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Construction and Standardization of Knowledge Test to Measure the Level of Knowledge of Tribal Farmers on Seed Banking

A. Srinivas[1*], V. Sudha Rani[2] and I. Sreenivasa Rao[2]

[1]ICAR-Central Tobacco Research Institute, Rajahmundry, Andhra Pradesh533 105, India.
[2]College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad. 500 030, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Intense knowledge on seed banks is prerequisite for ensuring seed banking and the associated traditional knowledge in tribal areas. Hence, it was thought necessary to construct a test for the purpose and an attempt has been made to develop a test for measuring knowledge of tribal farmers on seed banking. Pertinent items were collected covering all aspects of seed banking. The knowledge test was developed following step by procedures which included preliminary screening of the items based on Likert's method through calculation of t-statistics and mean score, followed by the item analyses through derivation of difficulty index, discrimination index and point biserial correlation coefficient. The final knowledge test contained 45 items which were retained from 60 items. Each item can be measured through two-point scale. The test was found to be highly stable and reliable which was indicated by highly significant value of reliability co-efficient (0.78). The social science researchers can use this to measure knowledge of tribal farmers on seed banking. It can help the extension personnel to formulate sound strategy to exploit the strong areas of knowledge and develop the weak areas of knowledge of the farmers regarding seed banking.

**Corresponding author: E-mail: seenu.adhi@gmail.com;*

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1. INTRODUCTION

Access to good quality seed is a prerequisite of successful crop production as an enterprise [1]. Seed banks can help farmers' to access seeds to grow crops during the next planting season or they can be used as an emergency seed supply when their crops are damage and destroyed. Seed banks usually store seed from a wide range of individuals, informal groups and NGOs who share seed among themselves [2]. They not only reduce farmers' dependence on seed companies but also help conserve the agro-biodiversity of their villages [2]. Seed banking is operationalized as tribal farmers behavior in terms of seed saving, seed accessibility, seed production, seed storage, use and distribution to others. Promoting the local seed varieties through informal seed distribution systems such as community seed banks/seed banks is the need of the hour in tribal areas [3]. Despite having various advantages of seed banks, these did not get tribal farmers acceptance adequately [4,5]. To promote seed banks in tribal areas it is essential to study knowledge of tribal farmers on seed banking activities, as knowledge forms an essential component in adoption of seed banks. Hence, in order to study the knowledge of tribal farmers on seed banking, a test has been developed.

2. METHODOLOGY

2.1 Collection of Items

Initially 75 items were collected focusing on various aspects of seed banking "i.e." seed accessibility, seed storage, use and seed distribution to others. Experts in the field of plant breeding, seed technology and scientists working in tribal areas were consulted to collect the above 75 items. After screening, fine tuning and editing based on the opinion of the concerned scientists 60 items were retained. These 60 items were subjected to item analysis to screen some more items based on the opinion of the respondents (from non sample area).

2.2 Item Analysis

The item analysis was carried out in terms of three indices that are item difficulty index and item discrimination index and point biserial correlation. The item difficulty index indicates the extent to which an item was difficult. The item discrimination index provides information on how well an item discriminates in agreement that is whether an item really discriminates a well informed respondent from a poorly informed respondent [6]. The point biserial correlation provided information on how well item measures or discriminates in agreement with the rest of the test.

Pretesting of the items was done as suggested by Gonard [7]. The 60 items were revised and administered to 90 respondents selected for the purpose of pretesting in controlled situation.

2.3 Item Difficulty Index (P)

The 60 items were administered to 90 non sample respondents with two point response continuum. The scores allotted were one for correct response and zero for incorrect response. After computing the total score obtained for each of the 90 respondents on 60 items, they were arranged in order from highest to lowest scores. Based on which the 90 respondents were then divided into six equal groups. These groups were labeled as G_1, G_2, G_3, G_4, G_5 and G_6 with 15 respondents in each group. For the purpose of item analysis, the middle two groups G_3 and G_4 were eliminated keeping only four extreme groups with high and low scores (Bloom et al.1956).

The item difficulty index was worked out as the percentage of the respondents answering an item correctly. The items with 'p' values ranging from 0.2 to 0.8 were considered for the final selection of the knowledge test battery.

Item discrimination index (E 1/3):

The item discrimination index indicated by "E 1/3" which is calculated by the formula.

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

Where S1, S2 and S5, S6 are the frequencies of correct answers in the groups G1, G2 and G5, G6 respectively. 'N' is the total member of respondents of the sample selected for the item analysis that is 90.

