A CASE STUDY | International Journal of Agricultural Engineering | Volume 9 | Issue 2 | October, 2016 | 239-243
e ISSN–0976–7223 ■ Visit us : *www.researchjournal.co.in* ■ **DOI: 10.15740/HAS/IJAE/9.2/239-243**

A test to measure knowledge of farmers about drip irrigation system

■ **S.D. PARMAR, H.B. SHAKYA, V.B. PATEL AND G.N. THORAT**

Received : 23.07.2016; **Accepted :** 27.09.2016

See end of the Paper for authors' affiliation

Correspondence to :

S.D. PARMAR
Extension Education Institute, Anand Agriculture University, ANAND (GUJARAT) INDIA
Email : sunilextensioneducation @gmail.com, pontingsunil@yahoo.co.in

■ **KEY WORDS :** Knowledge test, Drip irrigation system (DIS), Item difficulty index (p), Discrimination index ($E^{1/3}$), Biserial correlation, Representative of the test

■ **HOW TO CITE THIS PAPER :** Parmar, S.D., Shakya, H.B., Patel, V.B. and Thorat, G.N. (2016). A test to measure knowledge of farmers about drip irrigation system. *Internat. J. Agric. Engg.*, **9**(2) : 239-243, **DOI: 10.15740/HAS/IJAE/9.2/239-243.**

A standardized test as defined by Noll (1957) is one "that has been carefully constructed by experts in light of acceptable objectives or purposes, procedures for administering, scoring and interpreting score are specified in detail so that no matter was given the test or where it may be given, the results should be comparable and norms or averages for different age or status have been pre determined". Keeping this definition in view, a standardized knowledge test on drip irrigation system was developed with the help of following techniques:

Item selection :

The content of the text consisted of questions called items. The important factors considered in collecting items for knowledge test was to determine and classify the objectives to be measured by it. Items were collected by referring to the relevant literature by consulting the scientists working in Agronomy, Horticulture and Farm Engineering Department of College of Agriculture, Irrigation Department of College of Agricultural Engineering and Technology, water management project and from discussion with the extension experts. Selection of items pertaining to drip irrigation system was based on following criteria:

- Response to the items should promote thinking rather than rote memorization.
- They should differentiate well informed drip adopted farmers from less informed one and have certain difficulty value.
- The items included should cover all the area of knowledge about drip irrigation system.

With these criteria in view, 51 items were selected for the consideration of the knowledge test. Before editing of items, they were subjected to the expert scrutiny and then these items were framed in the objective form of questions to control bias, if any.

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 validity", "Index of item discrimination" and "Item of difficulty". The index of the item difficulty indicated the extent to which an item was difficult, while

the index of validity provided the information on how well an item measures or discriminates in agreement with rest of the test. The function of item discrimination index was to find out whether an item really discriminates a well informed drip adopted farmers from a poorly informed one.

The collected items were enumerated from 1 to 51 and administered to the 48 respondents selected from ode village of Anand district and Manjrol and Chani villages of Vadodara district.

The data thus, obtained were subjected for typical item analysis. To analyze 51 items, each one of the 48 respondents to whom the test was administered was scored on the basis of the score allotted, one correct answer and zero for incorrect answer. After computing the total score obtained by each of the respondents on 51 items they were arranged in descending order of the total score.

The respondents then were divided into six equal groups arranged in descending order of the total score obtained by them. The groups were labeled as G_1, G_2, G_3, G_4, G_5 and G_6, respectively with 8 respondents in each group. For the purpose of item analysis the middle two groups G_3 and G_4 were eliminated, keeping for extreme group with high and low scores. The scores of these six groups ranged as follows:

G_1= 48 to 44 G_4= 33 to 30
G_2= 42 to 39 G_5= 29 to 25
G_3= 38 to 34 G_6= 24 to 16

The maximum score was obviously 51 which were secured by a respondent when all the items were answer correctly. The data of correct responses for each of the four groups (G_1, G_2, G_5 and G_6) were tabulated and difficulty and discrimination of the method of calculating these indices appears in.

Selection of item for final test :

The selection of items for knowledge test about improved practices of drip irrigation system was made on the following criteria.

– Item difficulty index p
– Discrimination index $E^{1/3}$
– Biserial correlation
– Representative of the test.

Item difficulty index P :

The index of difficulty was worked out as the percentage of the respondents answering as item correctly. The assumption in this item index of difficulty was that the difficulty is linearly related to the level of respondents' knowledge about drip irrigation system. The items with P value ranging from 20 to 80 were considered for final selection of knowledge test battery.

