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Adoption of Integrated Soil Fertility and Nutrient Management Approach: Farmers' Preferences for Extension Teaching Methods in Bangladesh

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Abstract: The major purpose of the study was to determine the extent of preferences of different categories of farmers for effective extension teaching methods aimed at encouraging adoption of the Integrated Soil Fertility (ISF) and Nutrient Management (NM) approach. Data were collected from 120 farmers from eight villages in four districts in Bangladesh between December 2007 and January 2008. Of these farmers, 39 landless, 34 marginal, 19 small, 20 medium and 8 were large farmers. A four-point rating scale was used to analyze the preferences: strongly resist, mildly resist, mildly prefer and strongly prefer corresponded to scores of 0, 1, 2 and 3, respectively. The majority of the landless, marginal and small farmers preferred individual extension teaching methods; on the other hand, the largest segment of medium and large farmers preferred group and mass extension teaching methods. Inadequate education, poor training and low income were the major reasons for the landless, marginal and small farmers' relatively higher preferences for individual teaching methods. The channel of transfer of crop production technology showed that extension service providers had very little involvement in pre-extension activities. Conversely, farmers and farmers' representatives played very little role in planning, implementing, evaluating and verification of trials undertaken by the extension department. Present different farmers' groups require different types of extension teaching methods in order to adopt the ISF and NM approach.

Key words: Adoption, farmer, integrated soil fertility and nutrient management approach, preference, extension teaching methods, Bangladesh

INTRODUCTION

Today, more than ever, a wide range of information sources pertaining to new and innovative farming practices is available to farmers. Effective and planned communications are paramount at all stages in the production, testing, adaptation and delivery of agricultural services, whether these are physical technologies or management practices (Garforth and Usher, 1997). Extension teaching is the major source of information about alternative practices, from which farmers can choose the most desirable, as well as about the range of different methods that exist for carrying out farming and other operations. Delivering useful information to its consumers is an ongoing process; therefore, it is essential that farmers are able to acquire the necessary knowledge, skills and attitudes that will allow them to utilize information and technology effectively, with the ultimate aim of raising their efficiency and achieving a higher standard of living (Okunade, 2007). In pursuit of this broad aim, extension

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teaching uses a variety of methods in educating rural people. This methodological breadth is motivated by the notion that the more ways a topic is presented and practiced, the more quickly people will tend to grasp the subject matter.

The quality, capability and performance of farmers are fundamental indicators of the agricultural sector's efficiency, productivity, development and sustainability. People involved in the agricultural sector need improved skills, appropriate information and modern ideas in order to develop the sector, meet complex demand patterns, reduce poverty and preserve or even enhance ecological resources (Feder *et al*., 1999). However, changes in soil, plant nutrients and water management practices are needed to achieve increases in land and soil productivity. In order to meet the food demands of an ever-increasing population and save natural resources for future generations of Bangladeshis, a new approach to crop production is needed (Chowdhury, 1996). The Integrated Soil Fertility (ISF) and nutrient management (NM) approach is an advanced one that enhances soil productivity through a balanced use of local and external sources of plant nutrients, in a manner that increases crop yields, maintains or improves soil fertility and maintains environmental pollution at a minimum level (FAO, 1998).

Extension teaching methods need to appeal to the desire of farmers towards expected changes. Garforth (1997) classified extension teaching methods in three broad classes, in terms of their area of coverage, as follows: (i) individual teaching methods, (ii) group teaching methods and (iii) mass teaching methods. Because of the face-to-face relationship between teacher and learners, individual teaching methods are usually superior for instilling conviction and motivating action. Group methods are well suited for conveying specific information about practices, helping to move the individual through the desire for conviction and sometimes inspiring that person to take action. Mass teaching methods, on the other hand, attract attention and stimulate interest in and desire for further action. The choice of extension teaching methods plays a very important role in dissemination of specific technologies and it depends largely on the target participants, the subject matter, the steps involved in teaching, the resources available, the skills and knowledge of the instructors and the teaching situations (Odebode, 2004).

According to Okunade (2007), no agricultural extension agent can bring about significant changes in farmers' behavior without employing the right mode of extension teaching. The most effective extension workers should have a variety of tools and methods at their fingertips, they must also know where, to use them. In today's agricultural industry, survival often depends on having the edge on information related to improved production technologies, the markets, efficient allocation of available resources and use of new innovative farming practices. The value of information as a commodity in today's information age cannot be overemphasized; access to information has contributed immensely to the success or failure of many farming operations (Riesenberg, 1989; Jabbar *et al*., 2003).

