Development of Gender-Disaggregated Knowledge Test for measuring Knowledge Level of Farmers in Improved Rice Cultivation

Loukham Devarani[1] and A. K. Bandhyopadhyay[2]

1. Asstt. Prof., School of Social Sciences, College of Post Graduate Studies, CAU, Umiam, Meghalaya
2. Professor, Department of Agricultural Extension, BCKV, Mohanpur, Nadia, West Bengal

Corresponding author e-mail: loukham.d@gmail.com

ABSTRACT

Both male and female farmers participate in rice farming but have different roles. It is therefore not appropriate to measure their knowledge level with the same yardstick. In this study, gender disaggregated knowledge test was developed for measuring the knowledge level of male and female farmers of Imphal West District in improved rice cultivation practices. From an initial collection of 110 items, 22 items for male farmers and 19 items for female farmers were selected for the final format of the knowledge test based on their difficulty and discrimination indices. The knowledge test was administered to 76 male and 78 female farmers of Maklang gram panchayat and the result indicates that majority of the farmers: male (65.79%) and female farmers (70.51%) have medium level of knowledge. Farmers' knowledge in time and doses of application of fertilizers and treatment of seeds before sowing needed to be enhanced. It was also observed that education, socio-economic status and participation in training programme are the important characteristics showing positive correlation with knowledge level.

***Key words**: Knowledge test; Rice cultivation; Gender; Imphal valley;*

Rice is the main crop of the state of Manipur and like all rice growing areas of the world, both male and women play an active role in rice cultivation one way or the other. Knowledge about improved rice cultivation practices is an important determinant of effectiveness in rice farming. S*uleiman and Van den Ban (2000)* pointed out that the success of a farmer in the years to come is going to be primarily dependent upon his level of knowledge. However, men and women have varied roles, opportunities and constraints which in turn would affect their knowledge level. It is therefore, not appropriate to measure the knowledge level of both genders with the same measuring tool and conclude that one gender is more knowledgeable. Tools should also be gender specific. The objectives are as follows:

i. Development of gender disaggregated knowledge tests for rice farmers in improved rice cultivation practices
ii. Assessment of the knowledge level of male and female farmers using the developed tests
iii. Find the association of knowledge level with the selected personal variables.

METHODOLOGY

In this study, knowledge level of male and female farmers belonging to Maklang Gram Panchayat of Imphal West District of Manipur were assessed using knowledge tests developed specially for the study. the methodologies followed for the study are described hereunder.

A. *Development of gender disaggregated knowledge tests:* the steps followed for development of the test are:

i) Collection and selection of items: Items are the contents which are knowledge questions of the test. Items pertaining to improved rice cultivation were collected from various secondary sources such as publications on rice cultivation, plant protection and nutrient management by the Manipur State Department of Agriculture, related books authored by experts and also through interaction with scientists of Central Agricultural University, Imphal and selected rice farmers. 138 items were initially collected from which 110 were selected. The criteria for selection of items

were that it should promote thinking rather than rote-memorizing and it should differentiate the well informed farmers from the poorly informed ones and should have a certain difficulty value. A schedule was then prepared with these items for administering them to the rice growers for item analysis.

ii) Item analysis: The items were checked and modified on the basis of pre-testing and administered to 120 farmers (60 male and 60 female) for item analysis. The farmers were randomly selected from three villages in Patsoi Gram Panchayat, neighbouring Maklang Gram Panchayat. Both the areas are similar agro-ecologically. Each of the 120 farmers to whom the test was administered was given score 1 or 0 according to whether the answers were correct or incorrect. The total number of correct answers given by a respondent out of the 110 items was his/her knowledge score. The score of all the 120 farmers were then computed and disaggregated into two categories based on the gender of the respondents as male farmers and female farmers. On each category, the 60 scores were arranged from the highest to the lowest in order of magnitude. Now the 60 farmers in each category were divided into 6 equal groups each having 10 farmers and were arranged in descending order of the total score obtained by them. For each category the groups were named G_1, G_2, G_3, G_4, G_5 and G_6 respectively. For item analysis the two middle groups (G_3 and G_4) of each category was eliminated. The ranges of the scores obtained by the four groups of respondents in each category were as follows:

Group	Male	Female
G1	72 to 61	66 to 53
G2	60 to 52	51 to 43

Group	Male	Female
G5	42 to 35	31 to 25
G6	34 to 25	24 to 17

iii) Calculation of item difficulty index: Difficulty index of an item is defined as the proportion of farmers giving correct answers to that particular item. This is calculated by the formula:

$$P_i = 1 + \frac{n_i}{N_i} \times 100$$

Where,

Pi= difficulty index in percentage of i^{th} item

ni= number of farmers giving correct answer to i^{th} item

Ni= total number of farmers to whom i^{th} item was administered i.e., 30 in the present study.

iv) Calculation of item discrimination index: The method suggested by *Mehta (1958)* was adopted for the present study. The formula by which item discrimination was calculated is given below:

$$E^{\frac{1}{2}} = \frac{\{(S_1 + S_2)(S_5 + S_6)\}}{\frac{N}{3}}$$

Where,

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

N= total number of farmers to whom ith item was administered i.e., 60 in the present study.

v) Selection of items for test: For male farmers the item difficulty index value ranging from 46.7 to 70 and discrimination index ranging from 0.3 to 0.6 were included in the final format of knowledge test. As for female farmers, the item difficulty index value ranging from 46.7 to 73.3 and discrimination index ranging from 0.3 to 0.6 were included. In this way 22 items for male farmers and 19 items for female farmers were selected

Table 1: Calculated difficulty and discrimination indices of the selected items of knowledge test for male farmers

A	B	C				D	E	F
		S_1	S_2	S_3	S_4			
1.	6	10	10	10	0	42	70	0.5
2.	8	10	8	2	2	32	53.3	0.7
3.	9	8	8	4	2	38	63.3	0.5
4.	10	10	6	6	4	38	63.3	0.3
5.	12	10	8	2	4	34	56.7	0.6
6.	24	6	10	4	4	32	57.3	0.4
7.	25	10	10	6	4	40	66.7	0.5
8.	28	4	10	6	2	36	60	0.3
9.	31	10	8	6	2	42	70	0.5
10.	35	10	10	4	2	40	66.7	0.7
11.	36	10	10	2	2	34	56.7	0.8
12.	42	8	8	2	0	28	46.7	0.7
13.	43	10	8	6	2	32	53.3	0.5
14.	49	8	10	4	0	40	66.7	0.7
15.	55	10	6	2	2	32	53.3	0.6
16.	70	8	10	2	2	32	53.3	0.7
17.	71	8	10	2	2	32	53.3	0.7
18.	79	8	8	2	4	32	53.3	0.5
19.	82	10	8	6	2	42	70	0.5
20.	94	10	8	4	2	34	56.7	0.6
21.	99	10	8	6	6	42	70	0.3
22.	101	8	10	4	2	30	50	0.6

A= Item. No. B= Sl. No. of item in the initial test

C= Frequency of correct answers (S_1, S_2, S_3, S_4)

D= Total no. of respondents giving correct answers (N=30)

E= % of respondents giving correct answer (Difficulty Index)

F = $E^{1/3}$ (Discrimination Index)

Table 2: Calculated difficulty and discrimination indices of the selected items of knowledge test for female farmers

A	B	C				D	E	F
		S_1	S_2	S_3	S_4			
1.	1	10	4	6	2	30	50	0.3
2.	3	10	10	4	6	38	63.3	0.5
3.	6	10	6	6	2	32	53.3	0.4
4.	7	10	8	6	2	40	66.7	0.5
5.	9	8	6	6	2	36	60	0.3
6.	22	8	6	4	4	30	50	0.3
7.	25	10	6	4	4	40	66.7	0.4
8.	28	10	8	2	4	30	50	0.6
9.	29	10	8	6	4	44	73.3	0.4
10.	37	8	6	4	4	34	56.7	0.3
11.	49	10	8	4	8	44	73.3	0.3
12.	50	8	10	10	2	42	70	0.3
13.	67	8	10	10	0	38	63.3	0.4
14.	70	8	6	2	2	28	46.7	0.5
15.	82	10	10	8	4	44	73.3	0.4
16.	84	10	8	2	6	36	60	0.5
17.	86	8	8	4	6	30	50	0.3
18.	98	10	8	4	4	32	53.3	0.5
19.	101	10	8	4	0	38	63.3	0.6

