Bangladesh Journal of Extension Education
Volume 19, No. 1&2, 2007:11-18

ISSN 1011-3916
Research Article

A Scale to Measure Farmers' Attitude towards Integrated Plant Nutrient Management

M.A. Muttaleb[1], M.A. Kashem[2] and M.A. Islam[3]

Abstract

The study was designed to construct a standardized scale to measure the attitude of farmers towards integrated plant nutrient management (IPNM) through integration of Thurston's technique of equal appearing interval and Likert's technique of summated ratings scale. Data were collected during July to November, 2003. A total of 26 items of integrated plant nutrient management were selected through extensive review of literature and discussion with extension experts, the items were edited in the light of 14 criteria of Edwards and subjected to judge's ratings by the subject matter specialists on a three point continuum. Considering relevancy analysis, scale value and Q value obtained by judge ratting of subject matter specialists, 21 items were selected. Afterwards, 16 items were selected based on scale and Q value with seven point continuum from further judge rating by extension experts. Finally, twelve items were selected for the scale based on the results of item analysis. Significant reliability coefficients of the finalized attitude scale towards IPNM were 0.983 and 0.944 for split half and test retest method, respectively which indicated high stability of the attitude scale to measure farmers attitude towards IPNM.

Keywords: *Scale, farmer, attitude, IPNM*

Introduction

Decline in soil fertility, downward change in water table, rising of soil salinity and degradation of irrigation water quality are restricting the sustainable production systems (Aggarwal *et al*. 2000; Sidhu and Dhillon, 1997; Sarker, 2000; Sinha *et al.* 1998). The main causes of soil fertility decline are low and imbalanced use of fertilizers, untimely and unscientific use of fertilizers, continuous and intensive cropping (Kanwar, 1997; BARC, 1997). Increasing nutrient imbalanced trend along with decreasing inherent nutrient supply ability to crops of Bangladesh soil has already appeared (BARC, 1997). So, soil fertility conservation is essential for sustainable food production. IPNM can play an important role to maintain sustainable rice production systems and provides nutrients to plants from various available organic and inorganic sources of existing farming systems. Farmers are the decision maker of their crop management. Thus, their attitudes towards

[1] Senior Scientific Officer, Bangladesh Rice Research Institute, Regional Station, [2] Professor, Dept. of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh and [3] Senior Scientific Officer, Bangladesh Institute of Nuclear Agriculture, Mymensingh

improved practices largely determine the nature and extent of acceptance of improved farm technology in modernizing agriculture (Bheemappa *et al.,* 2002). Hence, attitude of farmers forms an essential component for better implementation and success of improved farm practices. There is a scarcity of systematic standardized developed scale of farmers' attitude measurement towards IPNM in general and particularly in Haor areas of Bangladesh. Therefore, it is crucial to develop a scale for sound measurement of farmers attitude towards IPNM. With this view, an attempt was made to construct a standardized scale to measure attitude of the farmers towards IPNM.

Methodology

Adequate statistical analysis is an indispensable step during development, evaluation and revision phases of a model. The assessment of the adequacy of models is only possible through the combination of several statistical analyses and proper investigation regarding the purposes for which the mathematical model was initially conceptualized and developed for (Tedeschi, 2006). Hence, both of Thurstone's technique of equal appearing interval and Likert's technique of summated rating scales were considered to develop scale for measuring attitude of farmers towards IPNM. Scale was developed through collection of items, editing of items, relevancy analysis and calculation of scale values, Q values and item analysis. Data collection and judges rating were accomplished during July to November, 2003. Twenty-six attitude statements on IPNM were collected initially after extensive review of literature and consultation with extension experts. These items were examined and edited as per 14 informal criteria set up by Edwards (1957:13-14). These 26 statements along with three-point continuum against each of the items were sent to 35 selected subject matter specialists (judges) who had the background of soil science and agronomy working in different agricultural research organization of Bangladesh along with proper instructions for their judgement. Among them, responses of 27 judges were as per instructions and were used for calculation of relevancy analysis, scale value and Q value for items selection of attitude scale. Responses of judges were scored 3, 2 and 1 for most suitable, suitable and least suitable respectively. Further judges ratings were done through extension experts with 21 selected items and were sent to 35 selected judges for further refinement along with a 7-point continuum ranging from most suitable to least suitable against each of the items. Among 35 selected extension experts, responses of 21 judges were considered for calculation of scale values and Q- values due to their timely response as per requested instructions. Detailed procedure of relevancy analysis, scale value calculation, Q value calculation and item analyses have been described in the following sections. Relevancy analysis consists of relevancy percentage (RP), relative weightage (RW) and mean relevancy score (MRS) and were calculated by the formula of Bheemappa *et al.,* 2002 and Saravanan *et al.,* 2004.