Extension agents use a variety of extension teaching methods to deliver their messages to their clientele. According to Rogers (1995), adoption of a new technology depends on several factors, such as its relative advantages, compatibility with existing practices, complexity, trainability and observability. Adoption also depends on the selection of appropriate extension methods by extension service providers. However, limited financial resources may force extension agents to choose among teaching methods and events. In such cases, understanding the target audience, including the methods by which they prefer to receive information, allows agents to select the most effective teaching methods and events accordingly and to transfer information efficiently (Richardson and Mustian, 1994). Sharma (2003) concluded that for quick dissemination of a technology in any region, a proper understanding about the existing flow of technology in that region is very important. However, to date no research has been conducted involving preferences of different categories of farmers for extension teaching methods to adopt Integrated Soil Fertility (ISF) and Nutrient Management (NM) approach for better crop production. The present study was, therefore, formulated with the following objectives: (i) to determine farmers' preferences for effective extension teaching methods that would encourage

adoption of the ISF and NM approach (ii) to describe personal and socio-demographic characteristics of different categories of farmers and (iii) to identify the channel of transfer of crop production technologies.

MATERIALS AND METHODS

Research Location, Population and Sampling

Eight villages, two from each of the 4 districts of Bangladesh (Mymensingh, Jamalpur, Sherpur and Netrokona) were selected for this research. These areas were selected due to the stagnation or reduction of crop yields in recent years and the gradual decline of soil fertility (BBS, 2001). A total of 598 farmers, ages 17-55, were selected from 494 families in the eight villages. About 20% of the total population, i.e. 120 farmers (39 landless, 34 marginal, 19 small, 20 medium and 8 large), were randomly sampled by ensuring that not more than one farmer was selected from the same family.

Measurement of Farmers' Preferences for Extension Teaching Methods

To measure farmers' preference for the different extension teaching methods (individual, group and mass methods), a four-point rating scale was used: the responses 'strongly resist', mildly resist, mildly prefer and strongly prefer corresponded to scores of 0, 1, 2 and 3, respectively. Farmers were asked to indicate their level of preference for each method as well as all events of each method. Their preference for teaching methods was measured by frequency distribution in different categories of farmers, while their preferences for various events of each method were measured by preference index. The following formula was used to calculate the preference index that helped arrange the various events in rank order.

$$\text{Preference Index (PI)} = \text{Psr } X_0 + \text{Pmr } X_1 + \text{Pmp } X_2 + \text{Psp } X_3$$

Where:

Psrp = Percentage of farmers with strongly resist
Pmr = Percentage of farmers with mildly resist
Pmp = Percentage of farmers with mildly prefer
Php = Percentage of farmers with strongly prefer

Thus, the Preference Index (PI) of any event could range from 0 to 300. A value of 0 indicates strongly resist while a value of 300 indicates strongly prefer.

Data Collection and Analysis

Data were collected from the 120 sample farmers; 39 landless (up to 0.2 ha), 34 marginal (0.21-0.6 ha), 19 small (0.61-1.0 ha), 20 medium (1.1 ha-3.0) and 8 large (>3.0 ha) categories, through face-to-face interviews using a structured survey questionnaire, during the period from December 2007 to January 2008. Data were also, collected from the Bangladesh Bureau of Statistics, as well as reports on agriculture and rural development of the areas under study. The collected data was grouped, summarized and presented, mainly in tabular form. Descriptive statistics were employed to analyze the data, using the Statistical Package for Social Sciences (SPSS).

RESULTS AND DISCUSSION

Personal and Socio-Demographic Characteristics of Different Categories of Farmers

An individual's feelings, thoughts, understandings, predisposition, etc. are dependent on various aspects of that person's mental makeup and situation. Thus, adoption of improved technologies concerning integrated farm management practices is dependent on a given farmer's personal, socio-economic, socio-cultural and psychological characteristics (Rogers, 1995).