The discrimination index varies from 0 to 1. The items with discrimination index ranging from 0.2 to 0.8 were selected for the final test.

2.4 Point Biserial Correlation (r_{pbis})

The main aim of calculating point biserial correlation was to work out the internal consistency of the items i.e. the relationship of the total score to a dichotomized answer to any given item. In a way, the validity power of the item was computed by the correlation of the individual item of preliminary knowledge test calculated by using the formula suggested by Garret [8].

$$rp_{bis} = \frac{MP-MQ}{SD} \times \sqrt{pq}$$

rp_{bis}= Point biserial correlation.

MP = Mean of the total scores of the respondents who answered the item correctly.

$$MP = \frac{\text{Sum total of x y}}{\text{Total number of correct answers}}$$

MQ = Mean of the total scores of the respondents who answered the item incorrectly.

$$MQ = \frac{\text{Sum total of x - Sum total of x y}}{\text{Total number of wrong answers}}$$

SD = Standard deviation of the entire sample.
P = Proportion of the respondents giving correct answer to the item.

$$P = \frac{\text{Total number of correct answers}}{\text{Total number of respondents}}$$

q = Proportion of the respondents giving incorrect answer to the item
(or) q = 1-P
X = Total score of the respondent for all items.
Y = Response of the individual for the "items i.e. (Correct = 1; Incorrect = 0)"
XY = Total score of the respondent multiplied by the response of the individual to the "item i.e (Correct = 1; Incorrect = 0)"

Items having significant point biserial correlation either at 1 per cent (or) 5 per cent level was selected for the final test of the knowledge.

Representativeness of the test:

Care was taken to see that the test items selected finally covered the entire universe of respondent's knowledge on seed banking behavior [9].

3. RESULTS AND DISCUSSION

Out of 60 items, 45 items were finally selected based on

1. Items with difficulty level indices ranging from 0.2 to 0.8
2. Items with discrimination indices ranging from 0.2 to 0.8.
3. Items having significant point biserial correlation either at 1 per cent or 5 per cent level.

Items have 0.80 and 0.20 as correct proportion. The average of these proportions is equal to (0.80 + 0.20)/2 = 0.50.

Thus, the finally selected knowledge test items comprised of 4 types of questions viz. true/false, multiple choices, fill up the blank questions and one word answer totaling to 45 items to measure the knowledge on seed banking behaviour. The selected items with P, E1/3 and rp_{bis} values are given in the Table 1.

3.1 Standardization of the Test

3.1.1 Reliability

The split half method: Total 45 statements in the knowledge test were divided into two equal halves by putting the odd numbered items on one side and even numbered items on the other side. Both halves were considered as separate schedule with 22 and 23 statements each. Each set of half part of a schedule was administered on the same group of 30 respondents alternatively who were not included in the final sample. To find out the agreement between two sets of statements of the schedule, correlation coefficient was calculated and put to Spearman Brown prophecy formula as given here

$$r_{11} = \frac{2\,(roe)}{1 + roe}$$

Where roe is the coefficient of reliability of two half test i.e. odd and even and r_{11} is the reliability coefficient of the entire test. Reliability coefficient for knowledge test was found to be 0.78. The scores for the subjects on the two forms were correlated and this correlation was taken as a measure of the reliability of the scales.

Table 1. Distribution of respondents based on knowledge test scores of item analysis