for inclusion in the final format of the knowledge tests. The difficulty and discrimination indices of the selected knowledge items for male farmers and female farmers are presented in Table 1 and 2 respectively.

vi) Testing of reliability and validity of the tests: The reliability and validity of the developed knowledge tests were tested.

B. *Assessment of the knowledge level of male and female farmers:* The respondents whose knowledge levels were assessed belonged to Maklang Gram Panchayat of Imphal West. Complete enumeration of all the rice growers in a selected rice field, *Lairam Loukol* was done. In the enumeration procedure, only farmers residing in the six villages within the Maklang Gram Panchayat and cultivating rice in the selected rice field were considered. The sampling was done keeping the agro-ecological and socio-cultural condition of the respondents as uniform as possible. In this manner 154 farmers (76 male and 78 female) were selected to whom the developed knowledge tests were administered. Here, it may be noted that the respondents for the item analysis and test of reliability of the developed knowledge tests were farmers of nearby villages having similar characteristics. These respondents were not included in the final set of farmers to whom the developed knowledge tests were administered.

C. *Variables associated with their knowledge level of farmers:* For this, thirteen variables which were presumed to be associated with the knowledge level of the farmers were selected. The relationship between each of the variables and the knowledge level was worked out using Pearson coefficient of correlation.

RESULTS AND DISCUSSION

Reliability and validity of the knowledge tests: The reliability of the knowledge tests developed were tested in two ways.

Split-half method: The final items in each of the two knowledge tests were first arranged randomly (through simple random sampling) and then divided into two sets according to their order in the arrangement viz. items with odd numbers and items with even numbers. For the male farmers the two sets: one with 11 odd numbered items and another with 11 with even numbered items. For the female farmers, one part has 10 items with odd number and 9 items with even number. The two sets each of the knowledge tests of the male and female farmers were administered to 30 male and 30 female farmers respectively. The co-efficient of correlation between the two sets scores were computed and the values were found to be 0.86 and 0.82 at 1 per cent level of significance for the knowledge test for male farmers and female farmers respectively.

Test-retest method: The final knowledge items of the male and female farmers were administered to 30 male and 30 female farmers at an interval of 20 days. The co-efficient of correlation values for the two set of tests for male and female were computed to be 0.80 and 0.82 at 1 per cent level of significance respectively. Hence, the knowledge tests constructed were highly stable and dependable for measurement of the variable 'knowledge level".

In the final selection of items care was taken to include items covering the entire universe of relevant behavioural aspects of the respondents with respect to knowledge about improved rice cultivation practices. Items were collected through various sources including specialists and hence, it was assumed that the score obtained by administering this test measure the intended knowledge of the respondents. However, the test is applicable to farmers of Imphal valley having somewhat

similar personal characteristics. The items of the knowledge test thus developed are listed out in Tables 4 and 5.

Measurement of the knowledge level of the respondents using the developed knowledge test: The knowledge tests developed was administered to the enumerated 76 male and 78 female farmers. The results of the test are presented in Table 3. It was observed that among the male farmers, 65.79 per cent have medium level knowledge while 14.47 per cent and 19.74 per cent were found to possess low and high level of knowledge respectively. As for the female farmers, a majority of the respondents (70.51%) have medium level knowledge while 15.38 per cent and 14.10 per cent were found to have low and high level of knowledge respectively. This was in line with the findings of *Kirar and Mehta (2009)* on tribal contact rice farmers.