Table 1: Salient features of personal and socio-demographic characteristics of different categories of farmers

Characteristics and their operationalization	Possible range	Mean value				
		Landless	Marginal	Small	Medium	Large
Age (exact year)	-	37.20	35.75	39.54	38.34	43.16
Education (year of schooling)	-	2.64	3.05	5.75	9.48	11.36
Family size (No.)	-	7.03	6.86	5.73	5.01	4.46
Farming experience (rated score)	0-30	12.40	14.24	16.13	19.51	23.14
Family income (thousand Bd. Taka)	-	30.25	34.54	55.36	98.59	165.32
Communication exposure (rated score)	0-54	23.15	26.38	30.14	40.54	46.91
Innovativeness (rated score)	0-20	8.26	10.12	12.54	16.34	18.10

Note: I US$ = 68 Bd. Taka

Table 2: Preference for individual teaching methods by different categories of farmers

Level of preference	Farmers' categories				
	Landless	Marginal	Small	Medium	Large
Strongly resist	2 (5)	2 (5)	1 (5)	7 (35)	4 (50)
Mildly resist	3 (8)	3 (9)	2 (11)	6 (30)	2 (25)
Mildly prefer	6 (15)	7 (21)	4 (21)	4 (20)	1 (13)
Strongly prefer	28 (72)	22 (65)	12 (63)	3 (15)	1 (13)
Total	39	34	19	20	8

Values in parentheses indicate percentage of total within the category

Table 3: Preference for group teaching methods by different categories of farmers

Level of preference	Farmers' categories				
	Landless	Marginal	Small	Medium	Large
Strongly resist	12 (31)	10 (29)	7 (36)	2 (10)	1 (13)
Mildly resist	10 (25)	13 (38)	6 (32)	4 (20)	1 (13)
Mildly prefer	8 (21)	6 (18)	4 (21)	4 (20)	3 (37)
Strongly prefer	9 (23)	5 (15)	2 (11)	10 (50)	3 (37)
Total	39	34	19	20	8

Values in parentheses indicate percentage of total with in the category

Many researchers in the field of agricultural technology transfer believe that farmers' personal socio-demographic traits play a major role in determining their propensity to adopt and continue using a given innovation. For the sake of brevity, seven characteristics/traits of farmers were considered in this study. A profile of personal and socio-demographic characteristics of different categories of farmers is presented simply in tabular form (Table 1).

Farmers' Preference for Individual Extension Teaching Methods

Table 2 shows that the majority of farmers in the landless, marginal and small categories (72, 65 and 63%, respectively) had a strong preference for individual extension teaching methods. On the other hand, the highest proportions of farmers in the medium and large category (65 and 74%, respectively) had either strongly resist or mildly resist for individual teaching methods.

Landless, marginal and small farmers in general had less access to education, training, resource possession and other physical facilities than did medium and large farmers. Ogunwale (1991) found that farmers' resource possession and education had a negative relationship with their extent of preference of individual teaching method of extension to adopt agricultural technology. Therefore, smaller farmers' preference for individual teaching method to adopt ISF and NM approach was rational.

Farmers' Preference for Group Extension Teaching Methods

Table 3 indicates that more than one-half of the farmers in the landless, marginal and small categories resist either strongly or mildly for group extension teaching methods. More than two-thirds of the medium and larger farmers expressed a strong or a mild preference for group teaching methods.

As most of the events regarding group teaching methods were generally dominated by the medium and large farmers and influential persons of the farming community, the landless, marginal and small farmers had relatively fewer opportunities to express their opinions at events of these teaching methods. Because they are inferior to medium and large farmers in terms of social, economical and cultural considerations, landless, marginal and small farmers are reluctant to consider themselves as active group members in such settings.

Farmers' Preference for Mass Extension Teaching Methods

Table 4 shows that a little more than one-half (51%) of the landless farmers strongly resist for mass extension teaching methods. The highest segment of marginal (47%) and small (42) farmers expressed a preference for mass teaching methods similar to landless farmers, whereas four-fifths of the medium farmers had a mild or strong preference. The overwhelming proportion of large farmers, on the other hand, had a high preference for mass teaching methods.

Because a strong educational and financial background increases the likelihood that a farmer will prefer mass teaching methods, illiterate/semi-illiterate farmers and those with minimal resources will normally want to avoid this method of extension teaching.

Farmers' Preference for Events of Individual Teaching Methods

Table 5 shows that among seven individual teaching method' events, three events (farm and home visit, neighbours and relatives/friends) had a preference index (PI)>200 (possible range: 0-300) among landless, marginal and small farmers. The most preferred events for the medium and large farmers, on the other hand, were mobile call and office call, which received PI>200 in these categories. Since more than three-fourths (77%) of the interviewed farmers belonged to the landless, marginal and small categories, their prime preference for farm and home visits, as component of the individual teaching method, was reasonable.