Relevancy percentage (RP): It refers to the percentage of judges who rated a particular item as most suitable and suitable to the total number of judges and was measured with the following formula (Bheemappa *et al.,* 2002):

Relative weightage (RW): It is the ratio of actual scores obtained to the maximum possible obtainable scores by each item and was computed with the following formula (Bheemappa *et al.,* 2002):

Mean relevancy score (MRS): It is the ratio of actual score obtained by each item to the total number of judges responded for that item (Bheemappa *et al.,* 2002).

Calculation of scale value: Thurstone and Chave used the median of the distribution of judgments of item as average value and this average value can be considered as scale value of statement (Edwards, 1957:85, Selltiz *et al*., 1959:360, Goode and Hatt, 1952:266; Sharma, 1975:71-72, Intodia *et al.*, 1993:148). Scale value was computed with the following formula (Edwards, 1957:87):

$$S = l + \left(\frac{0.5 - \sum p_b}{p_w}\right) \times i$$

Where,

S = the median or scale value of the statement

l = the lower limit of the interval in which the median falls

Σp_b= Sum of the proportions below the interval in which the median falls

p_w = the proportion within the interval in which the median falls

i = the width of the interval and was assumed to be equal to 1.0

Calculation of inter quartile range (Q): The inter quartile range (Q) is an index of dispersion of the statements on the scale (Edwards, 1969). The inter quartile range (Q) indicates the variation of the distribution of judgment. The inter quartile range contained the middle of 50 percent of the judgments. The inter quartile range or Q was measured by calculating the difference between 75th centile (C_{75}) and 25th centile (C_{25}).

Hence, $Q = C_{75}-C_{25}$.

75th centile: It was measured with the following formula (Edwards, 1957:88):

$$C_{75} = l + \left(\frac{0.75 - \sum p_b}{p_w}\right) \times i$$

Where,

C_{75} = 75th centile

l = the lower limit of the interval in which the 75th centile falls

Σpb= Sum of the proportions below the interval in which the 75th centile falls

p_w = the proportion within the interval in which the 75th centile falls

i = the width of the interval and was assumed to be equal to 1.0

25th centile: It was measured with the following formula (Edwards, 1957:88):

$$C_{25} = l + \left(\frac{0.25 - \sum p_b}{p_w}\right) \times i$$

Where,

C_{25}= 25th centile

l = the lower limit of the interval in which the 25th centile falls

Σpb= Sum of the proportions below the interval in which the 25th centile falls

p_w = the proportion within the interval in which the 25th centile falls

i = the width of the interval and was assumed to be equal to 1.0

Item analysis: For including an item (statement) in an attitude scale, item analysis is usually conducted to improve the scale to determine which items should be eliminated from the scale by considering discriminative power of the item (Goode and Hatt, 1952:275). For item analysis the items were piloted among 30 farmers. Farmers were asked to give their reaction to each statement on the five-point continuum i.e. strongly agree, agree, undecided, disagree and strongly disagree. The scoring pattern was 5,

4, 3, 2 and 1 for positive statements and reverse scoring system for negative statements. The score for each individual on the scale was computed by summing the weights of the individual item response. The frequency distribution of scores of farmers based on the responses to all statements was obtained. The respondents were arranged in the ascending order according to their total score. The criterion groups i.e. the 25 percent of the respondents having the highest score and 25 percent of the respondents having the lowest scores were found out and separated for the calculation of t values. The critical ratio
(t value) was calculated by using the following formula as suggested by Edwards (1957:152-153):

$$t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\dfrac{\sum(X_H - \bar{X}_H)^2 + \sum(X_L - \bar{X}_L)^2}{n(n-1)}}}$$

