DEVELOPMENT OF SCALE TO MEASURE THE KNOWLEDGE ABOUT DRIP IRRIGATION SYSTEM OF DRIP IRRIGATED BANANA GROWERS

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ABSTRACT

Due to non-availability of a proper scale to measure the knowledge about drip irrigation system of drip irrigated banana growers, it was thought necessary to construct a scale for the purpose. Keeping this in view, an attempt has been made to develop a scale for measuring the knowledge about drip irrigation system of drip irrigated banana growers. Among the techniques available for the development of scale, a standardized technique chosen to develop a scale for the purpose. The item analysis used by Jha and Singh (1970) was carried out. The Biserial correlation for each item was calculatedwith the help of the formula suggested by Guilford (1965). The significance of the Biserial correlation coefficient was tested by using the formula given by Guilford (1965). The items found significant at 0.5 per cent level of significance was included in the final format of the knowledge test battery.

Keywords : *knowledge about drip irrigation system, reliability, validity*

INTRODUCTION

Knowledge is generally understood as an intimate acquaintance of an individual with facts (Preethi *et al.*, 2015). Knowledge as a body of understood information possessed by an individual or by a culture. Knowledge is one of the important components of behaviour and as such plays an important role in the covert and overt behaviour of an individual. Keeping the above definition in view, a standardized knowledge test was developed with the help of following technique. This can scientifically measure level of knowledge about drip irrigation system of banana growers.

METHODOLOGY

In this study, an attempt has been made to develop a scale, which can scientifically measure level of knowledge about drip irrigation system of banana growers.

Steps in development of the knowledge test

Item collection

The content of a knowledge test is composed of questions called items. Items for the test were collected from different sources, such as literature, field extension personnel, relevant specialists and the researcher's own experience. The items were collected in relation to major fields. Care was taken to ensure that no crucial practice should be left out. The collected items were discussed with research scientists of the concerned fields (Horticulture, Agronomy, Extension education, Irrigation, *etc*.) for relevance of the statements and for addition and alteration of the items. Keeping the following three criteria in view, the items were selected for the test:

(a) The item should provide thinking rather than simply rote memorization.

(b) The item should differentiate the well informed farmers from the poorly informed farmers and should have certain difficulty value.

(c) The items included should cover all the areas of knowledge about concerned field.

With this criteria in view, 40 items were initially selected for developing knowledge test

Item analysis

The item analysis used by Jha and Singh (1970) was carried out so as to yield three kinds of information, viz., "Index of item difficulty", "Index of item discrimination" and "Index of item validity". Index of item difficulty indicate

that extent to which an item was difficult, while the index of item discrimination was calculated to find out whether an item really discriminates a well-informed person from a poorly informed one. The index of item validity provided the information on how well an item measures or discriminates in agreement with the rest of the test.

The items were checked and modified on the basis of pretesting and administered to 42 respondents for item analysis. The respondents for administering the items were randomly selected and were not included in the sample for final study. This was done to avoid testing effect.

Each one of the 42 respondents, to whom the test was administered, gave a score 1 or 0 for each item, according to whether the answer was right or wrong. The total number of correct answers given by respondent was the knowledge score of the individual. After calculating the score obtained by 42 respondents, the scores were arranged from highest to lowest in order of magnitude.

These 42 respondents were divided into six equal groups, each having "7" respondents and were arranged in descending order of total scores obtained by them. These groups were named as G_1, G_2, G_3, G_4, G_5 and G_6, respectively. For item analysis, the middle two groups, i.e. G_3 and G_4 were eliminated. Only four extreme groups with high and low scores were considered for computation of item difficulty and item discrimination indices were as follows:

G_1, G_2 } Groups with high scores

G_5, G_6 } Groups with low scores

Arrrangement of the scores obtained by respondents from highest to lowerst in order magnitude