The farm and home visit approach helps farmers to share both farm-related and familial concerns with the extension agents, in a friendly and familiar environment. Though, this method is time consuming, it improves the likelihood of successful demonstrations; furthermore, it helps to establish a strong bond between the extension workers and rest of the farming community, which in turn provides a base for launching future programmes. However, medium and large farmers prefer to maintain a mobile/cell phone as a marker of their status in society and they feel better discussing their farming matters when they receive a call from the office of extension service providers.

Table 4: Preference for mass teaching methods by different categories of farmers

	Farmers' categories				
Level of preference	Landless	Marginal	Small	Medium	Large
Strongly resist	20 (51)	16 (47)	8 (42)	1 (5)	0 (0)
Mildly resist	12 (32)	10 (29)	6 (32)	3 (15)	0 (0)
Mildly prefer	4 (10)	5 (15)	3 (15)	5 (25)	2(25)
Strongly prefer	3 (7)	3 (9)	2 (11)	11 (55)	6 (75)
Total	39	34	19	20	8

Values in parentheses indicate percentage of total within the category

Table 5: Preference index of different categories of farmers for different events of individual teaching methods

	Preference index (PI)	
Events	Landless, marginal and small farmers	Medium and large farmers
Farm and home visit	274	157
Neighbors	249	172
Relatives/friends	218	183
Ideal farmers	192	169
Mobile call	169	257
Office call	154	205

Farmers' Preference for Events of Group Teaching Methods

Table 6 indicates that among 8 group teaching method events, three events (result demonstration, field day and farmer field school) had a PI>200 among the landless, marginal and small farmers. All of the events (except lectures), on the other hand, had PI>200 among the medium and large farmers. Result demonstrations and farmers' field school are particularly effective when the majority of the client group is resource-poor and illiterate or semi-literate; as such, they have a tendency to avoid risk. As a majority (about three-fourths) of the farmers in the study areas belongs to resource-poor categories, extension service providers may consider these findings when they attempt to motivate farmers to adopt the ISF and NM approach.

These events create a greater impact when farmers see that someone from their own community has benefited from following the recommended package of practices. Such events also create a sustainable teaching method based on seeing is believing and develop confidence about the activities of extension agents. Farmer field school, on the other hand, provides an opportunity for farmers to discuss different aspects of an innovation with others who have vast experience and knowledge of better farming practices. In addition, the opportunity for social interaction and the refreshments organized by the extension service providers were also, attractive points of these events and may have resulted in higher preference by the farmers. As medium and large farmers are relatively more advantaged in terms of innovativeness, education and economic affairs, they also, prefer events that involve more skills and amusements.

Farmers' Preference for Events of Mass Teaching Methods

Table 7 shows that among nine mass teaching method events, only three events (folk song, film and poster) had the highest (PI>200) among by the landless, marginal and small farmers. On the contrary, except for two events (radio and film), the remaining seven events received PI>200 based on the preference of medium and large farmers. Newspaper and television were the top two events. Folk songs are extremely popular, especially among the poorer people and are closely integrated with rural life and culture in Bangladesh. Films, on the other hand, are effective tools for arousing interest among people because they involve seeing, hearing, and action. Posters create awareness and inspire people towards action.

Table 6: Preference index of different categories of farmers for different events of group teaching methods

	Preference Index (PI)	
Events	Landless, marginal and small farmers	Medium and large farmers
Result demonstration	262	202
Field day	238	222
Farmer field school	224	210
Method demonstration	159	254
Tour/visit/excursions	171	246
Lectures	152	184
Group meetings	146	238
Slide show	135	206

Table 7: Preference index of different categories of farmers for different events of mass teaching methods

	Preference Index (PI)	
Events	Landless, marginal and small farmers	Medium and large farmers
Folk song	249	203
Poster	208	214
Moving film show	221	175
Agricultural fair	165	228
Leaflet	153	207
Radio	149	164
Newspaper	140	245
Television	129	232
Bulletin	116	210

Since educational and economic barriers are not involved with folk songs or films and because a passerby with very little education can grasp the message from the poster, the landless, marginal and small farmers prefer these events over other events of mass teaching methods. Preparation of folk songs and films based on different aspects of the ISF and NM approach could be an important tool for increasing farmers' awareness concerning this advanced method of crop production, particularly among the poor. However, the availability of newspapers and television is limited in the rural areas and only a particular section of people (mostly medium and large farmers) can afford these events. Other mass teaching method events also require educational and economic involvement.