The data on the item difficulty index (P) are presented in Table 1. It was calculated by the following formula :

$$P = \frac{\text{No. respondents answered}}{\text{Total no. of respondents}} \times 100$$

$$\text{P for item no. 15 : } P = \frac{27}{48} \times 100 = 56.25$$

Discrimination index $E^{1/3}$:

The second criteria for item selection were discrimination index indicated by $E^{1/3}$. The items with discrimination index above 0.20 to 0.80 were considered for final selection in the knowledge test.

where, P = index of item difficulty,

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

where, S_1, S_2, S_5 and S_6 are the frequencies of correct answers in the group G_1, G_2, G_5 and G_6, respectively.

N = Total number of respondents in the item analysis = 48

For example, substituting the values for item number

Table 1: Calculating of difficulty and discrimination indices and Biserial correlation of knowledge items

Item No.	Frequency of correct answer S_1	S_2	S_5	S_6	Total frequency S_1 + ….+S_6	P-index of difficulty	$E^{1/3}$ index of discrimination	Biserial correlation	Selected / rejected
6	6	5	2	2	31	65	0.44	0.3336 NS	R
15	7	5	2	1	27	56	0.56	0.6784**	S
34	8	6	6	4	39	81	……	…….	R
50	5	3	2	0	19	40	0.38	0.403*	S
51	5	5	0	0	16	33	0.63	0.5743**	S

* and ** indicate significance of values at P=0.05 and 0.01, respectively NS=Non-significant,
NC – Biserial correlation not calculated for items with discrimination index less than 0.20 and item difficulty index (P) value ranging from 20 to 80,
S – Item selected for final knowledge test.

15 of table of illustration given above, the value was:

$$E^{1/3} = \text{for item no. } 15 = \frac{(7+5)-(2+1)}{16} = 0.58$$

Biseral correlation :

It was used for the test of the items validation when the criterion of validity is regarded as internal consistency that is relationship of total score to a dichotomized response to any given item. Keeping this in view, with the help of the formula suggested by Guilford (1965) Biserial correlation for each of the items was calculated. The significance of the Biserial correlation co-efficients was tested by using the formula given by Guilford (1965). The items found significant at 5 per cent level of significance were retained in the final format of the knowledge test battery.

$$\text{Biserial correlation } r_{bis} = \frac{Mp - Mq}{\sigma t} \times \frac{pq}{z}$$

where,

Mp= Mean of x value for higher group in dichotamised variable

Mq = Mean of x value for lower group in dichotamised variable

p= Proportion of cases in higher group

q= Proportion of cases in lower group

z= Ordinate of thr unit normal distribution curve with surface equal to 1.0 at the point of division between segments containing p and 1 proportion of the cases.

$$\sigma t = \sqrt{\frac{(X-\bar{X})^2}{n-1}} \quad \text{Standard deviation}$$

To illustrate, an r_{bis} for item 15 was worked out in this way.

The summation of the total score obtained by the 48 respondents considered for item analysis in relation to the list of 51 items was 1619.

Hence, the mean score = 61.0146 and the standard deviation st=7.855.

Item no. 15 had,

P = 705 (Summation of the score obtained by 19 respondents passing the item = 1619 – 914 = 705).

$$Mp = \frac{705}{19} = 37.10 \quad \text{Mean score}$$

q = 914 (Summation of the scores obtained by 29 respondents passing the item).

$$Mp = \frac{914}{29} = 31.51 \text{ (mean score)}$$

$$\text{Proportion } P = \frac{19}{48} = 0.39$$

Hence,

$\frac{pq}{z} = 0.6200$ Table value (from Guilford, 1965) substituting these values in the given formula r_{bis} for the item no. $15 = \frac{37.10 - 31.10}{8.6} \times 0.6200 = 0.403$

Testing the significance of r_{bis} :

The co-efficient of correlation was tested for their significance by using the following formula as given by Guilford (1965):

$$t = \frac{r_{bis}}{\sqrt{\frac{\frac{pq}{z} - r_{bis}^2}{N}}}$$

where,

r_{bis} = Biserial correlation

$\sqrt{\frac{\frac{pq}{z} - r_{bis}^2}{N}}$ = Standard error of Biserial correlation

N= Total number of respondents

In this illustration for item No. 15, the values are:

r_{bis}=0.403 r_{bis}^2 = 0.1624

$\sqrt{\frac{pq}{z}}$ = 1.271 (Table value) N = 6.93

Hence,

$t = \frac{0.403}{\frac{1.271 - 0.1624}{6.93}} = 2.5192$ (significance at .05 level of probability)

Likewise, Biserial correlation co-efficients for each of the 51 items computed and their significance worked out. Items having significant Biserial correlation at 5 per cent level of probability were finally selected for the final format of the knowledge test.

Representative of the test:

Though the aforesaid criteria were the main consideration for the final selection of the knowledge items, yet each was taken not to eliminate the important aspect, if any.

Thus, in light of aforesaid following 28 items were finally selected which formed the actual format of the knowledge test for drip irrigation.

Reliability of the test :

To know the reliability of knowledge test the following two methods were employed.