	Sr. no.	Form no.	Scores	Sr. no.	Form no.	Scores	
G1	1.	35	36	22.	6	25	G4
	2.	3	33	23.	10	25	
	3.	11	33	24.	12	25	
	4.	22	33	25.	38	25	
	5.	28	32	26.	9	24	
	6.	30	32	27.	15	24	
	7.	41	31	28.	34	24	
G2	8.	2	30	29.	17	23	G5
	9.	37	30	30.	21	23	
	10.	1	29	31.	26	23	
	11.	8	29	32.	5	22	
	12.	19	29	33.	40	22	
	13.	33	29	34.	13	21	
	14.	4	28	35.	20	21	
G3	15.	42	28	36.	39	21	G6
	16.	32	27	37.	27	20	
	17.	36	27	38.	14	18	
	18.	7	26	39.	23	18	
	19.	25	26	40.	16	17	
	20.	29	26	41.	18	17	
	21.	31	26	42.	24	17	

Formation of six different groups of respondents by arranging them in descending order on the basis of scores obtained by them

Group	Serial no. of the respondents in descending order	No. of respondents
G1	1 to 7	7
G2	8 to 14	7
G3	15 to 21	7
G4	22 to 28	7
G5	29 to 35	7
G6	36 to 42	7

Final four groups after elimination of middle two groups were as under:

Group	Serial no. of the respondents in descending order	No. of respondents
G1	1 to 7	7
G2	8 to 14	7
G5	29 to 35	7
G6	36 to 42	7

Calculation of Difficulty Index (P_i)

The difficulty index of an item is defined as the proportion of respondents giving correct answer to that particular item. This was calculated by the following formula:

$$\mathbf{P_i = \frac{n_i}{N_i} \times 100}$$

Where,

P_i = Difficulty index in percentage of the i^{th} item

N_i = Number of respondents giving correct answer to i^{th} item

N_i = Total number of respondents

An example of calculation of Difficulty Index (P_i) of item no. 3 is presented below:

$$\mathbf{P_3 = \frac{n_i}{N_i} \times 100}$$

$$P_3 = \frac{27}{42} \times 100$$

$$\mathbf{P_3 = 64.29\ \%}$$

Note: 1) Range of **P** values for final selection of the item was 20 to 80 per cent.

Calculation of Discrimination Index

The discrimination index can be obtained by calculating the phi-coefficient as formulated by Perry and Michael (1951). However, Mehta (1958) in using $\mathbf{E^{1/3}}$ method to find out item discrimination emphasized that this method was analogous to, and hence, a convenient substitute for the phi-coefficient. The Discrimination Index **($E^{1/3}$)** was used in the research study.

Where,

$$\mathbf{E^{1/3} = \frac{(S_1 + S_2) - (S_5 + S_6)}{N/3}}$$

S_1, S_2, S_5, and S_6 = the frequencies of correct answers in groups G_1, G_2, G_5 and G_6, respectively.

N = total number of respondents in the sample of item analysis.

An example of calculation of Discrimination Index () of item no. 3 is presented below:

$$\mathbf{E^{1/3} = \frac{(S_1 + S_2) - (S_5 + S_6)}{N/3}}$$

$$E^{1/3} = \frac{(7 + 7) - (3 + 1)}{42/3}$$

$$\mathbf{E^{1/3} = 0.714}$$

Note : (1) Range of $\mathbf{E^{1/3}}$ values for final selection of the item were above 0.20.

(2) The $\mathbf{E^{1/3}}$ values for all items are stated in appendix no. 3.

Calculation of Biserial Correlation (r_{bis})

It was used for the test item validation, when the criteria of validity are regarded as internal consistency that is, the relationship of total scores to a dichotomized response to any given item. Keeping this in view, with the help of following formula suggested by Guilford (1965), the Biserial correlation for each item was calculated. The significance of the Biserial correlation coefficient was tested by using the formula given by Guilford (1965). The items found significant at 0.5 per cent level of significance was included in the final

format of the knowledge test battery.

$$rbis = \frac{M_p - M_q}{6_t} \times \frac{pq}{y}$$

Where,

M_p = Mean of X values for higher group (Giving correct answer of particular item) in dichotomized variable

M_q = Mean of X values for lower group (Giving wrong answer of particular item) in dichotomized variable

p = Proportion of cases in higher group (Giving correct answer of particular item)

q = Proportion of cases in lower group (Giving wrong answer of particular item)

y = Ordinance of the unit normal distribution curve with surface equal to 1.0 at the point of division between segments containing p and q proportion of the cases.

