Global Scientific JOURNALS

GSJ: Volume 9, Issue 8, August 2021, Online: ISSN 2320-9186
www.globalscientificjournal.com

DETERMINANTS THE EFFECTIVENESS OF THE TRAINING ON SWEET POTATO CULTIVATION

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KeyWords
Training, Cultivation, Sweet Potato, Effectiveness, Nutrient value and **Consumption**

Abstract

The Purpose of study aimed at demining the effectiveness of training on sweet potato cultivation for the Char farmers. The study was accompanied in two randomly selected villages under Kurigram Sadar Upazila. Three hundred farmers were selected from population of 1200. Data were collected by using a structured interview schedule in a face to face manner during 1st February to 3o June, 2017. The determinant of effectiveness of training was measured following Donald Kirkpatric's model having 4 levels such as response, learning, behavior and results. The mean values of effectiveness of were 42.76, 40.65, 40.28 and 42.87 in respect to reaction, learning, behavior and result respectively. This means the mean values of reaction and results about effectiveness of training was more or less similar while the mean values of learning and behavior change regarding effectiveness of training were similar. But the difference between all the four values of evaluation criteria was minimal. A majority (57.30 percent) of the farmers have opined the training as moderately effective while 19.20 percent as highly effective and 23.40 percent opined as low effectiveness of training in cultivation of OFSP in the selected arena.

Introduction:
Bangladesh had achieved self-sufficiency in food production more than once but could not meet nutrition deficiency. There are some reasons may be happening might be as follows: (a) imbalance production level with the growing population, (b) decreasing agricultural land, (c) lack of appropriate technologies, (d) existing problem in technology transfer, (e) lower adoption rate of technology, (f) prevalence of wider yield gap between research and farmers field, (g) stagnation or declination of sweet potato area and (h) may be failure to maintain quality cuttings of sweet potato vines in favorable environment of the sweet potato cultivation.

In Bangladesh the farmers are the back bone of the nation are mostly illiterate. That's why they have been suffering from many problems in agriculture for last couple of years. The population of this country has been increasing day by day. On the other hand the agricultural land decreasing at a faster rate than earlier. As a result food requirements are more demandable according to population. Now we need to produce more food in limited land through new adoption of technology and new high yielding varieties. Such type of high technology and variety can be introduced through effective training to the farmers. The char areas at Kurigram district of Bangladesh are often perceived as zone of multiple vulnerabilities. But these have much potentials and opportunities. Moreover, the areas contain several important and critical ecosystems. By harnessing and exploiting these opportunities can make a substantial contribution to achieve the national goals of accelerated poverty reduction and economic growth. The need for an area specific program in char area of Bangladesh was recognized in number of earlier initiatives and the policies and programs of different government agencies. The life of the people of those areas is much more harsh and full of uncertainties totally different from that of main land. Basically, the poor people of bottom stratum of the society were having no capital and little access to resources. Interventions both form of

physical and livelihood supporting by the Government and other organizations are very meager than what is required at the minimum level. Normally it requires significant amount of time to stabilize newly accreted land having significant geographical and geomorphological characteristics (Haque, 1989). The extreme poor people of char areas are suffer from perennial scarcity of food. Unemployment and severe deprivation of food, is generally high in those areas. The situation of health, hygiene, women empowerment, coping mechanism, access to market, violence against women, youth development and nutrition is one of the main challenges in this area especially pregnant, lactating mother and adolescent girls. People of this locality have not sufficient knowledge about health and nutrition. Healthcare services are very limited due to remoteness. Water and Sanitation system is very fragile particularly in the poor and extreme poor households. The member of these households suffers from various types of diseases which hamper their family income and increases expenses.

General Background of Sweet Potato Cultivation

The root crops of Sweet potato (*Ipomoea batatas Poir*) is one of the important in many parts of Asia, Africa and Latin America. Because of its versatility and adaptability, sweet potato ranks as the world's seventh most important food crop after wheat, rice, maize, potato, barley, and cassava (Zuraida, 2003). The crop is highly nutritious and provides generous quantities of vitamin A, vitamin C, Beta carotene and Iron. It is also suitable to be grown in the tropical areas where the large portion of the world's poor people lives. Besides ensuring the food security of the human being, sweet potato is also used as animal feed in many countries. Sweet potato requires few inputs and can be planted in erosion prone areas to protect farmland as it spreads to cover the soil (Kassali, 2011). Sweet potato is also called disaster combating crop as it grows very faster without much cultural management even in the disaster affected areas. In developing countries, sweet potato ranks as the fifth most important food crop on a fresh-weight basis after rice, wheat maize and cassava. It is also considered as a food crop that can be used to alleviate the food shortage and overcome the hunger (Anonymous, 2009). In Bangladesh sweet potato is the 4th most important source of carbohydrate after rice, wheat and potato. Sweet potato plays a significant role in increasing food security and income for the poor farmers of Bangladesh. Sweet potato is mainly grown in the marginal land of Bangladesh during the period of October to February. It is consumed in different forms mainly boiled, fries and roasted. Sometimes it is also eaten as vegetable in curry used in the both rural and urban arena of the globe.

The leaves and tender shoots of sweet potato are also treated as vegetables. The leaf contains on dry mater basis about 8% starch, 4% sugar, 27% protein and vitamins and therefore they are very nutritious (Ohajianya *et al.* 2014). The Sweet potato is extensively grown in all the districts of Bangladesh particularly by the side of rivers and in the char land. In 2009-10, about 0.31 million metric tons of sweet potatoes were produced from 31.1 thousand ha of land in Bangladesh (BBS, 2010). According to the FAO Bangladesh ranks 23 in the world in terms of sweet potato production in 2011 (FAO, 2012). The Profitability of a crop depends on yield, price of the product, and cost of inputs as well. Any variation in any of the above factors obviously will change the profitability. It is changed over time, place and management level (Begum *et al.*, 2011). Mostly, farmers cultivate traditional varieties of sweet potato in Bangladesh which are good in taste but gives very low yield. Sweet potato gets very less importance in terms of input use and management practices by the farmers. Traditionally farmer uses very fewer inputs specially irrigation, fertilizers and pesticides to cultivate sweet potato. Bangladesh Agricultural Research Institute (BARI) has developed 9 High Yielding Varieties (HYV) of sweet potato having potential yield of 35 tons per hectare. But the average national yield of sweet potato is around 18-20 tons per hectare only. It has become an important issue to determine the cost-effectiveness and resource utilization efficiency of sweet potato. This study may help the policy maker of the country to take necessary action regarding the expansion and resource utilization of sweet potato cultivation. Our farmers are more likely to acquire up to date knowledge, efficiency and good agriculture practice through effective training. Only effective training could change farmer's behavior, philosophy and also motivated towards modern agricultural technology with new high yielding crop varieties.

Nutrient content of roots and leaves in Orange flashed sweet potato

The Orange Flashed Sweet Potato (OFSP) roots are rich source of pro-vitamin A and can meet easily the intake needs of young children in their commonly served form, boiled or steamed, as noted above. True retention (TR) of beta-carotene varies from 70-92%, depending on cooking time (longer cooking periods lowering TR) and whether the pot was covered with a lid (covering increases TR) (Jaarsveld *et al.* 2005). Dominant varieties of maize and cassava, in comparison, have no vitamin 'A' (Table 1.1), although biofortification efforts are underway to improve beta-carotene contents in these crops. Although sweet potato leaves contain ample amounts of beta-carotene, the amount of vitamin A available per 100 grams is estimated to be much lower (51 ug/100 gm) due to its presumed lower bioavailability, as no efficacy study has been done using sweet potato leaves. Sweet potato roots also are a good source of vitamin C and have moderate amounts of several B vitamins and vitamin E (Table 1.1). Protein levels in sweet potato and cassava leaves are higher than in their respective roots, but the amount of leaves consumed by humans limits their total contribution. Sweet potato leaves are widely consumed in several Sub Sahara African (SSA) countries, yet varietal specific information on nutri-

tional benefit is limited in SSA compared to Asia, as is data on the average amount consumed and the seasonality of consumption. The promotion of their consumption exists in a few initiatives, mostly through home or school gardens. Part of the difficulty in comparing sweet potato leaves from different varieties for human consumption is that young leaves are typically harvested piecemeal during the growing season. Hence, by the time roots are evaluated at the end of the growing season, the leaves from some varieties lack the desired palatability as fiber has accumulated. Hence, incorporation of regular assessment of organoleptic qualities of sweet potato leaves has logistic and cost implications. Specific varieties for use as a vegetable only do exist, but these are only being evaluated on a small scale in Kenya, Tanzania and Bangladesh.