Test retest method :

The developed knowledge test with 28 items was administered twice to the same 25 drip adopted farmers, who were neither previously interviewed nor had chance to come in the final sample. After a period of 15 days the same 25 respondents were again given the test. Two sets of knowledge scores were thus, obtained. A very high significant (r = 0.882) correlation was found between these two sets of scores which indicated that the knowledge test was dependable as the measuring instrument.

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

where,

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

$$(1) = \frac{51 - \frac{(31)^2}{28}}{28} = \frac{51 - \frac{961}{28}}{28} = \frac{51 - 3432}{28} = \frac{16.68}{28} = 0.5927$$

$$= \frac{7023 - \frac{(439)^2}{28}}{28} = \frac{7023 - \frac{192721}{28}}{28} = \frac{7023 - 6882.89}{28} = \frac{140.11}{28} = 5.012$$

$$r^u = 1 - \frac{0.5957}{5.012} = 1 - 0.118 = 0.882$$

Table 2 : Final format of knowledge test

Sr. No.	Name of the respondent: …… Village: …… Taluka : …… District: ……	Put tick mark (√)	
	Statement	Yes	No
1.	It requires initially high investment for installation of this system, but more useful on long term.		
2.	Drip irrigation system is useful in green house also, *i.e*. under controlled condition.		
3.	Chemical fertilizers can also be used under drip irrigation system.		
4.	Laterals are spread in the open fields and their spacing is decided on the basis of row to row distance of the crop.		
5.	Different types of valves are used in drip irrigation system.		
6.	Filter, main, sub-mains, laterals and drippers should be checked at frequent intervals.		
7.	Drip irrigation system is better than the sprinkler irrigation system for spaced crops.		
8.	Do you know the pipes used in drip systems are cheaper than sprinkler irrigation system?		
9.	Sub-main and lateral should be installed according to the slop of the field.		
10.	This system saves 50 to 70 per cent of water.		
11.	Land erosion and wastage of irrigation water can be minimized by adopting drip irrigation system.		
12.	Do you know the daily water requirements for the crops?		
13.	Is the water distribution is uniform?		
14.	Do you know how to adjust pressure through pressure gauges?		
15.	Do you know the fertilizer requirement is less, if applied through drip irrigation system?		
16.	Do you know that the water soluble / liquid fertilizer can be applied through drip irrigation system?		
17.	Do you know the drip system keeps soil moisture within the desired range for optimum plant growth?		
18.	Weed infestation can be reduced with the use of drip irrigation system.		
19.	Failure of filter is one of the reasons for clogging of the system.		
20.	HCl / H_2SO_4 and bleaching powder are commonly used for acid and chlorine treatment, respectively.		
21.	Do you know that soil health is improved as compared to traditional method?		
22.	Do you know that in this system intercropping is possible?		
23.	Do you know it can be run by computer?		
24.	Do you know the water requirement through drip irrigation is varied from crop to crop and season to season?		
25.	Do you know that the rate of subsidy for drip irrigation system is Rs. 50,000?		
26.	The average life span of drip sets is 5 to 10 years.		
27.	Do you know the drip irrigation system save electric energy?		
28.	Do you know the saline water can be used in drip irrigation system?		

Split halves method :

The 28 items were divided into two equal halves with odd numbered in one half and even number in the other. These were administered to 25 respondents separately. Thus, two sets of knowledge score were obtained. The correlation of co-efficient between two sets of score was computed and observed to be highly significant (r = 0.937).

Validity of the test :

The Biserial correlation was considered as a measurement of test item validity. Highly significant Biserial correlation co-efficient proved the validity of the items included in the knowledge test.

Methods of scoring knowledge :

After creating a good rapport with the respondents, the items of the knowledge test were read before them and they were asked to answer in dichotomized categories that are correct or incorrect and yes or no. The correct answers were tick marked. The total number of tick marked items was the knowledge score obtained by an individual respondents about the test. The range of the scores obtained by the might vary from 0 to 28 in the knowledge test which indicate the knowledge level of the respondents (Table 2).

Authors' affiliations:
H.B. SHAKYA, M.C. Polytechnique in Agriculture, Anand Agriculture University, ANAND (GUJARAT) INDIA
G.N.THORAT, Pashu Vigyan Kendra, (TRTC), D'Bariya, DAHOD (GUJARAT) INDIA
V.B. PATEL, Regional Research Station (A.A.U.) ANAND (GUJARAT) INDIA

REFERENCES

Chandel, R.S. (1974). *A hand book of Agricultural Statistics*. Achal Prakashan, Bombay (M.S.) INDIA.

Guilford, J. P. (1965). *Psychometric methods.* TNH. Ed., Tata-Mc Grow Hill Books Co. Ltd., NEW DELHI, INDIA.

Jha, P.N. and Singh, K.N. (1970). A test to measure farmer's knowledge about high yielding variety programme. *Inter Dis.* **7** (1) : 65-67.

Noll, V.H. (1975). *Introduction to educational measurement*, BOSTON.