S. no.	Frequencies of correct answer of respondents in four extreme groups				Total frequencies of correct answers by all six groups	% of giving correct responses	Difficulty index	Discri-mination power	Rp_{bis}
	G-1	G-2	G-5	G-6					
1.	15	15	7	6	64	71.11	0.71	0.6	0.642**
2.	11	6	8	5	40	44.44	0.50	0.1	0.188^{NS}
3.	12	12	10	9	64	71.11	0.72	0.16	0.219^{NS}
4.	12	9	6	0	39	43.33	0.45	0.5	0.443**
5.	12	9	3	0	33	36.67	0.40	0.6	0.514*
6.	13	13	11	9	71	78.88	0.76	0.2	0.239^{NS}
7.	12	9	0	0	24	26.67	0.35	0.7	0.670*
8.	6	11	4	6	39	43.33	0.65	0.23	0.171^{NS}
9.	15	3	3	1	21	23.33	0.4	0.5	0.254*
10.	7	7	6	4	34	37.78	0.40	0.1	0.115^{NS}
11.	12	12	9	0	60	66.67	0.55	0.5	0.460*
12.	12	3	6	0	27	30.00	0.35	0.3	0.361**
13.	12	9	8	8	56	62.22	0.61	0.16	0.232^{NS}
14.	10	10	6	6	45	50.00	0.53	0.26	0.205^{NS}
15.	15	15	12	12	81	90.00	0.90	0.2	0.121^{NS}
16.	15	6	0	0	24	26.67	0.35	0.7	0.422*
17.	15	9	6	3	51	56.67	0.55	0.5	0.399**
18.	15	6	6	3	36	40.00	0.50	0.4	0.43**
19.	12	9	6	0	39	43.33	0.45	0.5	0.443**
20.	15	9	3	0	30	33.33	0.45	0.7	0.697*
21.	15	12	6	3	66	73.33	0.60	0.6	0.479**
22.	9	15	6	0	39	43.33	0.50	0.6	0.450*
23.	12	15	3	6	51	56.67	0.66	0.6	0.493*
24.	15	9	3	3	45	50.00	0.50	0.6	0.550*
25.	15	12	6	0	45	50.00	0.55	0.7	0.577*
26.	15	3	3	6	42	46.67	0.45	0.3	0.390**
27.	15	0	3	3	24	26.67	0.35	0.3	0.325**
28.	15	6	3	0	30	33.33	0.40	0.6	0.647*
29.	15	3	3	0	36	40.00	0.35	0.3	0.251**
30.	9	12	3	0	39	43.33	0.40	0.6	0.592*

S. no.	Frequencies of correct answer of respondents in four extreme groups				Total frequencies of correct answers by all six groups	% of giving correct responses	Difficulty index	Discri-mination power	Rp_{bis}
	G-1	G-2	G-5	G-6					
31.	12	15	3	6	51	56.67	0.66	0.6	0.493*
32.	12	9	3	0	36	40.00	0.40	0.6	0.251**
33.	12	15	3	6	51	56.67	0.66	0.6	0.493*
34.	6	6	0	0	27	30.00	0.20	0.4	0.224^{NS}
35.	10	4	1	3	21	23.33	0.3	0.3	0.374**
36.	7	7	3	1	24	26.67	0.3	0.3	0.374**
37.	12	12	9	4	51	56.67	0.65	0.3	0.264**
38.	11	10	9	7	51	56.67	0.61	0.1	0.203^{NS}
39.	12	4	0	0	24	26.67	0.30	0.6	0.611*
40.	12	6	0	3	33	36.67	0.35	0.5	0.456*
41.	9	12	0	0	33	36.67	0.35	0.7	0.612*
42.	12	12	3	0	45	50.00	0.45	0.7	0.476*
43.	15	15	6	6	60	66.67	0.70	0.6	0.539*
44.	15	12	9	3	60	66.67	0.65	0.5	0.414**
45.	9	11	6	9	41	45.56	0.58	0.1	0.117^{NS}
46.	15	9	3	0	39	43.33	0.45	0.7	0.580*
47.	15	15	9	6	75	83.33	0.75	0.5	0.562*
48.	15	15	4	6	60	66.67	0.70	0.6	0.539*
49.	12	12	3	0	33	36.67	0.45	0.7	0.655*
50.	15	15	6	12	78	86.67	0.80	0.4	0.439*
51.	11	4	2	4	21	23.33	0.35	0.3	0.381**
52.	10	11	9	6	57	63.33	0.60	0.2	0.186^{NS}
53.	14	15	14	12	76	84.44	0.91	0.1	0.183^{NS}
54.	13	9	7	8	52	57.78	0.61	0.23	0.201^{NS}
55.	10	12	11	07	64	71.11	0.67	0.1	0.223^{NS}
56.	9	6	0	3	33	36.67	0.30	0.4	0.379**
57.	15	12	4	0	51	56.67	0.55	0.7	0.675*
58.	15	9	3	0	39	43.33	0.45	0.7	0.580*
59.	13	11	5	2	51	56.67	0.51	0.56	0.596**
60.	15	12	3	3	45	50.00	0.50	0.6	0.546*

** Significant at 0.01 % level of probability, ** Significant at 0.05 % level of probability, NS: Non Significant*

3.1.2 Validity

Content validation: The content validity of the knowledge test was derived from a long list of test items representing the whole universe of seed banking collected from various sources as discussed earlier. It was assumed that the score obtained by administering the knowledge test of this study measures what was intended to measure. Thus ensuring a fair degree of content validity.

Thus the knowledge test developed in the present study measures the knowledge of tribal farmers on seed banking as it showed a greater degree of reliability and validity [10,11].