Parallel to the state the nutrients found in vitamin A, flesh foods are rich sources of bio-available hemi iron and zinc, whereas many plant sources contain high levels of phytate and in some, polyphenols, which inhibit the absorption of iron and zinc even when they are present in relatively large amounts? Levels of phytates are particularly high in unrefined cereals, nuts, and legumes. Phytate levels are higher in sweet potato leaves than roots. One study from the Philippines found that only 5% of the iron from sweet potato leaves was absorbed (Ortaliza *et al.*, 1974). The negative effect of phytates on zinc uptake can be mitigated by increasing amount of dietary proteins consumed (WHO, 2002). Moreover, sweet potato has considerable amounts of vitamin C, which enhances non-heme iron absorption (Nestel and Nalubola, 2003). However, the effect of phytate comes from the amount in the entire meal. Hence, if sweet potato is consumed along with maize, for instance, the inhibitory effect on absorption would still be there. As sweet potato is consumed in some areas as a stand-alone breakfast food, in these instances phytate inhibition would be minimal.In addition, many studies have demonstrated a positive effect that vitamin A supplements or vitamin A fortified foods have had on hemoglobin concentrations in children and pregnant and lactating women (Semba and Bloem, 2002). Evidence of interactive effects between vitamin A and zinc is much less clear (Hess *et al.*, 2005). Since OFSP is naturally bio-fortified with pro-vitamin A, one might expect that the effects on iron status through increased OFSP consumption might be positive.

Table: 1.Nutrient composition of orange-flashed sweet potato

Nutrient	Units/100 gm	Orange-Flashed Sweet Potato	
		Fresh Roots	Leaves
Food Energy	Kilocalorie	86	63
Carbohydrate	Gm	19-23	9.7
Protein	Gm	1.5-2.0	4.2
Fat	Gm	0.05	.008
Fiber	Gm	3.0	2.4
Sugar	Gm	3-6	-
Calcium	Mg	38	360
Phosphorus	Mg	49	60
Iron	Mg	0.80	10
Zinc	Mg	0.30	-
Magnesium	Mg	27	-
Potassium	Mg	475	-
Sodium	Mg	55	-
Manganese	Mg	0.50	-
Vitamin "A"	Mg	5-9	0.50-.070
Thiamin (B1)	Mg	0.08	0.07
Riboflavin (B2)	Mg	0.06	0.24
Niacin (B3)	Mg	0.70	1.70
Vitamin (B6)	Mg	0.40	1.1
Vitamin "C"	Mg	19	27
Vitamin "E"	Mg	0.26	-
Vitamin "K"	Ug	1.80	-

Source: Q & N Lab-CIP, USDA SR-21 and TCRC, BARI, Gazipur

As per breeding, there is a positive correlation in the sweet potato germplasm between beta-carotene, iron, and zinc. If included as a selection criterion in breeding programs, average levels of iron and zinc in OFSP could be expected to double within the next five years. The range of iron and zinc values found to date in OFSP germplasm is provided in Table 1.1.7. Iron and zinc deficiency are the other two widespread micronutrient deficiencies in the world, with their deficiencies associated with increased susceptibility to infection, impaired growth, anorexia, and impaired cognitive function. Iron deficient anemia is estimated to affect over 1 billion people worldwide (Hess *et al.*, 2005). Clearly, if the three micronutrients could be enhanced simultaneously that would be highly necessary.

Significance of Training on Sweet Potato Cultivation

Training is an educational process that is based on the assumptions of adult learning, deciding on what they want to learn and the best way to learn. It encourages participants to see themselves as a source of information and knowledge about the real world. It re-

fuses to accept that people do not know anything, recognizes the value of popular knowledge and encourages people to participate in their own learning process. When they are encouraged to work with the knowledge they have from experience, they can develop strategies together to change their immediate situation. The participants control the process of learning and the trainers play the role of facilitators. According to Merriam Webster dictionary effectiveness refers to the capacity to persuade or the power to produce a desired result (Business Dictionary, 2010). Effectiveness of training refers to the capacity to persuade the farmers or the power to produce a desired result by disseminating his/her information. In this research the effectiveness of training found out from sustainable agricultural development perspective.

Materials and Methods

The research was conducted at Mogalbachha union in Sadar upazila of Kurigram district. The locale of the study was selected on the basis of pocket char land of high intensity practices on indigenous sweet potato cultivation. Kurigram is a border district in the northern region of Banghladesh. The district has an area of 2245.04 sq km. Kuch Bihar district of India is in the east, Gaibandha district on the south, Dhubri in Assam state of India and Tura Hill district of Meghalaya state, Lalmonirhat and Rangpur districts on the west. The international boundary is 278.28 kilometers. (http://www.kurigram.gov.bd). **Kurigram** is located as the Global Positioning System (GPS) coordinates the latitude 25° 48' 37.2492'' N and the longitude 89° 38' 55.3092'' E right near the Brahmaputra River in the northern part of the country. The population of this district is about 2 million people, and it is a large multi-cultural community speaking Bengali language and its dialects. Local cuisine is based on rice and spicy foods like the ones involving curry, and there are plenty of small restaurants and small cafes in the city, which offer great examples of local cuisine. **The** elevation is 32 meters height that are equal to 105 feet. (https://www.latlong.net/place/kurigram-bangladesh-126). The upazila is bounded on the north by Nageswari and Phulbari upazilas on the east by India, on the south by Ulipur upazila and on the west by Rajarhat upazila and Lalmonirhat Sadar upazila.

Kurigram district is the worst victim of climate change effect. Due to geo-physical setting, this district is severely affected to climate change effect as 16 (sixteen) rivers including 3 (three) mighty rivers like Bramhaputra, Dharla and Tista are passing through the District. Due to high temperature, melting of ice in Himalayans cause recurrent flood, carry sediments, form river islands and caused river erosion that severely affect people's lives and livelihoods. It damages assets like houses, livestock's, crops and croplands, vegetables, safe water sources, sanitation, Education and Agriculture system etc. Huge displacements of people are happened every year and are living in river islands, embankments in an inhuman situation.

Research Design as the Study

It is the blueprint of the detailed procedure of testing the hypothesis and analyses of obtained data. The procedural network of analytical steps through which scientific information is processed is called the research design. It accounts for the way data were obtained, what was done to them in the course of an analysis, and provides others with instructions as to what to do in order to replicate the results (Abedin, 1996).

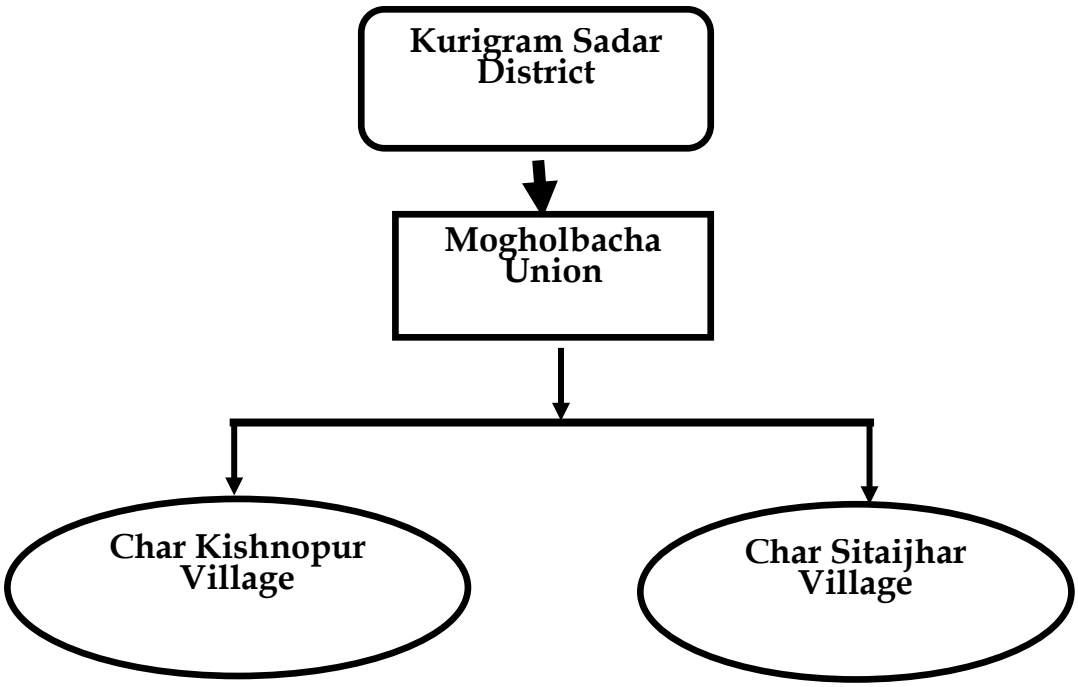

Fig. 1 Flow chart diagram of study area selection

According to Ray and Mondal (1999) there are three types of widely used research design like (i) exploratory or formulative (ii) descriptive and diagnostic and (iii) hypothesis-testing or experimental research design. The descriptive and diagnostic research design was used in the present study. Descriptive research design helps in stating characteristics of a particular situation, group or individuals and used for fact finding with appropriate interpretation. Diagnostic or analytical research design helps in testing of hypothesis and specifying and interpreting relationship of variables. Data relevant to the above mentioned facts were collected, following a quantitative method i.e. face to face interview administered through an interview schedule and then subjected to statistical analysis.