Where,

$$\sum(X_H - \bar{X}_H)^2 = \sum X_H{}^2 - \frac{(\sum X_H)^2}{n}$$

$$\sum(X_L - \bar{X}_L)^2 = \sum X_L{}^2 - \frac{(\sum X_L)^2}{n}$$

Where,

$\Sigma X_H{}^2$ = Sum of squares of individual scores in the high group

$\Sigma X_L{}^2$ = Sum of squares of individual scores in the low group

$\bar{X}_H$ = The mean score on a given statement for the high group

$\bar{X}_L$ = The mean score on a given statement for the low group

n = Number of respondents in each group

Findings and Discussion

Observed range of relevancy percentage, relevancy weightage and mean relevancy scores of the 26 selected statements by subject matter specialists, judge ratings were 65.38 to 96.15, 0.56 to 0.82 and 1.42 to 2.46, respectively (Table 1). In case of scale value for aforementioned items, observed range of was 1.31 to 2.64. On the contrary, observed range of Q values for same items was 0.71 to 1.31. The items having relevancy percentage of more than 75 percent, relevancy weightage of more than 0.75 and mean relevancy scores of more than one with the combination of comparatively larger scale values and lower Q values were considered for preliminary selection of attitude items towards IPNM. Large Q value of statement is an indication of ambiguousness of the statement (Thurstone and Chave, 1929) that indicates disagreement among the judges (Sharma, 1975:71, Goode and Hatt, 1952:266). Such result may be due to the fact that the statement is interpreted more than one way by their subjects. Hence, statements with large Q values and lower scale values were eliminated from the scale. Based on these procedures of subject matter specialists 21 items were selected for further refinement of items (Table 1).

The range of computed scale value and Q value based on judges rating by extension experts were 5.17 to 6.73 and 0.95 to 2.71, respectively and 16 items were selected (Table 1) based on scale and Q values. Item analysis was computed for these 16 selected items through piloted among 30 farmers. The range of t values of the 16 statements was from 0.48 to 6.73. The value of ‘t’ is a measure of the extent to which a given statement discriminate between the high score and low score groups (Feaster, 1968;

Saravanan *et al.*, 2004). Usually, a 't' value equal to or greater than 1.75 indicates that the average response of the high and low groups to a statement differs significantly (Edwards,1969). However, items with 't' values less than 1.72 were excluded from final attitude scale. Based on 't' values, twelve statements were finally selected for attitude scale.

Table 1. Percentage, weightage and mean score of relevancy with 'scale', 'Q' and 't' value of items of attitude obtained from judges

Sl. No.	Statements	Judges ratings by subject matter specialists					Judges ratings by extension experts		t value
		RP	RW	MRS	Scale value	Q value	Scale value	Q value	
+1.	IPNM helps to maintain environmental balance.	96.15	0.78	2.35	2.29	0.98*	6.67	1.18**	1.72***
+2.	IPNM conserves soil fertility	96.15	0.82	2.46	2.50	0.46*	6.73	1.30**	6.14***
+3.	IPNM increases the efficiency of applied chemical fertilizer.	92.31	0.82	2.46	2.57	1.09*	6.21	1.38**	2.43***
-4.	Use of IPNM in crop production is less profitable in relation to cost involvement.	88.46	0.74	2.23	2.20	1.03*	6.23	1.02**	1.87***
-5.	Use of IPNM practice cannot promote the soil fertility adequately.	80.77	0.67	2.00	2.00	0.80*	5.93	1.67**	2.15***
-6.	IPNM is not able enough to maintain soil fertility.	88.46	0.72	2.15	2.11	0.83*	5.50	2.71	-
+7.	Proper health of soil organisms may be maintained through practicing IPNM.	80.77	0.72	2.15	2.17	1.16	-	-	-
+8.	All kinds of household organic waste can be properly used through IPNM approach that ultimately reduces the household environment pollution.	84.62	0.72	2.15	2.15	1.00*	5.67	1.67**	0.48
-9.	Use of IPNM has risk on human and animal heath.	69.23	0.63	1.88	1.88	1.08*	6.59	0.95**	1.78***
+10.	It is possible to improve present crop productivity level by using IPNM practices.	92.31	0.79	2.38	2.41	1.09*	6.32	1.02**	2.28***
-11.	IPNM cannot reduce soil, water and air pollutions.	84.62	0.76	2.27	2.33	1.18	-	-	-
-12.	Management of IPNM practices is complex.	68.46	0.67	1.42	1.31	0.98*	5.50	2.20	-
-13.	In IPNM practices more labours are required than the existing chemical fertilization.'	65.38	0.62	1.85	1.85	1.01*	6.17	2.34	-
+14.	IPNM helps in promoting the inherent nutrient supplying capacity of soils to crops.	92.31	0.76	2.19	2.25	1.01*	6.00	1.69**	1.34
+15.	IPNM practices helps to preserve the biodiversity of soil organisms.	92.31	0.78	2.35	2.34	1.07*	6.28	1.16**	4.47***
+16.	IPNM helps to reduce the deleterious effects of chemical fertilizers in soil.	84.62	0.73	2.19	2.20	1.09*	5.83	1.88**	2.67***
-17.	IPNM can not reduces the nutrient loss of soil .	80.77	0.72	2.15	2.17	1.16	-	-	-
-18.	IPNM may not able to maintain soil organic matter.	80.77	0.72	2.15	2.17	1.16	-	-	-
-19.	IPNM is a costly practice as it includes both mineral fertilizers and organic manures.	88.46	0.71	2.12	2.09	0.71*	5.17	2.25	-

