 0.822$ ) supports the internal consistency of the 14-item instrument. Retained items capture efficiency-oriented beliefs (e.g., water-use efficiency, time saving) and perceived constraints (e.g., durability, rodent damage, after-sales support). From a measurement perspective, the spacing of  $S$  across 1.5–6.7 with moderate  $Q$  suggests reasonable discriminability across the latent continuum.

#### 5. Limitations and future work

The study reports split-half reliability; additional reliability indices (e.g., Cronbach's  $\alpha$ , McDonald's  $\omega$ ) and dimensionality analysis (e.g., exploratory/confirmatory factor analysis) were not conducted and are recommended in future work. Convergent and criterion validity evidence (e.g., association with adoption behaviour) would further strengthen inferential use of the scores.

#### 6. Conclusions

Using Thurston Equal Appearing Interval (EAI) within a CTT framework developed and validated a concise 14-item scale to quantify farmer attitudes towards drip irrigation in sugarcane. The instrument

exhibits satisfactory reliability and content validity and yields interpretable score categories for evaluative and programmatic applications.

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