In terms of research design, the research was descriptive in nature. Mainly the research was to fulfill the goal of describing and exploring the effectiveness of training program on sweet potato cultivation for char Landers at Kurigram. Besides, researcher made an effort to test the relationship between a dependent variable and some selected independent variables. Effectiveness of training program on sweet potato cultivation for char Lander at Kurigram treated as the dependant variable. On the other hand, review of related literature, personal observation of the researcher and discussion with the resource person made the way to select a number of independent variables. However, due to time and resource constraints researcher selected 18 independent variables among them. The research was conducted with both quantitative and qualitative approach.

Procedure of Data Analysis

The procedure of data analysis is the most elementary part of the phenomenon to be studied. It influences the research design, data collection and data analysis decisions. Orange Flashed Sweet Potato (OFSP) growers of the selected union were the unit of analysis of the present study.

Primary data

The primary data was collected from the two selected villages of research area with the help of a specifically designed and pre-tested questionnaire. Focus group discussion and case study method was followed for collecting qualitative data and the triangulation or cross check of the primary data.

Secondary data sources

Secondary data was collected from the government offices such as Department of Agricultural Extension (DAE), Bangladesh Agricultural Development Corporation (BADC), Bangladesh Agricultural University (BAU), Bangladesh Rice Research Institute (BRRI), Bangladesh Agricultural Research Institute (BARI), Bangladesh Agricultural Research Council (BARC), Bangladesh Institute of Nuclear Agriculture (BINA) etc, and non-government and international organizations such as SAARC Agricultural Information Center (SAIC), Country office of International Rice Research Institute (IRRI) etc. Besides books, articles, reports, related research paper, various publications, census, online documents, publications of different research organizations was used as the secondary data source in this research.

Sample Collection Techniques

The technique of data collection mainly depends on the objectives of the study and the characteristics of the target respondents (availability of adequate information for selection of samples as well as for data collection).Kothari (2003) suggested that the researcher would have to decide which sort of data he would be using (thus collecting) for his study and accordingly he will have to select one or the other method of data collection. The research was mainly based on primary data. For the purpose of successful collection of primary data, a number of data collection techniques have been used in this research. Some secondary data was also used in this research. The technique of collecting and using primary and secondary data are discussed bellows.

Personal interview method

This method is widely used for collection of data from primary sources. There are some advantages and disadvantages of this method. Personal interview method helps to collect timely and reliable data. This method also helps to reduce non-sampling errors and non-response/ refusal rate of data collection. Data collection through personal interview is relatively expensive than the other two methods of data collection. Personal interview method requires some basic survey instruments like questionnaires or survey forms, area maps, credential letter etc. as aides/ tools for data collection.

Questionnaire survey

Collecting data from a large number of respondents questionnaire survey is very fruitful. However, before using this method, it is always advisable to conduct 'pilot study' (Pilot Survey) for testing the questionnaires (Kothari, 2003). To prepare a final questionnaire a draft questionnaire was pre-tested among 25 farm family head. The pretest was helpful to identify the limitations of questions and statements thus helped the necessary correction, addition, modification and adjustment of the questionnaire. Finally in the collection of primary data from the study area this pre-tested questionnaire was used. The questionnaire was designed with both open-ended and close ended questions. Data were collected through face to face interview by using questionnaire. Whenever respondents faced any difficulty in understanding any question, the researcher carefully explained it to enable him to answer properly. An English version of the questionnaire is presented in *Appendix I*.

Observation of the sample collection

Statement is a good technique to make a valid and reliable research. The observation method is the most commonly used method especially in studies relating to behavioural sciences (Kothary, 2003). Here researcher carefully observed the non-verbal behavior and their daily practical works of the respondents. It helped researcher to triangulate the information collected by other techniques.

Variables of the Study

Correlation analysis studies the joint variation of two or more variables for determining the amount of correlation between two or

more variables (Kothari, 2003). Two sets of variables determined by extensive study of related literature and previous research. In this research, researcher also set a dependent variable and some independent variables to test the relationship between them.

Sample Design

The selection of sample or the sampling design is one of the important branches of the statistical theory. When we talk about sampling design then the question of sample selection will arise for the obvious reasons. The following basic concepts and issues are very much related with the sample selection:

- Sample survey
- Sample
- Sampling frame
- Determination of sample size

Sampling

The portion of population was selected as sample which for analysis or investigate at study area. There are two kinds of samples, namely (i) Non-probability sample, and (ii) Probability sample.

(i) A non-probability sample is one in which the items or individuals included are chosen without regard to their probability of occurrence.

(ii) A probability sample was one in which the subjects of the sample are chosen on the basis of known probabilities. In other words, every element in the population has a non zero probability of being selected.

Sampling frame

An appropriate data sources such as population list, directory, maps and other sources which are called frames, samples are drawn or selected from these frames. Frames are mainly of two types 1) List frame and 2) Area frame. Sampling unit is the unit used in a sampling process. It is not necessarily the same as the observation unit which is called Ultimate Sampling Unit (USU) on which the investigation is made through an interview or an observation.

Sampling from Population

Orange Flashed Sweet Potato growers of Char-Lander under Mogalbachha union were the population of the study.

Two villages, Char Sitaijhar and Char Kisnopur were selected randomly from Mogalbachha union. Total number of population in Char Sitaijhar and Char Kisnopur were 1200. Out of this population a number of 292 respondents were selected as sample followed the website https://www.calculator.net/sample-size-calculator.html. Finally the researcher was taking more eight samples to make 25% of total number of population. In total of the sample size at both villages were 300 out of total number of population (Table 2).

Table 2 Distribution of the sample respondents in two villages of the Mogalbachha union

Union	Village	Population	Sample
Mogalbachha	Char Sitaijhar	1200	300
	Char Kisnopur		
Total		**1200**	**300**

Collection of sample for the research

Systematic field work is an empanel aspect of socio-economic survey research. In this context, in depth survey and necessary efforts were given to make the field work successful and realistic, data were collected by the researcher himself from 1st February to 31st June, 2017. The researcher took at most care to establish rapport with the respondents, so that they did not feel hesitant or hostile to furnish proper responses to the questions of the interview schedule. The questions were explained and clarified whenever any respondent feel difficulty in understanding them properly.

Measurement of Effectiveness of Training Program on Orange Flashed Sweet Potato (OFSP) Cultivation at Study Area

There were two variables like independent (14) and dependent (4) which were measured by 4 Kirkpatrick's taxonomies. The training was provided International Potato Center (CIP) to improve farmer's livelihood at the study area.

Development the Scale of Effectiveness

To measure the effectiveness of training program on sweet potato cultivation for char Landers at Kurigram, a scale was developed based on Likert's (1932) technique. The collected statements were edited as per the suggestion given by Thrustone and Chave (1929), Edward and Kilpatrick (1948). Fourteen criteria suggested by Edward's (1957) were used to edit the statements. These statements were framed in such a way that they expressed the cognition, emotion, attitude and behavior towards effectiveness of training program on sweet potato cultivation for char Landers at Kurigram. A 5 point Likert- type modified scale was used in measuring the perception about effectiveness of training of the farmers. The scales were strongly agree, agree, undecided, disagree and strongly disagree. Appropriate wrights such as 5, 4, 3, 2 and 1 respectively were assigned to each of the scales. Adding all the weights were together to obtain the overall score of effectiveness of training. The score of each individual item on the scale was calculated by summing up the weights of the individual items. In order to find out the discriminating index for each item 't' value was calculated using the formula and procedure given by Edwards (1957). Thus, the scale was developed finally consisted of 48 statements whose 't' values were found to be significant at five percent level of probability.

Selection of Statements Related to effectiveness

According to the objectives of the study some related statements were collected from the respondents. At first to measure the effectiveness, 48 statements were selected according to the review of literature, discussion with researchers, teachers and other specialists. The statements were set in such an oversight, so that it may depict the psychological condition of the respondents. As the level of effectiveness were judged as per the four levels, so the 12 statements were set under each level. To identify the four different levels, effectiveness of training program on sweet potato cultivation for char Lander at Kurigram.

Independent Variables of the Study

The Independent variables 14 characteristics such as were age, education, farming experience, agricultural knowledge, training exposure, farm size, annual family income, agricultural credit received, commercialization, communication exposure, innovativeness, risk orientation, attitude towards modern agricultural technology and economic motivation of the farmers were selected. These characteristics are considered as independent variables of the study.