6t = Standard deviation

An example of calculation of Biserial Correlation (r_{bis}) of item no. 3 is presented below.

$$rbis = \frac{M_p - M_q}{6_t} \times \frac{pq}{y}$$

Where,

P = [Summation of the scores obtained by 27 respondents passing the item (giving correct answer of item no. 3)]

$$\mathbf{M_p} = \frac{746}{27} = 27.63 \text{ (Mean score)}$$

$$\textbf{Proportion} = \frac{27}{42} = 0.64$$

q = 329 [Summation of the scores obtained by 15 respondents not passing the item (giving wrong answer of item no. 3) = (1075-746)]

$$\mathbf{M_q} = \frac{329}{15} = 21.93$$

$$\textbf{Proportion} = \frac{15}{42} = 0.36$$

Hence,

$$\frac{pq}{y} = \mathbf{0.6158} \text{ [table value from Guilford (1965)]}$$

The proportion passing and failing are 0.64 and 0.36 respectively. The 'y' ordinate from table is 0.3741 [value of 0.64 in table value from Guilford (1965)]

Hence,

$$\frac{0.64 \times 0.36}{0.3741} = \mathbf{0.6158}$$

(Standard deviation of the total items scores) = 13.23

$$rbis = \frac{27.63 - 21.93}{13.23} \times 0.6158$$

$$r_{bis} = \mathbf{0.2651}$$

$$r^2_{bis} = \mathbf{0.0703}$$

The coefficient of Biserial Correlation was tested for their significance by using the following formula as given by Guilford (1965).

$$t = \frac{rbis}{\frac{\frac{\sqrt{pq}}{y} - r2bis}{\sqrt{N}}}$$

$$t = \frac{0.2651}{\frac{1.283 - 0.0703}{6.48}}$$

$$t = \mathbf{1.4168}$$

Significant at 0.5 level of probability.

Representative of the Test

Though the aforesaid criteria were the main consideration for the final selection of the knowledge items, the cares were taken not to eliminate the important aspects if any. In this way only one item was included in the final format of the knowledge test.

Reliability of the test

A test is reliable when it consistently produces the same results when it applied to the same sample. In the present study to test the reliability of the test, the split half method was used.

The 18 statements were divided into two halves with 9 odd numbered in one half and 9 even-numbered statements in the other. These were administered to 30 respondents. Each of the two sets of statements was treated as a separate test and then these two sub-tests were correlated. The co-efficient of reliability was calculated by the Rulon's formula (Guilford, 1954), which came to 0.76. Thus, the test developed was

found highly reliable. To understand this procedure, we can examine the statements for the test in Table 1.

Table 1: Reliability of test to measure knowledge about drip irrigation system of banana growers

No.	Score of Odd Statements	Score of Even Statements	D	d^2	t	t^2
	X_o	X_e	$X_o - X_e$	d × d	$X_o + X_e$	
1	5	5	0	0	10	100
2	3	4	-1	1	7	49
3	6	9	-3	9	15	225
4	5	3	2	4	8	64
5	5	5	0	0	10	100
6	5	6	-1	1	11	121
7	2	5	-3	9	7	49
8	6	7	-1	1	13	169
9	3	6	-3	9	9	81
10	5	5	0	0	10	100
11	4	4	0	0	8	64
12	3	3	0	0	6	36
13	3	2	1	1	5	25
14	7	8	-1	1	15	225
15	4	5	-1	1	9	81
16	6	6	0	0	12	144
17	5	5	0	0	10	100
18	6	4	2	4	10	100
19	7	8	-1	1	15	225
20	5	6	-1	1	11	121
21	6	4	2	4	10	100
22	6	6	0	0	12	144
23	6	4	2	4	10	100
24	4	3	1	1	7	49
25	7	8	-1	1	15	225
26	3	3	0	0	6	36
27	5	4	1	1	9	81
28	6	6	0	0	12	144
29	6	8	-2	4	14	196
30	4	2	2	4	6	36
Total	**148**	**154**	**-6**	**62**	**302**	**3290**

