

## RESEARCH NOTE

## Development and Standardization of a Knowledge Test On Mixed Farming for Farmers

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*Paper Received on December 22, 2015, Accepted on March 28, 2016 and Published Online on April 15, 2016*

### ABSTRACT

*Mixed farming systems are central to the livelihood and nutritional security of small, marginal and landless farmers in India and other developing countries of the tropics. Intense knowledge in this area is prerequisite for majority of Indian farmers to sustain themselves in the changing environment. In the present study, an attempt was taken to develop and standardize a knowledge test on mixed farming for farmers. Knowledge in mixed farming was operationalized as the totality of understood information possessed by the farmers about concept of mixed farming; mixed farming vis-à-vis different farming practices which included crop cultivation, animal husbandry and other miscellaneous practices in the form of duck-cum-fish culture and paddy-cum-fish culture; mixed farming vis-à-vis Low External Input Agriculture (LEIA); organic farming; Integrated Nutrient Management (INM); Integrated Pest Management (IPM) and sustainable agriculture; and mixed farming vis-à-vis farm management decisions. The knowledge items were collected based on mixed farming systems prevalent in the state of West Bengal. The steps viz. selection of items; item analysis and pre-testing; calculation of difficulty and discrimination index; final selection of items; and testing of reliability and validity; were followed to develop and standardize the test. The final knowledge test contained 55 items which were retained from 99 items. The test was found to be highly stable and reliable which was indicated by highly significant value of reliability co-efficient. It can help the extension personnel to explore the strong and weak areas of knowledge of farmers about mixed farming.*

**Key words:** *Knowledge test; Difficulty index; Discrimination index; Mixed farming;*

Mixed crop-livestock farming systems are central to the livelihood security of the small and marginal farmers and the landless, in the developing countries of the tropics (*Devendra and Chantalokhana, 2002*). Mixed farming is a combination of crop production with a significant amount of animal raising. Mixed farming can provide round the year employment opportunity and household food and nutritional security to resource-poor farm families. It is the key to low-external-input farming and/or organic farming which is suitable for and practiced by resource-poor farmers. The improvement of livelihood security of the rural poor in India and other developing countries of the tropics is, therefore, directly linked with the growth of the small farm, mixed crop-livestock economy (*ILRI, 2000*). Profound knowledge in the various areas of mixed farming is the prerequisite

for predominant small and marginal Indian farmers to sustain themselves in the changing environment.

According to English and *English (1958)*, knowledge is a body of understood information possessed by an individual or a culture. A test is a set of questions, each of which has a correct answer, to which the people respond (*Ray and Mondal, 1999*). A knowledge test has been defined by *Bloom et al. (1995)* as a test which refers to those behaviours and test situations which emphasize remembering by the recall of idea, material or phenomena.

There is no knowledge test available to measure the knowledge level of farmers in the area of mixed farming. In the present study, an attempt has been taken to develop and standardize a test to measure the knowledge level of farmers in the area of mixed farming.

## METHODOLOGY

In the present study, knowledge in the area of mixed farming was operationalized as the totality of understood information possessed by the farmers about mixed farming covering the areas of concept of mixed farming; mixed farming *vis-à-vis* different farming practices which included crop cultivation, animal husbandry and other miscellaneous practices in the form of duck-cum-fish culture and paddy-cum-fish culture; mixed farming *vis-à-vis* Low External Input agriculture (LEIA); organic farming; Integrated Nutrient Management (INM); Integrated Pest Management (IPM) and sustainable agriculture; and mixed farming *vis-à-vis* farm management decisions. The items of the knowledge test were collected based on mixed farming systems prevalent in the state of West Bengal. The knowledge test was developed and standardized by following the steps described below:

*Selection of items:* The content of the knowledge test is composed of items. A test usually contains problems or tasks graded in difficulty from very easy to very hard by known steps or intervals (Garrett, 1966). These problems or tasks are referred to as items. A comprehensive list of test items regarding the concept of mixed farming, crop cultivation, animal husbandry, miscellaneous practices (in the form of duck-cum-fish culture and paddy-cum-fish culture), mixed farming *vis-à-vis* LEIA, organic farming, INM, IPM and sustainable agriculture and mixed farming *vis-à-vis* farm management decisions was prepared by going through relevant literatures obtained from books and internet and in consultation with the experts. The applicability and suitability of these knowledge items in the study area was further validated by the local experts and some of the progressive farmers. The selection of items was done on the basis of following criteria:

- (i) It should promote thinking.
- (ii) It should have a certain difficulty.
- (iii) It should differentiate the well informed from the less informed.