Statistical analysis

Collected data were coded, complied, and tabulated for processing and analysis in accordance with the objectives of the study. The Microsoft Excel and SPSS software computer program were used to perform the data analysis. For clarity of understanding, tables and graphs were used for presentation of results. MS Excel statistical software was also used for graphical presentation of data. Various statistical measures such as range, mean, percentage, standard deviation were used in categorizing and describing the selected personal characteristics of the respondents. To find out the differences of fields performance t-test was used. Coefficients of correlations (r) were computed to explore the relationships between selected characteristics of the respondents, correlation and regression among dependent and independent variables were done SPSS software. Throughout the study five percent (0.05) level of probability was used to accept or reject the null hypothesis.

RESULTS AND DISCUSSION

Effectiveness of training on sweet potato cultivation

Effectiveness of training refers to the extent to which the training objectives or training goals are achieved through different training activities. Effectiveness of training of farmers had been measured each four level as well as integrated of each farmer. There were 12 statements contained each level, a total of 48 statements. Each level score range 12 to 60 overall score range from 48 to 240.

Effectiveness of training on reaction level

The sub score of the respondent's on reaction level ranged from 1 to 5 against the possible ranges of 12 to 60. In reaction level the mean value was 42.76 and standard deviation 6.896. Based on the reaction of farmers feedbacks they were classified into three categories namely "low", "medium" and "high" reaction. The distribution of the farmers according to their reaction level in training ses-

sion towards effectiveness has been presented in (Table 4).

Table 4 Distribution of the farmers according to reaction level in their effectiveness of training

Categories	Farmers		Mean	Standard deviation
	Number	Percent		
Low (up to 33)	47	15.7	42.76	6.896
Medium (34 – 47)	190	63.3		
High (48 and above)	63	21.0		
Total	300	100.0		

The information presented in Table 4 depicted that the highest proportion (63.30 percent) of the farmers showed medium reaction in different training activities and 21.0 percent farmers showed high reactions on various training activities. A few (15.70 percent) of the farmers showed low reactions regarding different training activities. This means the farmers were active training participants, the reaction of participants was encouraging towards perceiving training as effective in cultivating orange flashed sweet potato. The farmers were more eager in gathering knowledge on various outputs of training activities.

Effectiveness of training on learning level

The learning level score in relation to effectiveness ranged from 1 to 5 against the possible range of similar score. The mean value and standard deviation were 40.65 and 7.097 respectively. The farmers were classified into 3 categories such as "low" learning, "medium" learning and "high" learning presented (Table 5).

Table 5 Distribution of the farmers according to learning level of their effectiveness of training

Categories	Farmers		Mean	Standard deviation
	Number	Percent		
Low (up to 33)	51	17.00	40.65	7.097
Medium (34 – 47)	189	63.00		
High (48 and above)	60	20.00		
Total	300	100.0		

The information of Table 5 show that the majority (63 percent) of the farmers had medium learning level compared to 17 percent having low learning, and only 20 percent had high level of learning in respect to effectiveness of training on OFSP cultivation. Thus, the majority (80 percent) of the farmers obtained medium to high learning level. Learning is helpful to increase knowledge, improve skills and change attitudes of an individual. It built confidence of the farmers for making appropriate decisions at the time of need.

Effectiveness of training on behavioral level

The behavior level scores of the farmers ranged from 1 to 5 against the possible range of 12 to 60 with the mean and standard deviation being 40.28 and 7.56, respectively. Based on their behavior scores, the farmers were grouped into three categories as "low" (, "medium" and "high". The distribution of the farmers in regards to their behavior level, of effectiveness of training is shown in the following (Table6).

Table 6 Distribution of the farmers according to behavioral level of their effectiveness of training

Categories	Farmers		Mean	Standard deviation
	Number	Percent		
Low (up to 33)	59	19.67	40.28	7.555
Medium (34-47)	184	61.33		
High (48 and above)	57	19		
Total	300	100.0		

The majority (80.33 percent) of the farmers had medium to high behavioral change while the rest 19.67 percent had low behavior level. The proportion of the farmers having low, medium, and high changing behavior levels were 19.67 percent, 61.33 percent and 19 percent, respectively. The subject matters on which the farmers received training were sweet potato cultivation, pest management, and water management. Training generally improves skills, increases knowledge and changes attitude of an individual towards cultivation of OFSP. Behavior is an important factor, which enhance demand of knowledge and improve skill on various aspects of improved farming practices.

Effectiveness of training on result level

The result level scores of the farmers ranged from 1 to 5 against the possible range of 12 to 60. The mean and standard deviation were 42.87 and 6.901 respectively. Considering the result scores of the farmers, they were classified into three categories viz. "low" result, "medium" result and "high" result. The distribution of the farmers with regards to result level of effectiveness of training is shown in (Table 7).

Table 7 Distribution of the farmers according to result level of their effectiveness of training

Categories	Farmers		Mean	Standard deviation
	Number	Percent		
Low (up to 33)	62	20.67	42.87	6.901
Medium (34 to 47)	173	57.66		
High (48 and above)	65	21.67		
Total	300	100.0		

The information presented in Table 7 show that majority (57.66 percent) of the farmers had medium results compared to 21.67 percent having high result, and only 20.67 percent obtained low results. Thus, the majority (79.33 percent) of the farmers obtained medium to high level of results. The result showed that the farmers have obtained changed farming outputs like yield and other attributes of sweet potato cultivation. It also built confidence of the farmers for making appropriate decisions at the time of need. Therefore, it is expected that more results derived from a given training by the farmers the more is likely to consider effectiveness of training on cultivation of OFSP due to gathering of knowledge, improvement skills and changes attitude towards improved farming practices.

Overall effectiveness of training on four levels

The overall effectiveness score of the farmers ranged from 113 to 224 against the possible range of 48 to 240. The mean and standard deviation were 144.33 and 21.627, respectively. Considering the overall effectiveness score of the farmers, they were classified into three categories viz. "low", "medium" and "high". The distribution of the farmers according to their overall effectiveness of training is shown in (Table 8).

Table 8 Distribution of the farmers according to overall effectiveness of training

Categories	Farmers		Mean	Standard deviation
	Number	Percent		
Low (113-145)	49	16.34	144.33	21.627
Medium (146-188)	208	69.33		
High (189-224)	43	14.33		
Total	300	100		

The evidence of Table 8 show that the majority (69.33 percent) of the farmers had medium perception about effectiveness of training compared to 16.34 percent having low effective and 14.33 percent of farmers considered the training as highly effective. Thus, the majority (83.66 percent) of the farmers had medium to high level of proportion about effectiveness of training. The farmer also opined that they made remarkable change in cultivating OFSP because of timely training and other technological support from the concerned authority. The extent of reaction, learning, behavior and result levels of the farmers have been increasing due to training and overall effectiveness of training as well. It also built confidence of the farmers for making appropriate decisions at the time of need. Therefore, it is expected that more effectiveness of training of the farmers the more is likely to have change their farming behavior on sweet potato cultivation.The data of (Table 8) also revealed that more than three-fourths (83.66 percent) of the farmers considered the training as effective in cultivation of OFSP. It may be due to the reason that the training was used based to the farmers and presentation of training subject matter was understable to the farmers. In addition higher motivation and economic gain from OFSP cultivation prompted farmers to accept training with satisfaction.

Indicator wise rank on effectiveness of training

The Training Effectiveness Index (TEI) value of 12 statements under "reaction level" ranged from 1026 to 1142, in case of "learning" it varied from 1048 to 1141, for "behavior" the range was 964 to 1089 and in case of "result" the TEI value varied from 1031 to 1123. In all the cases the possible range of data was 300 to 1500 (Table 9)

Table 9 Rank order indicators of effectiveness of training

Sl. No.	Level of effectiveness	Extent of opinion						
		SA 5	A 4	Und. 3	DA 2	SDA 1	TEI Total	Rank Order
	Level -1 "Reaction"							

Sl. No.	Level of effectiveness	Extent of opinion						
		SA 5	A 4	Und. 3	DA 2	SDA 1	TEI Total	Rank Order
1	I am satisfied with the trainer's knowledge of course material and subject matter.	80	124	54	42	0	1142	I
2	I am satisfied with the trainer's ability to make me keep interest in the training session.	65	129	61	44	1	1113	II
3	I am satisfied with the trainer's presentation and explanation of training materials.	64	112	55	69	0	1071	IV
4	I am satisfied with the trainer's responsiveness to trainee questions and problems.	61	118	56	61	4	1071	IV
5	I am satisfied with the trainer's ability to maintain good with the participants.	54	129	54	63	0	1074	III
6	I am satisfied with the trainer's overall effectiveness.	46	117	69	66	2	1039	X
7	I am satisfied with the availability of training courses suitable for individuals of various categories.	58	111	73	58	0	1069	V
8	I am satisfied with the communication of training information to the trainees.	51	103	70	73	3	1026	XI
9	I am satisfied with the quality of training services provided to the trainees.	60	105	71	62	2	1059	VII
10	I am satisfied with registration process and information about fooding and other management aspect.	50	116	67	64	3	1046	IX
11	I am satisfied with fairness of the course exam (pre & post test)	53	122	62	61	2	1063	VI
12	I am satisfied with coverage and importance of material tested.	46	130	61	59	4	1055	VIII
	Level-2 "Learning"							
13	I am satisfied with theoretical and practical sessions of the training	85	118	50	47	0	1141	I
14	I am satisfied about learning knowledge on production technology	78	111	61	48	2	1115	II
15	I have learned new knowledge on modern technology	63	120	72	41	4	1097	III
16	Training materials booklet on production technology helps to earn more knowledge	67	93	83	53	4	1066	VI
17	Frequent ask question's answers were satisfied which will note down at note pad	55	106	83	53	3	1057	X
18	Training language were easily understandable	61	95	76	61	7	1042	XII
19	Concept was more clear after receiving training	65	101	74	59	1	1070	VI