Rulon's Formula

$$rtt = 1 - \frac{\sigma^2 d}{\sigma^2 t}$$

Where;

$$\sigma^2 d = \frac{\sum d^2 - \frac{(\sum d)^2}{N}}{N}$$

$$\sigma^2 t = \frac{\sum t^2 - \frac{(\sum t)^2}{N}}{N}$$

Calculation

$\sum d = -6$

$\sum d^2 = 62$

$t = 302$

$\sum t^2 = 3290$

$N = 30$

$$\sigma^2 d = \frac{\sum d^2 - \frac{(\sum d)^2}{30}}{30}$$

$$= \frac{62 - \frac{(-6)^2}{30}}{30}$$

$$= \frac{62 - 1.2}{30}$$

$$= \frac{60.8}{30}$$

$$\sigma^2 d = \mathbf{2.027}$$

$$\sigma^2 t = \frac{\sum t^2 - \frac{(\sum t)^2}{30}}{30}$$

$$= \frac{3290 - \frac{(302)^2}{30}}{30}$$

$$= \frac{3290 - \frac{91204}{30}}{30}$$

$$= \frac{3290 - 3040.133}{30}$$

$$= \frac{249.87}{30}$$

$$= \mathbf{8.33}$$

$$rrt = \mathbf{1} - \frac{\sigma^2 d}{\sigma^2 t}$$

$$= 1 - \frac{2.027}{8.33}$$

$$= 1 - 0.243$$

$$= 0.757$$

$$\approx \mathbf{0.76}$$

Content validity of the test

The Biserial correlation was considered as a measure of test item validity. Significant Biserial correlation coefficient proved the construct validity of the items included in the knowledge test battery.

Final format for measure the level of knowledge about drip irrigation system of drip irrigated banana growers

No.	Statements	Answer
1	Do you adopt earthing up practices in the drip irrigated banana cultivation?	
2	Do you put drip lines on both sides of the plant in drip irrigated banana cultivation?	
3	What is the discharge rate of drippers use in drip irrigated banana cultivation?	
4	At what pressure do you run the drip irrigation system in banana cultivation?	
5	How many hours do you run drip irrigation system in drip irrigated banana cultivation during September to October?	
6	How many hours do you run drip system in drip irrigated banana cultivation during november to february?	
7	How many hours do you run drip system in drip irrigated Banana cultivation during march to monsoon?	
8	Do you run the drip irrigation system in banana cultivation every day or in alternate days?	
9	Do you know the name and recommended dose of chemical fertilizer for Phosphorus in drip irrigated banana cultivation?	
10	Do you know the name and recommended dose of chemical fertilizer for Potash in drip irrigated banana cultivation?	
11	When do you apply chemical fertilizer after planting in different months In drip irrigated banana cultivation?	
12	At what interval do you apply chemical fertilizer In drip irrigated banana system?	
13	Whether pest and diseases are increase or decrease in drip irrigated banana cultivation?	
14	Do you know about the Insecticides, fungicides and nematicides use in drip irrigated banana cultivation?	
15	Do you use weedicides in drip irrigated banana cultivation?	
16	Whether the production is increase or decrease in drip irrigated banana cultivation?	
17	What precautions do you take to stop the damages done by rodents in drip irrigated banana cultivation?	
18	Which steps do you follow when the drip irrigation system not start?	

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