Applied Tropical Agriculture
Volume 24, No 1, 136-143, 2019

EFFECT OF EXTENSION SERVICES ON YAM PRODUCTION IN KWALI AREA COUNCIL, FCT ABUJA, NIGERIA

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ABSTRACT

This study was carried out to determine effect of extension services on yam production in Federal Capital Territory, Abuja, Nigeria. Its specific objectives are to identify effective method of extension service delivery and determine the technical efficiency of yam production in the study area. Eighty-four (84) respondents were randomly selected for the study using multi-stage sampling procedure, while structured questionnaire was used to collect the primary data. Descriptive Statistics and Stochastic Frontier Approach were used to analyze the data collected. The findings of the study revealed that majority (79.8%) of the respondents were in the age range of 21 – 50 years with mean age of 42 years. Also, 84.5% of the respondents were male and married, respectively. Majority (75.0%) of the respondents had household size of 1 – 10 people, while 46.4% had formal education implying that the educational levels of the farmers are low. The study also revealed that group method was the most effective means of extension service delivery as indicated by majority (80.9%) of the respondents, followed by the individual method 63.1% and mass media 50.0%. However, the stochastic frontier model result revealed mean technical efficiency of 0.9149 implying that about 91.5% of yam output was realised by the farmers from mix of production inputs through extension services delivery. Coefficients of technical efficiency for labour (7.29), yam seed (2.71) and agro-chemical (2.11) which were positive and statistically significant, while that of technical inefficiencies was experience (-0.987), extension contact (-0.170) and sex (-0.261) which were negative and statistically significant as well as education (0.459), age (0.491), farm size (0.464) and household size (0.393). Constraints indicated by the farmers among others were inadequate capital (63.1%), low price of produce (48.8%) and inadequate labour (26.2%). In conclusion, the farmers had contact with extension agents which have helped them to accept extension services on yam production. It was therefore recommended that extension education should be stepped up in the area to raise the farmers' awareness about innovations especially on improved yam seeds and fertilizer application.

KEY WORDS: Yam production, extension services, stochastic, technical efficiency

INTRODUCTION

Agricultural extension services are widely-used by researchers, planners and service providers to improve the performance of farmers as well as the scope for management and allocation of resource to achieve objectives of the farmers. Agricultural extension is of fundamental importance because it extends research information to targeted people where such information is to be put into productive use and serve as an indicator to the degree of social change, growth and development. Williams (1978) stated that agricultural extension education is to avail farmers with necessary education skills and technical information to enable them (farmers) take effective farm management decision to enhance their agricultural productivity. Agricultural extension represents a mechanism by which information on new technologies, better farming practices and better management can be transmitted to farmers. In Nigeria, the responsibilities of transferring agricultural information's and innovations to farmers are usually coordinated by government owned agricultural extension outfits (Akpantaku et al., 2005).

According to Niger State Agricultural Mechanization and Development Authority (NAMDA) (2014), extension teaching method for instance rural radio agricultural programmes provides fastest and successful avenue of disseminating research findings to rural farmers. This is because mass media had been found to increase farmers' knowledge of improved agricultural practices. Gaforth (1993) classified extension teaching methods into three broad classes in terms of area of coverage as: (a) Individual method (b)

Group method (c) Mass method. Agricultural extension education in Nigeria for farmers has gone a long way through the implementations of government strategies which focused on sensitizing farmers to produce food in abundance. Sandhu (1994) posited that extension method is a sequential step undertaken to create situations that are conducive for effective learning. There are various extension teaching methods which include rural- radio outreach, television, hand bills, newspapers, posters, farm and home visit. Therefore, extension teaching methods are tools used by the extension workers/agents to achieve their set out goals or objectives as a teacher.

According to Federal Capital Territory Agricultural Development Project (FCTADP) (2013), the ideal ratio of extension workers to farmers should be 1 to 50 for easy and effective work performance. In order to modify the 'traditional farming methods' of farmers, new yam variety was practiced on small portions of lands with close supervision from extension workers, and an impressive output was achieved for neighbouring farmers to observed the performance of the new yam variety. Thus, agricultural extension worker can present useful method of demonstration as well as showing a series of result demonstration through pictures which shows changes in all the time. All types of visual aids like charts, graphs, live object and black board can be used to increase teaching effectiveness. This in turn will have a significant effect on the production level of the farmers. In research conducted by Ogundari and Ojo (2006) on production efficiency of farmer using farm level data with stochastic frontier production and cost function model to predict the farm level technical and economic efficiencies found that cassava farms exhibit decreasing positive return-to-scale, meaning that farmers were efficient in allocating there resources in Nigeria.

Roots and tuber crops which yam belongs to have some inherent characteristics which makes it attractive especially to smallholder farmers in Nigeria. Yam is widely consumed especially in West Africa as a food crop. Babaleye (2003) observed that yam contributes more than 200 dietary calories daily for more than 150 million people in West Africa while also serving as important source of income to the people. Unlike Cassava and Sweet potato, one can store yam tubers for a period of up to four or six months at ambient temperatures. This characteristic contributes to sustaining of food supply, especially in the difficult period before the start of new season. According to Akoroda and Hahn (1995), the production of yam in Nigeria is grossly inadequate and cannot meet the ever increasing demand for it under present level of input use. In order to meet this level of demand and even surpass it, there is need to improve on the extension service delivery through the extension workers and also access the level of technical inefficiencies as determinants of yam production. As a result of aforementioned, this study was conceived to determine the extent of extension services of yam production in Kwali Area Council of Federal Capital Territory (FCT), Abuja, hence the specific objectives to:

i. describe the socio-economic characteristics of the respondents;
ii. identify effective method of extension service delivery on yam production;
iii. determine the technical efficiency of yam production, and
iv. identify the problems associated with extension service delivery on yam production.