The number of statements retained through preliminary screening of the test was 9, 30, 34, 5, 15 and 6 representing the concept of mixed farming, crop cultivation, animal husbandry, miscellaneous practices, mixed farming *vis-à-vis* LEIA, organic farming, INM, IPM and sustainable agriculture and mixed farming *vis-*

*à-vis* farm management decisions, respectively. The items were composed of a question followed by four possible responses i.e. multiple choice type. The items were not converted to genuine dichotomous type like true/false and yes/no type in order to increase the degree of openness of the response.

*Item analysis and pre-testing:* The preliminary knowledge test battery was administered to 40 respondents selected from non-sampling area of the locale of research. The scores assigned were 3, 2, 1 and 0 to accurate, somewhat accurate, least accurate and wrong/no reply. Total score of each respondent was ascertained by summing up the score obtained by him/her in each item. Later on difficulty index and discrimination index for each of the item were calculated separately. Point bi-serial correlation was not calculated for item analysis, as there was not any genuine dichotomy in items (Ray and Mondal, 2004).

*Calculation of Difficulty Index:* There are several ways to determine the difficulty of an item as given by Garrett (1966): (i) by the judgment of the competent people who rank the items in order of difficulty, (ii) speed with which the items can be correctly solved and (iii) by the number of examinees in the group who solve the item correctly. In the present study, the method of difficulty index was used to determine the difficulty of an item. The index was calculated by using the following formula:

$$DI = \frac{nc}{N}$$

Where,

DI = Discrimination index

DI = Difficulty index

nc = Number of respondents who answered the question correctly

N = Total number of respondents

*Calculation of Discrimination index:* It expresses the extent to which an item discriminates among the subjects who differ sharply in their knowledge measured by the test as a whole. Bean (1953) defined discrimination index as the degree to which the single item separates the superior from the inferior individuals in the trait or group of traits being measured. An item has greater power to discriminate more knowledgeable from less one if it can be answered correctly only by some instead of whole. On the other hand, a statement which is either answered correctly by everyone or none in the sample

has no power of discrimination. Individuals can be discriminated only when they obtain different scores instead of identical scores.

In order to compute discrimination indices for all the items, the total scores of all the respondents were arranged in descending order. Out of this, top 25 per cent and bottom 25 percent of the respondents were treated as high and low group. Then the discrimination index was calculated as under:

$$DI = \frac{DI = (n_1H - n_2L)}{n}$$

Where,

DI = Discrimination index

$n_1H$  = Number of respondents in 25 per cent high group who answered correctly

$n_2L$  = Number of respondents in 25 percent low group who answered correctly

$n$  = ( $n_1 + n_2$ ) = Total number of respondents in 25 percent high group and 2 percent low group

*Final selection of items:* An item having a difficulty index value between 0.25 and 0.75 and a discrimination index value above 0.20 was considered for final selection of items. Only 5, 18, 18, 2, 9 and 3 items pertaining to the concept of mixed farming, crop cultivation, animal husbandry, miscellaneous practices, mixed farming *vis-à-vis* LEIA, organic farming, INM, IPM and sustainable agriculture and mixed farming *vis-à-vis* farm management decisions, respectively were included in the final knowledge test. Thus, finally a sum of 55 items from a total of 99 items was retained for final knowledge test in mixed farming.

*Testing reliability of the knowledge test:* Reliability refers to the consistency of scores obtained by the same individuals when re-examined with test on different occasions, or different sets of equivalent items, or under variable examining conditions (Anastasi, 1968). It is the accuracy or precision of a measuring instrument (Kerlinger, 2004, and Satyapriya, 2015). In this study, reliability of the test was assessed by using 'split half' technique. The final knowledge test consisting of total 55 items was divided in two sets containing odd and even numbered items. These two test sets were administered to 20 farmers of non-sampling area one by one at the same time. The total scores obtained by each of the respondents in odd and even numbered item set were calculated separately. Then the Pearson

Product Moment correlation coefficient between the two sets of scores was calculated. The 'r' value calculated was 0.613 and was found significant at 1 percent level of probability. It indicated that the test had high level of internal consistency.