Sl. No.	Level of effectiveness	Extent of opinion						
		SA 5	A 4	Und. 3	DA 2	SDA 1	TEI Total	Rank Order
20	I have learn about updated information	63	106	70	55	6	1065	VIII
21	I have learn on modern newly released variety	65	92	72	68	3	1048	X
22	I learn new idea on agricultural knowledge	59	106	81	49	5	1065	VIII
23	I have evaluated my own knowledge on agricultural farming system	67	113	67	50	3	1091	V
24	Able to compare traditional and modern technology on agriculture	71	105	76	44	4	1095	IV
	Level-3 "Behavior"							
25	Changed old or traditional concepts on agriculture	67	113	65	52	3	1089	I
26	I have capable to take decision through own judgment about agricultural activities	56	98	61	77	8	1017	III
27	I have applied agricultural knowledge as per training at my land	60	87	76	67	10	1020	II
28	My confident and farming skill has been improved	49	88	92	62	9	1006	VI
29	Quality and quantity of my work has improved	56	83	87	63	11	1010	V
30	Own capacity to agricultural technology has developed	51	91	76	74	8	1003	VII
31	Leadership on technology dis-semination has developed skill	49	92	76	70	13	994	IX
32	I am capable to identify lacks and problems of agriculture	53	87	76	72	12	997	VIII
33	I am capable to overcome farming problems	40	106	60	81	13	979	XI
34	I encourage others to apply modern agricultural technolo-gy	52	79	68	83	18	964	XII
35	I advise others about improve farming practices	47	96	71	71	15	989	X
36	I fell proud as an advanced farmer	59	94	63	72	12	1016	IV
	Level-4 "Results"							
37	I got maximum yield of sweet potato	81	108	65	45	1	1123	I
38	I got optimum size and shape of sweet potato	70	115	60	55	0	1100	II
39	I got optimum market price of sweet potato	62	117	72	48	1	1091	IV
40	My socio-economic status has been improved	72	104	63	56	5	1082	V
41	My health and nutritional sta-tus has been improved	67	100	60	70	3	1058	VII
42	I think it helps food security "Alternative of rice"	54	109	74	57	6	1048	X
43	I think as per training, the un-necessary production cost has been minimized	60	104	73	59	4	1057	VIII

Sl. No.	Level of effectiveness	Extent of opinion						
		SA 5	A 4	Und. 3	DA 2	SDA 1	TEI Total	Rank Order
44	I understood that commercial demand of sweet potato is high in urban area	66	89	82	58	5	1053	IX
45	My cattle health and nutritional status has been improved.	67	103	60	65	5	1062	VI
46	I am very much pleased to make diversified use of sweet potato	56	94	81	64	5	1032	XI
47	I am very much pleased to see medicinal value of OFSP especially night blind and cancer prevention	75	83	72	64	6	1057	VIII
48	I mentally convinced for adoption of OFSP cultivation	84	98	53	61	4	1097	III

Legend:
SA= Strongly Agree, A = Agree, Und. = Undecided, SDA = Strongly Disagree and TEI = Training Effectiveness Index
In the above information (Table 9) it can apparently be said that the perception of farmers about "learning level" (1048-1141) was higher followed by "reaction level" (1026-1142), result level (1032-1123) and behavior level (964-1089).

From the above information it can be said that the farmers acquired better learning of skills, knowledge and attitude followed by reaction on various learning activities of training, obtained moderate output from training and behavioral change in practicing various farming operation on OFSP.However, the overall TEI values of all the 48 statements ranged from 964 to 1142 against the possible range of 300 to 1500). Although, all the REI values were close to one another, no major differences between indexes values were formed (Table 4.20).

Effectiveness of training at different levels for Sweet potato Cultivation
The mean values of 4 levels of effectiveness of training were 42. 76, 40.65, 40.28 and 42.87 found in reaction, learning, behavior and result respectively. The mean values of all the levels were perceived by the training participants more or less in similar fashion. Based on these 4 level scores, the accumulated over all effectiveness of training programme was completed and shown in Fig. 2.

Fig. 2 Distribution effectiveness of training of famers at different levels

Conclusion
From the above result and discussion the draw the conclusion state the majority of the respondents three-forth (83.66 percent) of the farmers opined the training as moderate to high effective in conducting farming operations. This means the perception about overall effectiveness of training was rational, logical and acceptable in persecuting farming operations as regards cultivation of OFSP. This findings lead to the conclusion that the training curricula and other related training activities were need based to the farmers this was helpful in addressing their farming demand. The demand driven training is essential for increasing farming skills and knowledge of the farmers.
The mean values of effectiveness of training 42. 76, 40.65, 40.28 and 42.87 were found in respect to reaction, learning, behavior and result respectively. Here farmer's reaction (42.76) and result (42.87) was more or less same on the other hand learning (40.65) and behavior (40.28) level also more or less same. Initially the trend of farmer's reaction (42.76) was higher than learning (40.65) and behavior (40.28) level. Finally, they convinced to get good results (42.87) more than reaction (42.76) on orange flashed sweet potato cultivation with maximum satisfaction on others benefits. So, it may be concluded that the indicators used in measuring effectiveness of training was rightly chosen and almost equally contributed to measurement of effectiveness.
So the the effectiveness of training on high nutrient contained of orange flashed sweet potato cultivation for char Landers being a new attempt in Bangladesh.

REFERENCES

Abedin, M.Z. 1996. A Handbook of Research for the Fellows of M. Phil. and Ph. D. programs (Dhaka: Book Syndicate). p. 52.

Abubakar, B. Z., A. K. Ango and U. Buhari, 2009. The Roles of Mass Media in Disseminating Agicultural Iformation to Farmers in

Birnin Kebbi Local Government Area of Kebbi State: A Case Study of State Fadama II Development Project. *Journal of Agricultural Extension,* 13 (2): 42-54.

Adnan, S. (1976), Land, Power and Violence in Barisal Village, the village study group working paper No. 6, p. 1-9.

Agbarevo and Benjamin, M.N., 2007. Farmer' Perception of Effectiveness of Agricultural Extension Delivery in Cross-River State, Nigeria. J. of Afril. & Vet. Sci. ISSN:2319-2372. 2(6) pp.01-07. Agriculture. Rome.

Ahmad, I. 1997. Extension methods and the adoption of modern agricultural technology, *Sarhad Journal of Agriculture*, 13(6): 627-632.

Ahmad, N. (1956), Rural Settlement in Pakistan, Geographical review, vol. 46, p. 388-398.

Akhter, T. 2003. Participation of Woman in Income Generating Activities of SUS. M.S. (Ag. Ext. Ed.) Thesis, Depart of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Alam, A.B.M.T. 2001. Study on Socio-economic Aspect of the Participating Group Members of Agricultural Extension Edn., Bangladesh Agric. Univ., Mymenisngh.

Alliger, G. M., and Janak, E. A. (1989). Kirkpatrick's levels of criteria: Thirty years later. *Personnel Psychology, 42,* 331-341.

Alliger, G. M., Tannenbaum, S. I., Bennett, Jr., W., Traver, H., and Shotland, A. (1997). A meta-analysis on the relations among training criteria. *Personnel Psychology, 50,* 341-358.

Amalu, U.C., 1998. Agricultural Research and Extension Delivery in Sub-Saharan Africa. Calabar University of Calabar press.

Ann, M. and Hobley, M., (2003), Journal of International Development J. Int. Dev. 15, 893– 909.

Annual report, 2012. International Potato Center, Lima, Peru press.

Anonymous, (2009). Sweetning lives with sweetpotato. CIP Nwsl. 2(3):1 (http://www. cipotato.org/publications/newsletter/2009_10-newsletter.pdf).

Balderas, S.R. 1970. Some factors associated with perception on adequacy of the training experiences by Camarines Sur National Agricultural School College Graduates, Unpublished *M.S. Thesis*, UPLB.

