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RESEARCH ARTICLE :

Development of a test for measuring the knowledge level of farmers in maize cultivation

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SUMMARY : It has become imperative to develop an effective and holistic system of high production and tackling pests to make it more environmental friendly, economically viable and socially acceptable to farmers which can be achieved through adoption of technologies, so it is very important to assess the knowledge level of farmers in maize farming in order to identify gap in adoption. Hence, a study was designed to develop a standardized test using test construction methodology adopting item analysis procedure, pilot tested with 30 farmer members from non-sample area. The final test consisted of 7 questions having difficulty index value in the range of 30 to 80 and discrimination index value above 0.3 and above was retained and used to measure the knowledge of maize growing farmers. The reliability of the knowledge test was measured with the help of split-half method and the reliability co-efficient was found to be 0.8, which indicates that the knowledge test is reliable. Also, criterion validity was measured after establishing theoretical relationship between knowledge and adoption of recommended package of practice. Adoption levels of recommended package of practices for maize were calculated for 30 farmers. These scores were correlated with the knowledge scores. The 'r' value was found to be 0.85. Since the 'r' values were significant at 0.01 level of probability, the scale developed was considered as valid. The test was further administered to 150 respondents and it was found that majority of the respondents (44%) had medium level of knowledge about recommended package of practices for paddy cultivation.

KEY WORDS :
Knowledge test, Reliability, Validity, Item analysis, Difficulty index

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BACKGROUND AND OBJECTIVES

Maize is widely cultivated in Jammu and Kashmir, being grown in the Kandi, Karewa, and plain areas. It thrives well in the sandy loam to loamy soils. Varieties of maize have also been developed which perform well in the colder hilly and mountainous areas. Maize (*Zea mays* L.) is the staple food of Gujjars and Bakar- wals, living in the Kandi and hilly areas. Moreover, the grains form an important cattle food, being fed to farm cattle and horses. The different parts of the plant and the grain are put to a number of industrial uses.

Though the technological breakthrough in agriculture has resulted in increased productivity, yet the crop yields realized on the farmers' fields are considerably low as compared to those obtained on demonstration plots and farms of Research Stations. There exists considerable untapped yield potential in various crops which may be attributed to the gap in adoption of recommended practices and differences in input use levels between at the farmer's field and demonstration plots. However, there is a sufficient potential to increase the productivity of food grains if farmers know and adopt scientific technologies that assumes greater significance in attaining potential output at the farm level.

Knowledge is generally understood as an intimate acquaintance of an individual with facts. 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. In a development programme it is our endeavor to improve the level of knowledge of the participants with relevant facts. An appropriate knowledge test helps us to know the level of relevant knowledge of the respondents from time to time. Knowledge test score is also used as a variable to test its relationship with other variables.

There are considerable knowledge gaps between researchers, extension agents, and farmers. Farmers' experience or indigenous knowledge (IK) is accumulated over generations. Scientists' technical knowledge is synthesized from years of research. These two systems of knowledge should be integrated for the benefit of both and to enhance mutual learning to reduce knowledge gaps between farmers and researchers. The new knowledge and technologies are not reaching most of the farmers due to poor extension efforts. The technology delivery system should be re-oriented to handle changing circumstances and to deliver complex, knowledge-intensive technologies to farmers. Technical knowledge is an important factor in determining the adoption of improved crop management practices and increased yields. Transfer of knowledge intensive technologies has to receive priority. The bridging of knowledge gaps can bridge yield gaps. New paradigms need to be added to transfer and use newer quality seed and knowledge based technologies under new policy environments.

It has become imperative to develop an effective and holistic system of tackling lower production problems along with management of pests and diseases to make it more environmental friendly, economically viable and socially acceptable to farmers, which can be achieved through ecofriendly technologies. Extension activities involving more of skill based techniques which can be learned only through active participation of farmers is necessary. Hence, it was felt important to assess the knowledge level of maize growing farmers in order to identify gap in adoption. Therefore, a study was designed to develop a standardized test to measure the knowledge of maize growing farmers.