Channel of Transfer of Crop Production Technologies and Its Improvement

For effective dissemination of any crop production technology in any region/area, understanding of the channel through which it passes is very important. From Fig. 1, it is clear that any crop production technology developed at research stations is transferred to extension service providers after application and also, after farming systems research undertaken at research stations within the study area. Next, extension agents, both from GOs and NGOs, disseminate the technology among the farmers. If farmers face problems in adopting the technology, they contact extension agents, who provide help in solving their problems by consulting with research stations. However, in this flow of technology transfer, farmers have historically had very little involvement in planning, implementing and evaluating the activities undertaken by the research stations or the extension departments.

According to Arnon (1987), when local people play a role in guiding research and extension efforts, the acceptance and effectiveness of research and extension work at the grassroots level are enhanced considerably. On the other hand, field-level extension service providers are inadequately involved in observing pre-extension activities; consequently, extension agents do not have the chance to express their opinion about new technology based on existing farmers' needs. Considering these deficiencies in the current channel of technology transfer, a new model has been suggested.

In this model, extension service providers would have adequate opportunities to participate in pre-extension activities and farmers would be involved in planning, implementing and evaluating the activities undertaken by the extension service providers. In addition, a farmers' association (consisting of representatives from all categories of farmers) could play an important role in speeding up the

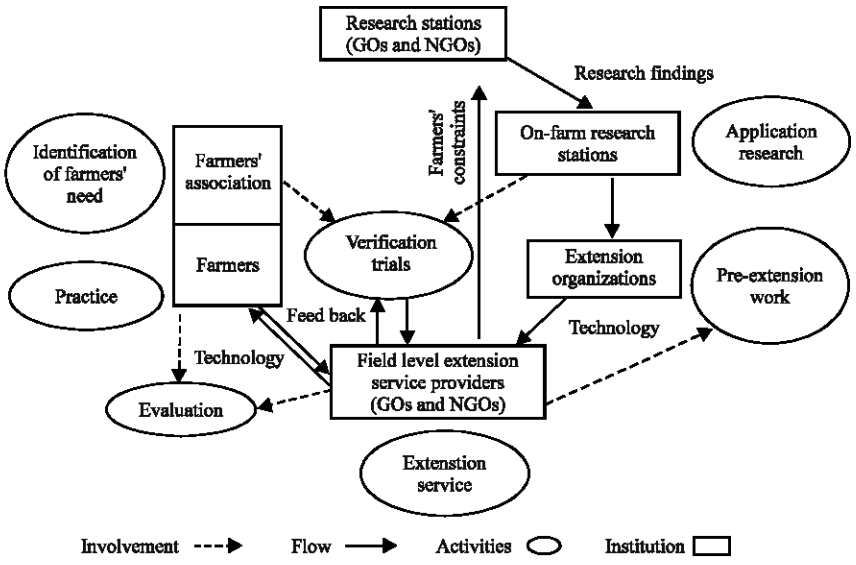

Fig. 1: A suggested model for flow of transfer of crop production technologies

transfer process through active participation in verification trials and direct contact with extension service providers. According to available evidence, some developing countries such as Malaysia, Thailand and Vietnam, as well as many states in India, have encouraged the formation of farmers' associations and delegated to them in whole or in part the responsibility for extension education of their members. Even in Bangladesh, poultry farmers' and mango producers' associations are successfully performing these responsibilities, especially in the areas of marketing, technology dissemination and efficient allocation and distribution of inputs for farming. Among the extension teaching methods, poultry farmers' associations mostly use group and mass methods such as group discussion, visits to more successful farms, video shows, cell phone calls, newspapers and TV. The mango producers' associations, on the other hand, use mass media methods such as newspapers, leaflet, cell phone calls and TV more than group methods (Islam, 2001). Organization of farmers' association in crop sector, therefore, could serve a vital role in identifying the farming community's needs, efficiently collecting and distributing the inputs (especially chemical fertilizers and farmers' loans) and developing a market information linkage that would allow farmers to know the real price of their products. There are some factors that have hindered organizing farmers' associations in the crop sector in Bangladesh prior to now. The major factors include political ideology, religion, caste, land ownership patterns, social stratifications and a lack of proper initiative by the government. Considering the present situation, farmers in the study areas should organize themselves under the umbrella of farmers' associations. Even on a limited scale, such organizations could solve many of their problems, uphold their rights and sustain their livelihood in a better way.