Baqee, M.A. (1998), "Peopling in the land of Allah Jaane"- Power, Peopling and Env. The case of char-lands of Bangladesh, the university press limited.

Baral, J.R. 1971. Relative Effectiveness of some Group Methods in Agricultural Information Communication in Nepal. Unpublished *M.Sc. Thesis*, University of Udaipore.

Barkat, A., Roy & Khan, M.S. (2007), Char land in Bangladesh: Political economy of ignored resources, Dhaka, Pathok Samabesh

Barua, P. and Sulaiman, M. (2007), Impact evaluation and client satisfaction of northwest microfinance expansion project. Research and Evaluation Division, BRAC: Dhaka.

BBS, (2010). Statistical Yearbook of Bangladesh, Bangladesh Bureau of Statistics. Planning Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

Begum, MEA, Islam MN, Alam MQ and Hossain SMB (2011). Profitability of some BARI released crop varieties in some locations of Bangladesh, Bangladesh Journal of Agricultural Research, 36(1): 111-122.

Bennett, and Kay Rockwell, 1995. Outcomes of Program. http:// deal.uni.edu/ TOP/Synopsis.html.

Berdegue, J.A., A. Schejtman and M. Chiriboga et al. (2006). "Towards National and Global Agendas Latin America and the Caribbean." Background paper, Version 1, for the World Development Report 2008. Latin American Center for Rural Development. Santiago: Chile: Rimisp.

Berti, P.R. 2008. Micronutrients and AIDS: A review of the literature and discussion of relevance to Food Fortification in Africa. A literature review prepared for the Micronutrient Initiative and HarvestPlus. HealthBridge. Ottawa, Canada.

Bisen, J. S. 1962. "A Study of Agricultural Extension Officers in Relation to Role, Workload and Training Needs in Maha ,Koshal Region " M.Sc. Thesis, Jaabalpur Government Agricultural college, M.P. India.

Blaikie, P., Cannon, T., Davis, T. I. and Wisner, B. (1994), At Risk: Natural hazards, people's vulnerability and disasters. London: Routledge. p. 284.

Boone, H., Gartin, A., Wright, C., Lawrence, L., & Odell, K. (2002). Adult education philosophies practiced by agricultural education teachers in Pennsylvania, Virginia, and West Virginia. *Journal of Agricultural Education, 43*(3), 37–48.

Bouis, H. 2002. A new tool for fighting micronutrient malnutrition. Journal of Nutrition 132 (Symposium: Plant breeding): 491S-494S.

Brookfield, S.D., 1998. Understanding and Facilitating Adult Learning: A comprehensive.

Business Dictionary, 2010. Electronic Version http://www.businessdictionary. com/definition/electronic- media.html. Accessed on 02-02-2010.

Calvo, C. and Dercon, S. (2007), Vulnerability and Poverty. Oxford: Oxford University Press.

Campbell, D. A. (1999, March). *Managing public sector extension organizations: Some critical issues*. Paper presented at the 15th Annual Meeting of the Association for International Agricultural and Extension Education, Trinidad–Tobago.

Carney, D. (2002), Sustainable Livelihoods Approaches: Progress and Possibilities for Change, London.

Chambers, R., & Conway, G. (1992), Sustainable rural livelihoods: practical concepts for the 21st century. IDS Discussion Paper 296, Sussex: IDS, University of Sussex. Retrieved October 29, 2010, from http://catalogue.nla.gov.au/Record.

Chambers, R., 2004. Challenging The Profession: Frontiers for Rural Development. London.

Chauban, S., and R.U. Stone, 1994. Training Trainers for Development Handbook. The Sea burry Press. New York.

Chowdhury, E.H. (1988), Human adjustments to river bank erosion hazard in the Jamuna floodplain, Bangladesh. Human Ecol 16 (4), p 421-37.

Christoplos, I., & Farrington, J. (Eds.). (2004). *Poverty, vulnerability and agricultural extension: Policy reform in a globalizing world.* New Delhi: Oxford University Press.

Davis, K., Nkonya, E., Kato, E., Mekonnen, D., Odendo, M., Miiro, R., & Nkuba, J. (2010). *Impact of farmer field schools on agricultural productivity and poverty in East Africa.* Washington, DC: International Food Policy Research Institute.

Drain, P.K., Kupka, R., Mugusi, F., and Fawzi ,W.W. 2007. Micronutrient in HIV-positive persons receiving highly active antiretroviral therapy. American Journal of Clinical Nutrition 85: 333-345.

Dubey, A.K. and Srivastava, J.P. 2007. Effect of Training Program on Knowledge and Adoption Behaviour of Farmers on Wheat Production Technology. Indian Res. J. Extn. 7 (2&3). pp. 41-43.

Duldulao, A.C. 1975. Kaingineros' perception on an attitude towards forest conservation in Mt. Makiling, Laguna, Philippines. Unpublished *Ph.D. Thesis*, UPLB.

Edward, A. L. 1957. *Techniques of attitude scale construction*. Prentice-Hall. New York.

Edward, A. L. and F. P. Kilpatrick. 1948. A technique for construction of attitude scales. *J. App. Psycho*, 32: 374-384.

Ellis, F. (1998), Household strategies and rural livelihood diversification, Journal of Development Studies, 35(1), p 1-38.

Faintuch, J., Soeters, P.B., and Osmo, H.G. 2006. Nutritional and metabolic abnormalities in pre-AIDS HIV infection. Nutrition 22:

683-690.

FAO, (2009). "The State of Agricultural Commodity Markets 2009. High Food Prices and the Food Crisis – Experiences and Lessons Learned". Food and Agriculture Organization. Rome: Italy.: FAO.

FAO, (2012). Food and Agriculture Organization, http://faostat.fao.org/site/291 /default.aspx

FAO, 1995. Performance Evaluation Guide: Assessing Competency Based Training in Agriculture. Rome.

FAO, 2002. Planning for Effective Training: A Guide to Curriculum Development. Rome. 201p.

Hagman, J., Chuma, E., Murwira, K., and Connolly, M., 2000. Learning Together through Participatory Extension. Harare, Zimbabwe.

Hakimian, H. and Amdisa Teshome, 1993. Trainers Guide: Concepts, Principles, and Methods of Training, With Special Reference to Agricultural Development. FAO, Rome.407p.

Halim, Abdul and A.F.M. Serajul Islam, 1973. Attitude of Front Line Extension Workers Towards In-service Training Program. Ind. J. of Extn., 9(3&4):108-104.

Haque, C.E. (1989), Coping with river bank erosion and hazard and displacement in Bangladesh: Survival Strategies and Adjustments, Disasters, Vol. 13 No. 4, p 300-314.

Haque, M. and Mohammad, A. Z. (2006), Report Card on char livelihood program.

Haque, M.M. 1982. Masaguna 99 Farmers perception on the effectiveness of communication Media and their use in Bay Laguna. *M.S. Thesis* (Development communication), UPLB.

Harwood, R. (1993). Chair, committee of sustainable agriculture and environment in the humid tropics. National Academy press, Washington DC. pp. 64-65.

Hassen, Hakimian and Amdisa Teshome, 1993. Trainers Guide: Concepts and Principles.

Headey, D., and S. Fan. (2008). "Anatomy of a Crisis: The Causes and Consequences of Surging Food Prices." Agricultural Economics 39(s1): 375-391.

Hellin, J. (2012): Agricultural extension, collective action and innovation systems: Lessons on network brokering from Peru and Mexico. *Journal of Agricultural Education and Extension*, *18*(2), 141–159.

Helmore, K., Singh, & Haque, N. (2001), Sustainable Livelihoods: Building on the Wealth of the Poor, West Hartford, CT:Kumarian Press.

Hess, S.Y., Thurnham, D.I., and Hurrell, R.F. 2005. Influence of provitamin A carotenoids on iron, zinc, and vitamin A status. Washington D.C., International Food Policy Research Institute (IFPRI) and the International Center for Tropical Agriculture (CIAT).

Holton, E. F., Bates, R. A., Seyler, D. L. and Carvalho, M. B. (1997). Toward construct validation of a transfer climate instrument. *Human Resource Development Quarterly, 8*(2), 95-113.

Hossain, M. 1983. Credit Programe for the Landless: The Experience of Grameen Bank Project, Dhaka: Grameen Bank.

ICE AV, Communications Teaching Aids Packet, (p8) CPC/ICE), 1982.

Institute of Medicine, 2001. Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. Washington D.C., National Academy Press.

International Institute for Rural Reconstruction (IIRR), 1997. Manual for Training of Trainers for Sustainable Agriculture Course. Philippines.

Islam, & Islam, (1985), A Brief Account on Bank Erosion, Model Studies and Bank Protective works in Bangladesh', REIS Newsletter, No.2, Jahangirnagrar University.