Table 3: Knowledge level of the male and female farmers

Male farmers (n=76)			Female farmers (n=78)		
Knowledge level	No.	%	Knowledge level	No.	%
Low (< 9.85)	11	14.47	Low (< 8.42)	12	15.38
Medium (9.85 to 14.92)	50	65.79	Medium (8.42 to 13.30)	55	70.51
High (> 14.92)	15	19.74	High (> 13.30)	11	14.10
Mean	12.38		Mean	10.86	
S.D	2.53		S.D	2.44	

The knowledge test for male farmers consists of 22 items pertaining to rice cultivation. The score of each of the items i.e, the number of respondents giving correct answer to the said item is presented in Table 4 along with the percentage of the score to the total possible score and the rank of the item among the 22 items. As per *Siegal (1956)* while ranking, when tied scores occur, each of the tied observations is given the average of the ranks they would have had if no ties had occurred. The score of the 19 items of the female knowledge test are also presented in Table 5 in a similar manner.

It is observed in Table 4 that item No.16 received the highest score with 98.68 per cent of the male farmers

Table 4: Knowledge level of male farmers in improved rice cultivation practices (N=76)

Item No.	Knowledge items	Score	%	Rank
1.	Please mention the correct procedure to be followed while treating the seeds before sowing	23	30.26	17.5
2.	Mention the seed rate per *sa-ngam**	20	26.32	22
3.	At what time should you apply fertilisers in the nursery?	26	34.21	15
4.	Mention the fertilisers used in nursery along with their quantity per *sa-ngam**	40	52.63	12
5.	How many days after top dressing should water be drained in?	66	86.84	4.5
6.	What should be the level of water in the field at normal times?	66	86.84	4.5
7.	At what stages of the crop should adequate water be ensured in the field so that the yield is least affected? Active tillering	55	72.37	8.5
8.	Panicle initiation	68	89.47	2.5
9.	Grain filling	21	27.63	21
10.	After weeds starts growing in the field, if you want to apply weedicide, which one should you use?	25	32.89	16
11.	Do you know what is soil testing?	59	77.63	7
12.	Why should soil testing be done?	46	60.53	10
13.	How much urea is required per *sa-ngam* of rice field?	23	30.26	17.5
14.	Please mention the amount of DAP /SSP required per *sa-ngam**?	22	28.95	19.5
15.	Please mention the stages at which split doses fertilizers is to be applied. Just before transplanting	22	28.95	19.5
16.	Active tillering	75	98.68	1
17.	Panicle initiation	68	89.47	2.5
18.	Name an important disease of rice	55	72.37	8.5
19.	What are the associated symptoms?	41	53.95	11
20.	At what time of the day should spraying of chemical pesticides be done?	27	35.53	14
21.	How many days after harvesting should threshing be done?	33	43.42	13
22.	Name a long duration rice variety	60	78.95	6

(**Sa-ngam is a customary unit of area, which is approximately equal to 0.617 acre or one-fourth of a hectare.*)

Table 5: Knowledge level of female farmers in improved rice cultivation practices (N=78)

Item No.	Knowledge items	Score	%	Rank
1.	How would you separate healthy seeds from unhealthy ones?	39	50.00	12
2.	Please mention the correct procedure to be followed while treating the seeds before sowing.	16	20.51	18.5
3.	When is the best time for sowing *kharif* rice?	66	84.62	5
4.	What is the appropriate transplanting depth?	68	87.18	3
5.	If due to some reasons, the seedling collection is delayed and seedlings start to tiller, what should you do while transplanting to ensure good yield?	40	51.28	10.5
6.	At the time of transplanting the water level in the field should be.....	68	87.18	3
7.	At what stages of the crop should adequate water be ensured in the field so that the yield is least affected? Active tillering	68	87.18	3
8.	Panicle initiation	50	64.10	9
9.	Grain filling	16	20.51	18.5
10.	When should SSP be applied in the soil?	20	25.64	16
11.	Please mention the stages at which split doses fertilizers is to be applied. Just before transplanting	17	21.79	15
12.	Active tillering	75	96.15	1
13.	Panicle initiation	33	42.31	13
14.	Name two important insect pests of rice	29	37.18	14
15.	Name an important disease of rice	57	73.08	8
16.	Name a nutrient enriching plant	23	29.49	15
17.	How many days prior to harvesting should water be drained out from the field?	40	51.28	10.5
18.	Name a medium duration rice variety	62	79.49	6
19.	Name a long duration rice variety	58	74.36	7