+20.	IPNM plays an important role to prevent soil erosion.	69.23	0.58	1.73	1.79	0.87*	5.50	2.00**	1.09
+21.	By using IPNM practices, declining trend of inherent nutrient supplying'' capacity of soil can be arrested.	88.46	0.76	2.27	2.26	1.08*	5.50	2.00**	2.28***
-22.	Delayed and non-visible responses of some components of IPNM like organic manure may hinder the use of these practices to the users.	66.54	0.56	1.69	1.72	1.03*	5.17	2.00**	0.54
+23	Increasing deficiency trend of secondary and micronutrient of soil may be reduced through following IPNM practices.	84.62	0.69	2.08	2.06	0.75*	5.72	1.38**	2.28***
-24	Insufficient availability of some IPNM components like cowdung, compost, oil cake etc. may the cause of non-use of these practices.	80.77	0.79	2.38	2.64	1.31	-	-	-
-25.	IPNM is not able enough in maintaining nutrient balance in soil.	92.31	0.78	2.35	2.34	1.07*	5.70	1.90**	2.84***
+26.	Some of the components of IPNM like organic manure contain all plant nutrients in relatively small amounts.	76.92	0.69	2.08	2.09	0.82*	5.36	2.03	-

Selected for further refinement; ** Selected for item analysis; * Selected for final scale*

Reliability of the scale: Reliability is one of the most important decisive factor for sound measurement of research instruments and it provides the ability of producing consistent results of a scale (Kothari, 1995). Split half and test retest methods were used for reliability computation. For computation of reliability by split-half method, all the 12 items of attitude scale were divided into two equal halves. These two sets, each having six items, one with odd numbers and the other with even numbers and were administered to 30 farmers. Spearman's rho was used to determine the reliability. The coefficient of correlation (Spearman's rho) was 0.928 and significant at 1% level. Hence, this reliability coefficient indicated the high internal consistency of items of the attitude scale developed for the study. In test-retest method, twelve items of attitude scale was administered to 30 farmers twice at the interval of 30 days. The reliability coefficient (Spearman's rho) of test retest method was 0.941 and significant at 1% level. Therefore, the attitude scale constructed was highly stable and dependable for measurement of attitude towards IPNM of farmers.

Validity of the scale: Initial items of the scales were collected from review of literature and discussion with the relevant experts. Again, these items were subjected to judges rating by subject matter specialists, extension specialists and piloted among 30 farmers. So it was assumed that the scales had content validity.

The 12 selected statements for final format of the attitude scale were randomly arranged to avoid response bias that might contribute to low reliability of the scale. The respondents were asked whether they strongly agreed, agreed, undecided, disagreed, strongly disagreed with the statements. Scores of 5, 4, 3, 2 and 1 were given for strongly agree, agree, undecided, disagree, strongly disagree, respectively for the positive statements and reverse scoring system was followed for the negative statements. Total attitude score of a farmer towards IPNM was equal to the sum of the scores of all the twelve statements of the final format of attitude scale. The final attitude scale towards IPNM (Table 2) is therefore, useful to measure the attitude of the farmers towards IPNM in a scientific manner.