Selected items:

Fill in the blanks

1. _____ is the best source of seed in your community.
2. By using _____ seed we can conserve genetic material.
3. In _____ way the demand for seed can be fulfilled.
4. _____ fungicide is used for seed treatment.
5. _____ percent moisture content should be maintained during seed storage.
6. Before storing of harvested seed _____operation is required.
7. The seed security can be achieved through_____ in tribal areas.
8. Seed exchange with in community members is known as_____.

Multiple choices:

9. What is meant by community seed bank?
a) Seed saving b) Seed accessibility c) Seed distribution d) All the above
10. In situ conservation of seed means, conserving the seed in
a) Natural population b) Community seed bank
c) Storage bins d) Conserving the hybrid seed
11. Can you give the meaning of individual seed exchange?
a) Individual purchased seed will be exchanged
b) Individual saved seed will be exchanged with other farmers
c) Seed exchanged with external agencies
d) Seed exchanged with other community members
12. Which is the best seed in tribal area?
a) Local seed varieties b) Hybrid seed
c) Seed from government agencies d) Seed from input dealers
13. For which purpose the saved seed can be utilized?
a) As seed for next season b) For own consumption
c) Exchange with others d) Both a& d
14. Products from which seed is healthier to human being and environment?
a) Seed from private agencies b) Hybrid seed
c) Seed from govt agencies d) Local seed varieties
15. Which seed will be available at lower price?
a) Local seed varieties b) Seed from govt agencies
c) Hybrid seed d) Seed from private agencies
16. In which way seed sovereignty can be achieved?
a) Seed from govt agencies b) Hybrid seed
c) Local seed varieties d) Seed from private agencies
17. Seed accessibility at community level can be improved through?
a) Input dealers b) Community seed banks
c) Seed from govt agencies d) Seed from private agencies
18. Which is the best source of seed for small and marginal farmers?
a) Seed from input dealers b) local seed varieties from farmers
c) Seed from govt agencies d) Seed from private agencies

19. Sustainable use of genetic resources can be achieved through?
a) Hybrid seed b) local seed varieties
c) Seed from govt agencies d) Seed from private agencies
20. Seed conservation and exchange at village level can be happen through?
a) Seed from govt agencies b) Hybrid seed
c) Community seed banks d) Seed from private agencies
21. Farmer's dependence on seed companies can be reduced through?
a) Local seed varieties b) Hybrid seed
c) Seed from govt agencies d) Seed from private agencies

True/False

22. Informal seed distribution system means, seed distribution with neighbors, friends and relatives without any formal procedure.
23. Local seed varieties ensure that good quality seed is always available in tribal areas.
24. Local seed varieties ensure that seed is available at cheaper price.
25. The community seed bank become lively hood source of for farmers.
26. Local seed varieties will give good yield even in dry land areas also.
27. Local seed varieties will reduce input cost for cultivation.
28. Seed treatment necessary for the seed that you use.
29. Empowerment of farmer's organization can be achieved through activities like community seed banks.
30. By using of high yielding varieties indigenous varieties depletion happen.
31. Community seed banks can act as an alternate income generating activity.
32. Reason for depletion of seed stock in the villages is use of hybrid seed.

One word answer

33. Indigenous seed variety means?
34. Please name any two indigenous varieties in your community?
35. What is meant by local seed fairs?
36. What is meant by farmer's right?
37. What is the difference between the local seed variety and hybrid seed?
38. What are the consequences of continuous using of hybrid seed and replacing the local varieties?
39. Which is the best place for seed storage?
40. Please mention any one pesticide which will control the storage pest?
41. Tell any indigenous practice for rodent control?
42. How the seed is distributed from community seed bank?
43. Can you give any activity through which we can conserve agro biodiversity?
44. What are the different sources of seed collection in your community?
45. How can we establish alternate seed supply in tribal areas?

4. CONCLUSION

Understanding the knowledge of the individuals is very important in social science research as it influences the adoption phenomenon to a great extent. A reliable and valid knowledge test is required for this purpose. In the present study a knowledge test on seed banking was developed and standardized. This knowledge test covered every possible area of seed banking. It was found to be highly stable and reliable which was indicated by the highly significant value of reliability co-efficient. The social science researchers can use this to measure knowledge of tribal farmers on seed banking. It can help the extension personnel to formulate sound strategy to exploit the strong areas of knowledge and develop the weak areas of knowledge of the farmers regarding seed banking.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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