Keeping in view the importance of knowledge as one of the basic components that greatly affect the extent of adoption of the scientific practices the present study entitled "development of a test for measuring the knowledge level of farmers in maize cultivation" was undertaken.

RESOURCES AND METHODS

Following steps were followed in the process of knowledge test construction

Collection of items :

Considering the subject matter coverage forty nine and twenty seven items on different dimensions of maize were selected as knowledge measurement items.

Item selection :

A list of 65 judges was prepared, the judges considered were the agricultural extension workers, scientists in the agricultural universities, senior level extension workers of State Department of Agriculture and scientists in the area. A total of 37 judges have responded to the judgment sheets sent to them indicating the relevancy of statements included in the format. The responses were given in the form of most relevant, relevant, undecided and not relevant to measure the knowledge of recommended package of practices for paddy. Based on the responses the relevancy weightage (ratio of actual score obtained by an item to the maximum possible score of that item) were calculated for all the items. The items which had 79.92 relevancy weightage score and every one selected to measure the knowledge maize growing farmers.

Framing of test items :

Each item was transformed into a question form to elicit the information from the farmer as possessed by him or her at that point of administration of the test. The questions were framed in a simple and unambiguous manner.

Pre-testing and item analysis:

The test items were initially pre tested in a non sample area to know the opinion of the 30 farmers about the language and content used in the test and to carry out the item analysis.

The item analysis of a test usually yields two kinds of information *i.e.* item difficulty and item discrimination. The index of item difficulty reveals how difficult an item is, whereas, the index of discrimination indicates the extent to which an item discriminates the well informed individuals from the poorly informed ones. The items were checked and modified on the basis of pretesting and administered on 30 respondents (here they were farmers) for item analysis. They were non respondents and randomly selected for the study. The items were administered on theses non sample respondents given a score 1 or 0 for each correct and incorrect item, respectively. After calculating the total score of each respondent, the scores were arranged from highest to lowest in order of magnitude. These 30 respondents were divided in six groups, each having five respondents and were arranged in descending order of total scores obtained by them. These were named G1, G2, G3, G4, G5 and G6, respectively. For item analysis middle two groups were eliminated and only four extreme groups were considered for item analysis.

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

$$Pi = \frac{ni}{Ni} x\ 100$$

where, Pi = Difficulty index in percentage of the i^{th} item

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

Ni = Total number of respondents to whom the i^{th} item was administered *i.e.* 30 in the present case.

Calculation of discrimination index: the discrimination index can be obtained by calculating the phi-co-efficient formulated by Mehta (1958) using $E^{1/3}$ formula

$$E^{1/3} = (S1+S2) - (S5+S6) \ / \ N/3$$

where, S1, S2, S5 and S6 were the frequencies of correct answers in groups G1, G2, G5 and G6, respectively.

Selection of items for test:

The two criteria *viz.*, item difficulty index and item discrimination index were considered for the selection of items in the final format of the knowledge test. The items with difficulty index ranging from 30 to 80 and discrimination index ranging from 0.30 and above were used. That is the items which are neither too difficult nor too easy to reply and could discriminate the well informed individuals from the less-informed ones were selected.

Final selection of items:

After the item analysis out of 27 statements a total of 7 statements were obtained and selected to carry out the study. The items in the final knowledge test maize were covering every major practice of the foodgrain cultivation. Therefore, it was assumed that the scores obtained by administering this test measured knowledge of the respondents as intended. Each item was transformed into a question and the responses were divided into three categories *viz.*, ‘Full’, ‘Partial’ and ‘No’. a score of ‘2’, ‘1’ and ‘0’ was given to each response, respectively.

The developed measurement was administered to farmers in non sample area to know its reliability and validity.