able to name active tillering as one of the stages at which split doses of fertilizers are to be applied. 89.47 per cent were able to answer that panicle initiation is a critical stage of irrigation (Item No. 8) as well as split dose application of fertilizer (Item No. 17) in rice crop. However, only 27.63 per cent of the male farmers knew that grain filling (Item No. 9) is a critical stage of irrigation in rice crop. The lowest score was observed in Item No. 2 with only 20 farmers out of total 76 being able to answer the optimum seed rate of rice correctly. It is also interesting to note that only 28.95 per cent of the farmers were aware that a split dose of fertilizers are to be applied to the field just before transplanting (Item No. 15).

The knowledge test result for the female farmers as presented in Table 5 revealed that 96.15 per cent of the total farmers have answered active tillering as one of the stages in which split doses of fertilizers are to be applied (Item No. 12). The second highest score of 87.18% was observed in three items: appropriate transplanting depth (Item No 4); optimum water level at the time of transplanting (Item No. 6) and active tillering as one of the critical stages of water requirement in rice

Table 6: Pearson coefficient of correlation between independent variables and knowledge level of male and female farmers

Variables	Male (N=76)	Female (N=78)
Age	0.520**	0.119
Education	0.424**	0.206*
Socio Economic Status	0.379**	0.266**
Farming Experience	-0.168	-0.199*
Annual income	0.343**	0.061
Economic Motivation	-0.126	0.069
Risk Orientation	-0.098	0.140
Innovation proneness	0.132	0.154
Attitude towards improved agricultural technology	-0.080	-0.007
Participation in training programme	0.555**	0.403**
Social participation	0.010	0.215*
Utilisation of personal cosmopolite sources of information	0.039	0.416**
Utilisation of mass media sources	0.166	0.117

(Item No.7). The female farmers were least knowledgeable about the correct procedure for seed treatment (Item No. 2) and grain filling stage as a stage of critical water requirement (Item No. 9) as indicated by only 20.51 per cent respondents giving correct answer.

Relationship of the knowledge level with personal variables : The association of the knowledge level of the respondents with certain personal characteristics was worked out using *pearson product correlation*. The results are presented in Table 6. It was observed that for male farmers, positive and significant association was observed with their knowledge level in improved cultivation practices and their age, education, socio-economic status, annual income and participation in training programme. As for the female farmers, positive and significant association was observed with education level, socio-economic status and participation in training programme, social participation and utilization of personal cosmopolite sources of information. Interestingly, women having more experience in farming have low knowledge level as indicated by the negative 'r' value. This may be because farm-women having higher farming experience are generally aged and less educated and hence are not aware or interested in improved practices. *Nagarajaiah et. al. (2005)* also reported education and socio-economic status to be important variables affecting knowledge level while *Nagaraja and Mariswamy (2010)* also observed that the variables education, farming experience, annual income, extension contact, and extension participation exhibited significant association with knowledge level.

CONCLUSION

The knowledge tests developed for measuring the level of knowledge in improved rice cultivation practices for male and female farmers were found to be highly stable and reliable as indicated by the highly significant value of reliability co-efficient. The knowledge level of the respondents measured using the developed tests indicated that majority of the male (65.79%) and female farmers (70.51%) have medium level of knowledge. As indicated by the score of the individual items of the tests, it can be inferred that though both male and female farmers were found to possess high level of knowledge in certain aspects of fertilizer and water management, their knowledge level were very low in some other aspects of the same. Treatment of seeds with chemicals before sowing is another area where the level of knowledge is low. Important variables found to be significantly associated with knowledge level of the farmers were education, socio-economic status, and participation in training programmes.

Paper received on : August 20, 2013
Accepted on : October 23, 2013

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