*Testing validity of the knowledge test:* The validity of the test was established on account of content validity which means the representativeness of the content of a measuring instrument to the whole subject intended to measure. According to Anastasi (1968), content validity involves essentially the systematic examination of the test content to determine whether it covers a representative sample of the behaviour domain to be measured. All possible statements covering all aspects of mixed farming practices were collected and the same were subjected to measure item difficulty and discrimination index to select the final statements. Hence, it was logical to consider that the test satisfied representation as well as sensible method of test construction which is the criterion for content validity.

## RESULTS AND DISCUSSION

The number of knowledge items selected on concept of mixed farming after preliminary screening was nine. Five items having a difficulty index value between 0.25 and 0.75 and a discrimination index value above 0.20 were selected for final test battery from these 9 items (Table 1 (A)).

The number of knowledge items selected on crop cultivation after preliminary screening was thirty. Eighteen items having a difficulty index value between 0.25 and 0.75 and a discrimination index value above 0.20 were selected for final test battery from these 30 items (Table 1(B)).

Thirty four knowledge items were selected on animal husbandry after preliminary screening of items. Among these 34 items, 18 items were found to have a difficulty index value between 0.25 and 0.75 and a discrimination index value above 0.20 and these items were selected for final test battery (Table 1 (C)).

Five knowledge items were selected on miscellaneous practices after preliminary screening of items. Among these 5 items, 2 items were found to have a difficulty index value between 0.25 and 0.75 and a discrimination index value above 0.20 and these items were selected for final test battery (Table 1 (D)).

**Table 1. List of knowledge items on concept of mixed farming with their respective values of difficulty index (DI) and discrimination index (Dis.I)**