CONCLUSIONS

The old practice of delivering technical messages to different types of farmers using identical extension methodologies should be replaced by client-focused approaches. This study examines the preferences of different categories of farmers for different extension teaching methods that encourage adoption of the ISF and NM approach and the existing channel of transfer of agricultural technologies within the study area. The landless, marginal and small farmers preferred individual teaching methods over group and mass teaching methods. The medium and large farmers, on the other hand, expressed a preference mostly for group and mass teaching methods rather than individual methods. Among the events of different extension teaching methods, farm and home visit, neighbors, relatives/friends, result demonstration, field day, farmer field school, folk song, film and poster were identified as the most preferred events by the landless, marginal and small categories of farmers. The medium and large categories of farmers, on the other hand, preferred mobile call, office call, method demonstration, tour/excursions, group meetings, newspaper and television as the most effective events. Larger farmers had a greater inclination to attend events of group and mass teaching methods than events of individual teaching methods; the situation was essentially reversed among the landless, marginal and small farmers.

It is clear from the above circumstance that different categories of farmers require different types of extension teaching methods, with different events of each type, in order to effectively disseminate even a single innovation. The landless, marginal and small farmers may be taken as a single category, since their preferences are more or less similar and the medium and large farmers may be considered as a second category based on the same consideration. There are, however, some limitations and weak points in the existing channel of transfer of crop production technologies, including inadequate involvement of extension service providers in pre-extension activities, very little involvement of farmers in local program development, limited verification trials and absence of farmers' associations. Hence, strengthening the above institutions may speed up the technology transfer process in the study areas. The agricultural policy planners and rural development organizations may consider these findings when seeking ways to motivate farmers to adopt the ISF and NM approach and thereby preserve soil fertility and increase crop yields in Bangladesh in a sustainable manner.

REFERENCES

Arnon, I., 1987. Modernization of Agriculture in Developing Countries: Resources, Potentials and Problems. 2nd Edn., Wiley- Interscience Publication, Wiley, ISBN: 0471915866.

Bangladesh Bureau of Statistics (BBS), 2001. Statistical year book of Bangladesh. Govt. of the People's Republic of Bangladesh. March 1993, pp: 204

Chowdhury, S.M.U., 1996. Technology assessment and transfer for sustainable agriculture and rural development in the Asia pacific region. Food and Agriculture Organizations (FAO) of United Nations. http://www.fao.org/sd/rtdirect/RTre0019.htm.

FAO, 1998. Guide to Efficient Plant Nutrition Management. Land and Water Development Division. 1st Edn., Food and Agriculture Organizations of Untied Nations, Rome, Italy.

Feder, G., A. Willet and W. Zijp, 1999. Agricultural extension-genetic challenges and some indicators for solutions. http://www.worldbank.org/html/dec/publications.

Garforth, C., 1993. Extension Technique for Pest Management. In: Decision Tools for Pest Management, G.A. and Munllard, J.D. (Eds.). A.B. International Walling land, UK., pp: 247-264.

Garforth, C. and R. Usher, 1997. Promotion and uptake pathways for research output: A review of analytical frameworks and communication channels. Agric. Syst., 55: 301-322.

Islam, M., 2001. Farmers' Association in Bangladesh: A Body to Uphold Farmers' Right. 1st Edn., Daily Independent, Dhaka, Bangladesh.

Jabbar, M.A., M.A.M. Saleem, S. Gebresalaissie and H. Beyene, 2003. Role of knowledge in the adoption of new agricultural technologies: An approach and an application. Int. J. Agric. Res. Gov. Econ., 2: 312-327.

Odebode, S.O., 2004. Effective Communication Teaching Methods in Technology Transfer in Nigeria: Sweet Potato Processors Experience. 1st Edn., Department of Agricultural Extension and Rural Development, Nigeria.

Ogunwale, A.B., 1991. Extension Communication Patterns in Oyo North Agricultural Development Project. Unpublished M. Phil Thesis Obafemi Awolowo University, http://www.insinet.net/jasr/2007/282-286.pdf.

Okunade, E.O., 2007. Effectiveness of extension teaching methods in acquiring knowledge, skill and attitude by women farmers in osun state. J. Applied Sci. Res., 3: 282-286.

Richardson, J.G. and R.D. Mustian, 1994. Delivery methods preferred by the target clientele for receiving specific information. J. Applied Commun., 8: 22-31.

Riesenberg, L.E., 1989. Farmers' preferences for methods of receiving information on new for innovative farming practices. J. Agric. Edu., 30: 7-13.

Rogers, E.M., 1995. Diffusion of Innovation. 4th Edn., The Free Press, New York, ISBN: 0029266718.

Sharma, V.P., 2003. Cyber extension: Connecting farmers in India-Some Experiences. http://www.gisdevelopment.net/pdf/i4d003.pdf.