Islam, M. A. (1974), Tropical Cyclones in coastal Bangladesh, Natural Hazards: Local, National, Global, New York: Oxford University Press

Islam, M. S. 2000. Farmers' Perception of the Harmful Effects of Using Agro-chemicals in Crop Production with regard to Environment Pollution. Ph.D. Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh, Bangladesh.

Islam, M.R. 1998. Effectiveness of Mati-O-Manush Television Program in disseminating agricultural Information to the Television Viewer Farmers. *M.S. (Agril. Ext. Ed.) Thesis*, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

ISPAN, (2006), Irrigation Support project for Asia & Near East, newsletter March

Ivanic, M. and W. Martin. (2008). "Implications of Higher Global Food Prices for Poverty in Low-Income Countries." Agricultural Economics 39(s1): 405–416.

Jaarsveld, P.J. v., Faber, M., Tanumihardjo, S.A., Nestel, P., Lombard, C.J., and Benade, A.J. 2005. Beta-carotene-rich orange-fleshed sweet potato improves the vitamin A status of primary school children assessed with the modified-relative-dose-response test. American Journal of Clinical Nutrition 81: 1080-1087.

Kabir, L.I. 2005. Comparative Analysis of Livelihood Status between the Adibashi and the Native Women. *M.S. (Ag. Entn. Edn.) Theis,* Dept. of Agril. Edn. Edn., Bangladesh Agril. Univ., Mymensingh.

Kabir, M.F. 2003., Effect of Palli Daridro Bimochon Foundation (PDBF) on Reducing the Level of Poverty of Landless People. *M.S. (Ag. Ext. Edn.) Thesis,* Dept. of Agricultural Extension Education, Bangladesh Agricultural Univ., Mymensingh.

Kamaly, M. H. K. 2011. Farmer's Perception on the Harmful Effects of Using Agrichemical in Rice Production. Ph.D. Thesis. Institute of Bangladesh Studies (IBS), University of Rajshahi, Rajshahi-6205, Bangladesh.

Kasie, M., Jaleta, M., Shiferaw, B., Mmbando, F., & Mekuria, M. (2012, August). *Interdependence in farmer technology adoption decisions in smallholder systems: Joint estimation of investments in sustainable agricultural practices in rural Tanzania.* Paper presented at the International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguacu, Brazil.

Kassali, R (2011). Economics of Sweetpotato Production. International Journal of Vegetable Sciences. 17(4): 313-321, DOI: 10.1080/19315260.2011. 553212.

Kaufman, R. and Keller, J. M. (1994). Levels of Evaluation: Beyond Kirkpatrick. *Human Resource Development Quarterly, 5*(4), 371-380.

Kefyalew, Worku, 2006. Evaluation of farmers' Training programs: the Case of Eastern Harerghe (Babile and Hudne Woredas). Unpublished, M.Sc Thesis, Haramaya University, Ethiopia.

Kelly, P., Musuku, J., Kafwembe, E., Libby, G., Zulu, I., Murphy, J., and Farthing, M.J. (2001). Impaired bioavailability of vitamin A in adults and children with persistent diarrhoea in Zambia. Aliment Pharmacol. Ther. 15(7): 973- 979.

Kerlinger, F. N. 1973. Foundations of Behavioral Research. 2nd edn. New York: Holt, Rinehard and Winston, Inc.

Kirkpatrick, D.L., 1998. Evaluating training programs. 2nd edn. Alexandria, Virgina: Berrett-Koehler.

Kline, R.B. 1998. *Principles and Practice of Structural Equation Modeling.* New yourk: Guildord press.http://www2.chass.ncsu.edu/garson/PA765/kline .htm>

Kothari, C. R. 2003. *Research Methodology: Methods and Techniques*. Wishwa Prakashan, New Delhi, India.

Kraiger, K., Ford, J. K. and Salas, E. (1993). Application of cognitive, skill-based, and affective theories of learning outcomes

to new methods of training evaluation. *Journal of Applied Psychology, 78,* 311-328.

Kumar, N; Rautaray, S.K; Gupta, M. and Singh, A.K. 2005 Impact of scammer school on mechanization of rice production system. Indian J. of Ext. Ed. 41 (1&2):54-57.

Kyaruzi, A. A., Mlozi, M. R. S., & Busindi, I. M. (2010). Gender based effectiveness of agricultural extension agents' contacts with smallholder farmers in extension services delivery: A case of Kilosa District, Tanzania. *Journal of Continuing Education and Extension, 2*(3), 85–93.

Leeuwis, C., with contributions from Van den Ban 2004. Communication for Rural Innovation: Rethinking Agricultural Extension, Black Well Publishing, CTA, 407p.

Leonard, D. K. (1997). Reaching the peasant farmers: Organization theory and practice. London, UK: The University of Chicago Press.

Likert, R.A. 1932 . *A technique for the measurement of attitude*. Arc. Psycho.

Low, J.W., Arimond, M., Osman, N., Cunguara, B., Zano, F., and Tschirley, D. 2007 b. A food based approach introducing orange-fleshed sweet potatoes increased vitamin A intake and serum retinol concentrations in young children in rural Mozambique. Journal of Nutrition 137: 1320-1327

Lusweti, C.M., Nkonge C., Nandasaba J., Wanjekeche E., Lobeta T. and Rees D. (1999). "On-farm evaluation of promising Sweet Potato varieties in the NARC Kitale mandate region". Proceedings of Pre-conference mini-papers prepared for the KARI/DFID NARP II Project. End of Project conference, 23rd. -26th. March, 1999. Nairobi, Kenya.

Lynton, R.P. and Pareek, U., (1990).Training for Development. New Delhi. 333p.

Majydan, R. 1996. Perception on the Effectiveness of Selected Communication Media used by the BAUEC Farmers. Unpublished *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Mani, R.; 1974. A study on the In-service Training NEEDS OF Dy. A.O's in Tamil Nadu. M.Sc. (Ag.), Thesis, TNAU, Coimbatore. India.

Marissa, B., 1997. Espeneli for the Training of Trainers for Sustainable Agriculture Course. IIRR Head quarters, Silang, Cavite, Philippines.

Mathews-Njoku, E. C. and E. U. Onweremadu. 2007. Adoptability of Planted Fallows and Efficacy of Natural Types in Fertility Regeneration of a Typic Paleudult. *Nature and Science*, 5(3): 12-19.

Mattee, A. Z. (1994). Reforming Tanzania's agricultural extension system: The challenges ahead. *African Study Monographs, 15*(4), 177–188.

McLaren, D.S., and Frigg, M. 2001. Sight and Life guidebook on vitamin A in health and disease. Basel, Switzerland, Task Force Sight and Life.

Miller, Janis, A., 2002. Training Need Assessment. SHRM Training and development committee. UK.

Mitchell I (1998) .Student Support VS Student Control. On-Line Paper. (http://www.usq.educ.au/material/resource/treasre/Tdatab.htm). Paper 4486. National Bureau of Economic Research (NBER). Cambridge, Mass.

Moris, J. (1991). *Extension alternatives in tropical Africa*. London, UK: Overseas Development Institute.

Mortuza, M.G., Kashem, M.A. and Halim, A., 1998. Relationships and influence of Grupo Characteristics and Organizational Factors upon the Effectiveness of Krishak Samabay Samity (KSS). Bangladesh Journal of Extension Education, 10(1&2): 75-80.

Nagel, U. (1997). *Improving agricultural extension: A reference manual*. Rome, Italy: FAO.

Narayan, D. 1996. Toward Participatory Research. World Bank Technical paper no. 307, The World Bank, Washington, DC.

Nestel, P., and Nalubola, R. 2003. The bioavailability of iron from dark green leafy vegetables is low. I. H. N. Institute. Washington D.C., International Life Sciences Institute (ILSI).

Nicklas, T.A., Baranowski, T., Cullen, K.W., and Rittenberry, L. 2001. Family and child-care provider influences on preschool children's fruit, juice and vegetable intake. Nutrition Review 59: 225-235.

Nuruzzaman, M. 2013. Effectiveness of Integrated Crop Management Training as Perceived by the Farmers, MS thesis, Agril. Extn. & Rural Dev., PSTU, Patuakhali, Bangladesh.

Ohajianya, DO, Otitolaiye JO, Saliu, OJ (2014). Technical Efficiency of Sweet Potato farmers in Okene Local Government Area of Kogi State, Nigeria. Asian Journal of Agricultural Extension, Economics and Sociology.

Omotayo, A.,D. Chikwendu, M.Zaria, J. Yusuf and Z.Omenesa 1997. Effectiveness of radio in Nigeria in dissemination of information on improved farming practices. *Journal of Extension System,* 13(1-2), 103-120.

Ortaliza, I.C., Salamat, L.A., Cruz, B. de la, Trinidad, T.P., and Jacob, F.O.1974. Iron absorption studies using biologically labeled vegetables. Philippine Journal of Nutrition 27(3): 22-29.