Table 2. Distribution of final items of finalized attitude scale towards IPNM

Sl. No.	Items	SA	A	UD	D	SD
+1.	IPNM helps to maintain environmental balance.					
+2.	IPNM conserves soil fertility.					
+3.	IPNM increases the efficiency of applied chemical fertilizer.					
-4.	Use of IPNM in crop production is less profitable in relation to cost involvement.					
-5.	Use of IPNM practice cannot promote the soil fertility adequately.					
-6.	Use of IPNM has risk on human and animal heath.					
+7.	It is possible to improve present crop productivity level by using IPNM practices.					
+8.	IPNM practices helps to preserve the diversity of soil organisms.					
+9.	IPNM helps to reduce the deleterious effects of chemical fertilizers in soil.					
-10.	By using IPNM practices, declining trend of inherent nutrient supplying capacity of soil cannot be arrested.					
+11.	Increasing deficiency trend of secondary and micro-nutrient of soil may be reduced through following IPNM practices.					
-12.	IPNM is not able enough in maintaining nutrient balance in soil.					

SA= Stronlgy agree, A = Agree, UD = Undecided, D=Disagree, SD = Strongly disagree

Conclusions

Farmers' attitude towards improved practices is one of the determinants of adoption of improved practices. Hence, this developed and standardized scale to measure farmers' attitude towards IPNM can be used by the future researchers in conducting attitude studies and constructing scales on improved farm technologies related to IPNM.

References

Aggarwal, P.K., N. Kalra, S. Kumar, H. Pathak, S.K. Bandyopadhyay, A.K. Vasisht, R.P. Rotter and C.T. Hoanh. 2000. Haryana State Case Study: Trade off between Cereal Production and Environmental Impact. Systhesis of Methodology and Development and Case Studies. *SysNet Research Paper Series No. 3.*

BARC. 1997. *Fertilizer Recommendation Guide*. Bangladesh Agricultural Research Council, Dhaka.

Bheemappa, A., L.V. Hirevenkanagourdar, B. Sundarswamy and D.M. Chandargi. 2002. A Scale to Measure the Attitude of Farmers towards Improved Farm Practices. *Indian Journal of Extension Education*, 38(3&4): 178-185.

Edwards, A.L. 1957. *Techniques of Attitude Scale Construction.* New York: Appleton-Century Crafts, Inc.

Edwards, A.L. 1969. *Techniques of Attitude Scale Construction.* Bombay: Vakils. Feffer and Simsons Private Ltd.

Feaster, J.G. 1968. Measurement and Determinants of Innovativeness among Primitive Agriculturists. *Rural Sociology*, 33(3): 339-348.

Goode, J. and P.K. Hatt. 1952. *Methods in Social Research*. New York: McGraw-Hill Book Company, Inc.

Intodia, S. L, L. L Somsni and J. P. Lakhera (1993) *Dictionary of Extension Education*. Udaipur, India: Agrotech Publishing Academy.

Kanwar, J.S. 1997. Soil and Water Management-The Base of Food Security and Sustainability. *Journal of the Indian Society of Soil Science,* 45(3): 417-428.

Kothari, C.R. 1995. *Research Methodology: Methods and Techniques*. New Delhi: Wishwa Prakashan.

Saravanan, R., V. Veerabhadraiah and N.S. Shivalinge Gowda. 2004. A Scale to Measure Client Satisfaction and Accountability of Extension Personnel. *Indian Journal Extension Education,* 40(1&2): 99-102.

Sarker, A.K. 2000. Integrated Nutrient Management for Better Livelihood of Farmers in Rainfed Areas. *Journal of the Indian Society of Soil Science,* 48(4): 690-696.

Selltiz, C., M. Jahoda, M. Deutsch and S.W. Cook. 1959. *Research Methods in Social Relations*. New York: Halt Rinehart and Winston.

Sharma, M.V.B. 1975. Villagers' Attitude towards Applied Nuttrition Programme. *Indian Journal Extension Education,* 11(1&2): 70-71.

Sidhu, R.S. and M.S. Dhillon. 1997. Land and Water in Punjub: Their Degradation and Technologies for Sustainable Use. *Indian Journal Agricultural Economics,* 52(3): 508-518.

Sinha, S.K., G.D. Sngh and M. Qai. 1998. Decline in Crop Productivity in Haryana and Punjub: Myth or Reality. New Delhi: Indian Council of Agricultural Research.

Tedeschi, L.O. 2006. Assessment of the Adequacy of Mathematical Models. *Agricultural Systems,* 89: 225-247.