Knowledge items	DI	Dis.I		
<i>(A) Concept of Mixed Farming</i>				
What is 'Farming System'?	0.22	0.35		
What are the elements of a Farming System?	0.18	0.25		
What is the basis of a Farming System?	0.02	0.05		
What is 'Mixed Farming'?	<b>0.67</b>	<b>0.25</b>		
What should be the contribution of animal in income from Mixed Farming?	<b>0.27</b>	<b>0.40</b>		
Suppose, your annual income from crop cultivation is Rs 10000/- and from selling milk, eggs and meat is Rs 1000/-. What type of farm you are having?	<b>0.25</b>	<b>0.40</b>		
What is the principle of Mixed Farming?	0.07	0.10		
What are the advantages of Mixed Farming?	<b>0.42</b>	<b>0.40</b>		
What are the limitations of 'Mixed Farming'?	<b>0.27</b>	<b>0.30</b>		
<i>(B) Crop cultivation</i>				
What do you mean by 'Mixed Cropping'?	<b>0.67</b>	<b>0.25</b>		
Differentiate between 'Mixed Farming' and 'Mixed Cropping'.	0.67	0.15		
What do you mean by 'Crop Rotation'?	<b>0.72</b>	<b>0.35</b>		
Give example(s) of Crop Rotation?	<b>0.72</b>	<b>0.35</b>		
What are the advantages of 'Crop Rotation'?	0.77	0.25		
What do you mean by 'Legume'?	<b>0.55</b>	<b>0.20</b>		
Give examples of some legume crops.	0.42	0.15		
Why do we cultivate legume?	0.27	0.15		
"Legumes require special seed treatment"- What is that?	0.22	0.20		
Give some examples of fodder crops.	<b>0.47</b>	<b>0.40</b>		
What is the appropriate time to apply FYM?	<b>0.70</b>	<b>0.25</b>		
How do you select a variety?	<b>0.57</b>	<b>0.45</b>		
What are the points you should keep in your mind while adopting a new farm technology?	<b>0.52</b>	<b>0.45</b>		
What is 'Mulching'?	<b>0.47</b>	<b>0.40</b>		
What do you mean by 'Green Manuring'?	<b>0.37</b>	<b>0.25</b>		
Give some examples of Green Manuring Plants.	0.27	0.15		
What are the major diseases of rice?	<b>0.75</b>	<b>0.25</b>		
What are the major insect pests of rice?	0.90	0.10		
What are the major diseases of potato?	<b>0.67</b>	<b>0.25</b>		
What are the major insect pests of potato?	0.72	0.15		
Tell the name of some popular pesticides?	<b>0.75</b>	<b>0.25</b>		
Tell the name of some phosphatic fertilizers.	<b>0.57</b>	<b>0.35</b>		
Tell the name of some compound fertilizers.	0.37	0.20		
Tell the name of some mixed fertilizers.	<b>0.67</b>	<b>0.30</b>		
Name some paddy HYV.	<b>0.75</b>	<b>0.25</b>		
What is the seed rate of rice in transplanting method?	<b>0.75</b>	<b>0.40</b>		
			What is the fertilizer dose in rice cultivation?	<b>0.62</b> <b>0.35</b>
			What is the optimum planting density of potato?	0.18 0.25
			How will you control rats?	0.80 0.45
			What are the characteristics of a good storage?	0.45 0.20
			<i>(C) Animal husbandry</i>	
			Name some dairy breeds.	<b>0.32</b> <b>0.30</b>
			Name some layer breeds of poultry.	<b>0.30</b> <b>0.25</b>
			Name some meat purpose poultry breeds.	0.35 0.20
			How an animal can be bred?	0.77 0.45
			What are the heat symptoms of an animal?	<b>0.57</b> <b>0.30</b>
			When an animal should be inseminated after coming in heat?	0.22 0.25
			After how many days of calving a cow/ buffalo should be inseminated?	0.32 0.20
			At what age a cross-bred heifer should be inseminated?	0.20 0.15
			What characteristics you should keep in mind while purchasing dairy animals?	<b>0.57</b> <b>0.40</b>
			Why green grasses are necessary for cattle?	<b>0.37</b> <b>0.30</b>
			What is good ration for dairy animals?	<b>0.42</b> <b>0.35</b>
			What is the balanced feed for a lactating cross-bred cow giving 8 litres milk/day in flush season?	0.12 0.10
			When green fodder in scarcity, then how much green fodder should be fed to a cross-bred cow producing 8 litres milk/day?	0.18 0.30
			When jowar should be cultivated to feed animals?	0.27 0.15
			When a newly born calf should be allowed for sucking its mother?	0.25 0.20
			How long a newly born calf should be fed colostrums?	<b>0.32</b> <b>0.35</b>
			On what basis you will formulate feed quantity of your milch animal?	<b>0.37</b> <b>0.40</b>
			How many times in a day water should be offered to animal in Summer?	<b>0.52</b> <b>0.45</b>
			What is most suitable feed for goats kept under Mixed Farming?	<b>0.47</b> <b>0.40</b>
			Give examples of some commercial poultry feed.	0.22 0.30
			Identify the sources of poultry feed in Mixed Farming?	<b>0.42</b> <b>0.25</b>
			What are the common diseases of cattle?	<b>0.37</b> <b>0.35</b>
			What are the common diseases of goat?	0.05 0.10
			What are the common diseases of poultry birds?	<b>0.32</b> <b>0.40</b>