Reliability of the scale :

Reliability refers to the precision of the instrument *i.e.* to the extent to which repeated measurement produces the same result. Any newly constructed scale has to be tested for its reliability before it is used. In the present study, the reliability of knowledge test scale was determined by test-retest method and split half method as followed by Yadav *et al.* (2013)

Split-half method :

Split-half method of reliability was used to ensure internal consistency of the scale. The final knowledge test was administered to a new sample of 30 maize growers farmers in Baramullah district. The items on the scale were divided into odds and even numbered items. Scores of the two sets of the items obtained from 30 respondents were computed and correlated. A correlation co-efficient of r=0.87 was obtained which was high enough to adjudge the scale as reliable. The reliability of the test was calculated by the Spearman-Brown formula (Guilford and Fruchter, 1978). The reliability co-efficient of the test was found to be 0.92, which was found to be highly significant.

Table A : Item analysis of statements selected for testing knowledge about recommended package of practice of maize

Sr. No.	Knowledge items	Difficulty index (P) (30-80)	Discrimination index ($E^{1/2}$) (0.3 and above)	S=item selected R= item rejected
1.	Do you know the recommended varieties of maize? if yes name	76.6*	0.7*	S
2.	How many ploughings are recommended during land preparation?	76.6*	0.7*	S
3.	What is the recommended time of sowing?	100	0	R
4.	What are the recommended chemicals for seed treatment?	46.6*	0.6*	S
5.	What is the recommended seed rate?	76.6*	0.7*	S
6.	What is the recommended spacing for line sowing?	0	0	R
7.	What is recommended rate of fertilizers?	76.6*	0.7*	S
8.	Do you know fertilizers should be applied away from plants? If yes how much?	0	0	R
9.	Do you know zinc sulphate should be applied only if deficiency is observed?	0	0	R
10.	Do you know the recommended split dose of N fertilizer?	50*	1*	S
11.	Do you know proper crop stages for weeding and irrigation?	76.6*	0.7*	S
12.	What are recommended foliar sprays to control fungal diseases?	0	0	R
13.	Do you know the recommended management strategy for insect pests?	0	0	R

* indicates significance of value at P=0.05

Table B : Final items selected for knowledge test of recommended package of practice of maize

Sr. No.	Statements
1.	Do you know the recommended varieties of maize? if yes name
2.	How many ploughings are recommended during land preparation?
3.	What are the recommended chemicals for seed treatment?
4.	What is the recommended seed rate?
5.	What is recommended rate of fertilizers?
6.	Do you know the recommended split dose of N fertilizer?
7.	Do you know proper crop stages for weeding and irrigation?

$$r_{tt} = \frac{2r_{hh}}{1 + r_{hh}}$$

where, r_{tt} = reliability co-efficient of the test and r_{hh} = the correlation between two halves of the test.

Validity of the scale :

To ensure that obtained test scores measure the variable they are supposed to do, validity of the scale has to be observed.

Criterion validity:

In the present study, criterion validity was measured after establishing theoretical relationship between knowledge and adoption of recommended package of practice. Adoption level of recommended package of practices for maize was calculated for 30 farmers following the procedure recommended by Sengupta (1967). These scores were correlated with the knowledge scores. The 'r' value was found to be 0.92. Since the 'r' values were significant at 0.01 level of probability, the scale developed was considered as valid.

OBSERVATIONS AND ANALYSIS

From 13 knowledge items, 7 items having difficulty index ranging from 30-80, discrimination index above 0.3 and significant was selected as shown in the Table A.

The final knowledge items were administered on new 150 respondents. When the knowledge scores were analyzed, it was observed that only 17.3 per cent of the respondents had high level of knowledge, 34.6 per cent had medium level of knowledge and about 48 per cent of the respondents had low level of knowledge (Table 1).

Table 1 : Level of respondent's knowledge on paddy cultivation (n=150)

Levels of knowledge	Details of respondents (%)
Low	48
Medium	34.6
High	17.3

Yadav *et al.* (2013) and Divakar *et al.* (2012) also made similar observations using standardized knowledge test in their respective studies.

Conclusion :

The test developed was scientifically tested for its validity and hence, it can be very well used to measure the knowledge level of farmers on scientific technologies related to maize farming in similar conditions with necessary modification. The result obtained would help to derive appropriate strategy for technology innovation, refinement and dissemination with respect to scientific technologies in maize farming.

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