Paton, N.I., Sangeetha, S., Earnest, A., and Bellamy, R. 2006. The impact of malnutrition on survival and the CD4 count response in HIV-infected patients starting antiretroviral therapy. HIV Medicine 7(5): 323-330.

Paul, R.K. 1989. Effectiveness of Result Demonstration as an Extension Teaching Method. *M.Sc. (Ag. Ext. Ed.) Thesis,* Department of Agricultural Extension, Bangladesh Agricultural University, Mymensingh.

Perumal, G., 1983. "Training of Extension Personnel in India: A brief Review", Ind. J. of Extn. Edn. 19 (1&2):23-32.

Rahman, A. (2007), Health Poverty in Island Chars of Northwest Bangladesh for the Nodi o Jibon Policy Paper.

Rahman, M. M. 2008. Attitude of Rice Cultivating Farmers' Towards Integrated Pest Management Practice in a Selected Barind Area under Rajshahi District. PhD Thesis, Department of Agronomy and Agricultural Extension, University of Rajshahi, Rajshahi, Bangladesh.

Rahman, M.M. 1974. Attitudes of Farmers Towards High Yielding variety of Rice and Organizational Effectiveness of ARPP (Accelerated Rice Production Program) *M.Sc.* Agricultural University, Mymensingh.

Rahman, S.M.M. 2002. Seed Uptake Programme of RDRS: Its Impact on Livelihood Asset Building of Resource Poor Farmers. *M.S. (Ag. Ext. Ed.) Thesis,* Dept. of Agril. Entn. Edn., Bangladesh Agric. Univ., Mymensingh.

Rama, B.R., Etlling, A.W.W., and Bowen. B.E., 1993. Training of Farmers and Extension Personnel. In R, K.Samanta (ed.), Extension strategy for Agricultural Development in 21st Century. New Delhi.

Ramamurthy, H.S. 1976. Some factors influencing IR-8 Adopter's perception on characteristics of innovations and its relation to adoption (*Thesis Abstract 2:1)* Hariana Agril. University.

Rashid, H. (1981), An economic geography of Bangladesh, the university press limited.

Rashid, M. H. and Mahboob, S.G. 1987. Agricultural Problems of the Farmers. Bangladesh Journal of Extension Edn. Vol.2(2): 24-25.

Rashid, M.H. 1996. Issues in Measuring and Modeling Poverty. *Economic Journal,* 106: 1328-1343.

Ray, G.L. and S. Mondal. 1999. Research Methods in Social Sciences and Extension Education. Naya Prokash, Calcutta, India.

Ray, G.L. and S. Mondal. 2004. *Research Methods in Social Sciences and Extension Education.* New Delhi: Kalyani Publishers.

Ray, G.L., P. Chatterjee and S.N. Banerjee. 1995. Technological gap and constraints in agricultural technology transfer. 94 pp.

Rivera, W. M. 2001. Cited in Agricultural and Rural Extension Worldwide: Options for Institutional Reform in the Developing Countries Report and Census. Food and Agriculture Organization (FAO) of the United Nations.

Rokanuzzaman, M. 2004., Impact of Community Based Fisheries Management Project on Livelihoods of a Fishing community in Haor Area of Sunamganj District. *M.S. (Ag. Ext. Edn.)Thesis,* Dept. of Agril. Exten. Edn., Bangladesh Agric. Univ., Mymensingh.

Rouiller, J. Z. and Goldstein, I. L. (1993). The relationship between organizational transfer climate and positive transfer training. *Human Resource Development Quarterly, 4*(4), 377-390.

Roy, S.; Bag, T.K.; Prasad, A. and Yadav, S.K. 2015. Impact Analysis of Training Interventions on Potato Growing Tribal Farmers of Meghalaya, India, Indian J. of Ext. Edn. 16 (1) p. 116-119.

Rural Institute for Social Education (RISE), 2002.Training of Trainers: A Manual for Participatory Training Methodology in Development. Kuppam, India.

Salcedo, A.M. 1972. In service training needs of agriculture teachers in public elementary schools. Unpublished *M.S. Thesis,* UPLB.

Sangalang, R.S. 1975. Expectation in extension from the Don Severino Agricultural College by farmers in selected barrios of Indang, Cavite. Unpublished *M.S. Thesis,* UPLB.

Sarker, M.M.R. 1996. Effectiveness of Agricultural Information Disseminated to the farmers through Agricultural Radio Program. *M.S. (Agril. Ext. Ed.) Thesis,* Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Scarl Borough, V., Killough,S, Jhonson,D.A, Farrigton, J. 1997. Farmer - Led Extension, Concepts And Practices. London, UK.

Scott, G.J. and Maldonado L. (1999). CIP sweet potato facts. A compendium of key figure and analysis for 33 important sweet potat producing countries. Interntional potato center (CIP). Lima, Peru.

Semba, R.D., and Bloem, M.W. 2002. The anemia of vitamin A deficiency: epidemiology and pathogenesis. European Journal of Clinical Nutrition 56: 271-281.

Sharma, A. K.; Kaur, R., Kumar, V. and Singh, D. 2016. Effectiveness of Model Training Course (MTC) on Advances in Seed Production, Processing and Certification in Rabi Field Crops. Indian Res. J. Extn. 16 (3) p.10-14.

Shelton, S., and Alliger, G. M. (1993). Who's afraid of level 4 evaluation? A practical approach. *Training and Development Journal, 47*, 43-46.

Simonne, A.H., S.J. Kays, P.E. Koehler and R.R. Eitenmiller 1993. Assessment of β carotene content in sweetpotato breeding lines in relation to dietary requirements. Journal of Food Composition and Analysis 6: 336-345.

Sohn, T., 1995. How Adult Participant Learn. CEPDA. Washington, D.C., U.S.A.

Sommer, A., and West, K.P.1996. Vitamin A deficiency: Health, survival and vision. New York, Oxford University Press.

Soontarajumpaka, S. 1980. Farmers' perception on the agricultural radio program in North-east Thailand, Unpublished *M.S. Thesis,* UPLB.

Szalczyk, Z. 1996. The role of agricultural advisory services in multifunctional development of rural areas. *Zeszyty Probemowe Prostepow Nauk Rolniczych,* 433:307-919.

Taiwo, Williams, S.K.1971. "Training of Agricultural Extension Officers in Nigeria" Ind. J. of Extn. Edn., 7(1&2).

Tannenbaum, S. I., and Yukl, G. (1992). Training and development in work organizations. *Annual Review of Psychology, 43,* 399-441.

The World Bank, 2006. Repositioning nutrition as central to development: A strategy for large scale actions. Washington D.C.:

246.

The World Health Organization (WHO), and the Food and Agriculture Organization (FAO). 2002. Human vitamin and mineral requirements. Rome, FAO.

Thurstone, L. and E. J. Chave. 1929. The *measurement of attitude*. Chicago University Press, USA. pp 39-40.

UNAIDS, and The World Health Organization. 2007. AIDS epidemic update. Geneva, Switzerland: 50 p.

Walpole, R.E. (1982). Introduction to Statistics. 3rd Edn., New York: MacMillan Publishing Co.

Wambura, R., Acker, D., & Mwasyete, K. (2012). Extension systems in Tanzania: Identifying gaps in research (Background papers for collaborative research workshop). Retrieved from https://docs.google.com/file/d/ 0B0k_cmRaulGQQXZ Hdkk3bEZfNTg/edit?pli=1

Wanjekeche, W E. (1999). Potential for increased cash and food security through processing of sweet potato for smallholder farmers.

Wanjekeche, W.E (1995). Post-harvest practices and constraints to increased Utilisation of the major food crops in Trans Nzoia, Uasin Gishu, Keiyo, Marakwet and West Pokot Districts. In: D.J Rees *et al* (eds). Proceedings of a Review of Agricultural Practices and Constraints in the North of Rift Valley Province. Kenya. 26th – 28th September 1995.

Web based, (http://www.kurigram.gov.bd/site/page/6ecd5c03-18fd-11e7-9461-286ed488c766).

Werner, J. M., and DeSimone, R. L. (2009). *Human Resource Development* (5th ed.). Mason: South-Western Cengage Learning.

Wik, M. P. Pingali, and S. Broca. (2008). "Global Agricultural Performance: Past Trends and Future Prospects." Background Paper for the World Development Report 2008.

Williams, S.K.T., 1984. Rural Development in Nigeria. Life. University press.

Zachariah, R., Fitzgerald, M., Massaquoi, M., Pasulani, O., Arnould, L., Makombe, S., and Harries, A.D. 2006. Risk factors for high early mortality in patients on antiretroviral treatment in a rural district of Malawi. AIDS 20(18): 2355-2360.

Zuraida, N (2003). Sweet potato as an alternative food supplement during rice storage, J. Lubang Pertanian, 22(4): 150-15