What are the common diseases of livestock against which vaccination can be done?	<b>0.22</b>	<b>0.15</b>	“To some extent, Mixed farming facilitates IPM.”- How?	0.27	0.15
What are the important symptoms of FMD?	<b>0.27</b>	<b>0.25</b>	What do you mean by ‘Sustainable Agriculture’?	<b>0.32</b>	<b>0.30</b>
What precautions you will take against contagious diseases of animals?	<b>0.27</b>	<b>0.25</b>	What are the major components of ‘Sustainable Agriculture’?	0.18	0.10
What are the important symptoms of worm trouble in calves?	<b>0.25</b>	<b>0.30</b>	What are the benefits of Mixed Farming in Sustainable Agriculture?	<b>0.27</b>	<b>0.25</b>
When should a calf be dewormed earliest?	0.12	0.10	(F) <i>Mixed Farming vis-à-vis Farm Management Decisions</i>		
What are the characteristics of a good animal house?	<b>0.32</b>	<b>0.25</b>	What do you understand by the term ‘Farm Management’?	<b>0.25</b>	<b>0.25</b>
What should be the age of calf for dehorning?	0.12	0.05	What are the major Farm Management Decisions?	0.15	0.10
At what age male calf should be castrated?	0.07	0.05	What are the decisions involved in production?	<b>0.30</b>	<b>0.30</b>
How much dry period should be allowed for a lactating pregnant cow/buffalo?	<b>0.27</b>	<b>0.25</b>	What are the decisions involved in purchasing?	0.30	0.15
To avoid ammonia poisoning in birds kept in deep litter system, what you should do?	0.02	0.00	What are the decisions involved in selling?	0.25	0.15
(D) <i>Miscellaneous practices</i>			Which has more liquidity potential in Mixed Farming?	<b>0.32</b>	<b>0.25</b>
How do you describe ‘Duck-cum-Fish-Culture’?	<b>0.47</b>	<b>0.35</b>			
What should be the stocking weight of fish seeds in ‘Duck-cum-Fish Culture’?	0.12	0.20			
What should be the age of ducklings for ‘Duck-cum-Fish Culture’?	0.20	0.20			
What do you mean by ‘Paddy-cum-Fish culture’?	<b>0.52</b>	<b>0.45</b>			
Tell the name of rice varieties suitable for Paddy-cum-Fish culture.	0.22	0.15			
(E) <i>Mixed Farming vis-à-vis LEIA, Organic Farming, INM, IPM and Sustainable Agriculture</i>					
What do you mean by ‘Low External Input Agriculture (LEIA)’?	<b>0.27</b>	<b>0.40</b>			
What are the basic principles behind Low External Input Agriculture (LEIA)?	0.07	0.05			
How do you correlate ‘Mixed Farming’ with ‘LEIA’?	<b>0.25</b>	<b>0.35</b>			
What do you understand by ‘Organic Farming’?	<b>0.47</b>	<b>0.35</b>			
“Mixed Farming helps in Organic Farming”- in what ways?	<b>0.42</b>	<b>0.45</b>			
What do you understand by ‘Integrated Nutrient Management (INM)’?	<b>0.37</b>	<b>0.40</b>			
“Mixed farming leads to INM”- how?	<b>0.37</b>	<b>0.35</b>			
1 kg urea is equivalent to ___kg goat manure.	0.02	0.05			
1 kg urea is equivalent to ___kg FYM.	0.20	0.10			
1 kg urea is equivalent to ___kg poultry manure.	0.12	0.05			
What do you understand by ‘Integrated Pest Management (IPM)’?	<b>0.42</b>	<b>0.25</b>			

Note= Difficulty and Discrimination Index values of finally selected items are highlighted.

The number of knowledge items selected on mixed farming *vis-à-vis* LEIA, organic farming, INM, IPM and sustainable agriculture after preliminary screening was fifteen. Nine items having a difficulty index value between 0.25 and 0.75 and a discrimination index value above 0.20 were selected for final test battery from these 30 items (Table 1 (E)).

Six knowledge items were selected on mixed farming *vis-à-vis* farm management decisions after preliminary screening of items. Among these 6 items, 3 items were found to have a difficulty index value between 0.25 and 0.75 and a discrimination index value above 0.20 and these items were selected for final test battery (Table 1 (F)).

Finally a sum of 55 items (5 items on concept of mixed farming, 18 items on crop cultivation, 18 items on animal husbandry, 2 items on miscellaneous practices, 9 items on mixed farming *vis-à-vis* LEIA, organic farming, INM, IPM and sustainable agriculture and 3 items on mixed farming *vis-à-vis* farm management decisions) from a total of 99 items were retained for final knowledge test in mixed farming.

## CONCLUSION

Knowledge is an overt component of human behaviour which largely affects other components of human behaviour like attitude, skill and understanding. Researches also proved that cognitive domain of the human being influences the adoption phenomenon to a great extent and knowledge is the key part of this cognitive domain. So understanding the knowledge of the individuals is very important in social science research. A reliable and valid knowledge test is required for this purpose. In the present study a knowledge test on mixed farming was developed and standardized. This knowledge test covered every possible and popular area

of mixed farming. 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 it to test the knowledge level of farmers in mixed farming which is being practiced in India since time immemorial and needs to be improved considering the changing environment. The strong and weak areas of knowledge about mixed farming can be explored by administering this knowledge test on farmers. 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 mixed farming.

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