CONCEPTUAL FRAMEWORK

The Stochastic Frontier Model (SFM) incorporates composed error structure with two sided symmetry and one sided component. The one sided component reflects the inefficiency while the two sided component capture the random effects outside the control of production unit including measurement errors and other statistical noise typically of empirical relationship. Factors explaining technical and allocative inefficiency in a developing country's agriculture are many including socio-economic, demographic or environmental factors. However, Farm-specific efficiency or inefficiency can be related to farmer characteristics. These variables may measure information status and managerial skills such as education, technical knowledge and extension contacts, as well as system effects exogenous to the farm, such as credit, input markets or tenancy (Ali and Byerlee, 1991).

According to Ajibefun and Daramola (2003), education is an important policy variable and could be used by policy makers to improve both technical and allocative efficiency of farmers. Thus, there is need for policy makers to focus on extension education in order to increase farm level production and reduce inefficiency. Owens et al. (2001) investigated the impact of farmer contact with agricultural extension services on farm productivity using panel data obtained during the period 1993–1997 in Zimbabwe. The data were drawn from a sample of households re-settled in three regions in Zimbabwe. The results showed that access to agricultural extension services, defined as receiving one or two visits per agricultural year, raises the value of crop production by about 15%. More so, impact of

agricultural extension services differed across individual crop years, with the impact being markedly different in drought and non-drought years. In another research by Ogundele and Okoruwa (2004), farm size significantly determines levels of technical efficiency in Nigeria, while other determinants include labour, herbicides, seeds, education and farming experience with a computed mean technical efficiency of 90%. Technical efficiency is the maximum attainable level of output for a given level of production input, given the best technologies available to the farmer.

METHODOLOGY

The study area

This study was conducted in Kwali Area Council of Federal Capital Territory (FCT), Abuja, Nigeria. Kwali is located between Latitude $4^0 9'$ North and Longitude $7^0 8'$ East of the equator with a land area of 1,206 square kilometres representing about 0.5% of the total land area of the country. It has an annual rainfall which ranges from 1100mm – 1600mm, average monthly temperature ranges of 23°C to 34°C and derived savanna vegetation zone which consists of short grasses, shrubs and trees. The total population of Kwali Area Council was given as 778,567 (National Population Commission (NPC), 2006). The indigenes of Kwali are mainly subsistence farmers producing food crops such as yam, maize, guinea corn, beans and millet. Fishing activities are also prominent among the Bassa people and villagers. Besides farming, wood and craft work was and still a notable occupation of the people of the territory especially the Gbagyis. Multi-stage sampling technique was used to obtain respondents for this research. In the first stage, three (3) communities were randomly selected in the area. In the second stage, four (4) villages were selected randomly from each community. In the final stage, seven (7) yam farmers were randomly selected to give a total of eighty four (84) yam farmers that were sampled. Primary data were obtained from the respondents with the aid of structured questionnaire complemented with an interviewed schedule. Data collected were analyzed with descriptive and inferential statistics (stochastic frontier approach).

Model Specification

Stochastic Frontier Approach was used to determine the technical efficiency of yam production in the study area. Cobb-Douglas functional form was chosen as the lead equation which is expressed in its explicit form as:

$$\ln Y = \beta\square + \beta_1 lnX_1 + \beta_2 lnX_2 + \beta_3 ln\beta_3 + \beta_4 lnX_4 + \beta_5 lnX_5 + Vi - Ui$$

Where:

ln = natural logarithms
Y = Output of yam measured in kilogram
$X_1 - X_5$ = independent variables in the model
X 1 = Land size (ha)
X 2 = Labour (man days)
X 3 = Yam sett (kg)
X 4 = Fertilizer (kg)
X5 = Agro-chemical (litres)
β = inputs coefficients for the resources used in yam production;
Vi = farmers specific characteristics related to production efficiency;
Ui = statistically disturbance term.

$$\mu = \delta_0 + \delta_1 Z_1 i + \delta_2 Z_2 i + \delta_3 Z_3 i + \delta_4 Z_4 i + \delta_5 Z_5 i + \delta_6 Z_6 i + \delta_7 Z_7 i$$

The V_i's are assumed to be independent and identically distributed normal random errors having zero mean and unknown variance.

The Ui are non-negative random variables called technical inefficiency of production of the respondents which are assumed to be independent of the Vi such that Ui are the non-negative trunμationσ^2it zero) at the normal distribution with mean and variance

Z 1 = Education (years)
Z 2 = Age (years)
Z 3 = Farm size (hectares)
Z 4 = Experience (years)
Z5 = Household size (number)
Z6 = Extension contact (number)
Z7 = Sex (dummy: male=1, otherwise=0)

Socio-economic characteristics of the respondents such as: age, education, farm size, experience, household size, extension contact, sex were the technical inefficiencies variables included in the model for their effects on the efficiency of production. Thus, the production efficiency of the farmers is expressed as:

T.E. = exp (-Ui)

Where:
TE = Technical Efficiency
exp = Exponential
Ui = Non negative random variables called the technical inefficiency of production

RESULT AND DISCUSSION

Socio Economic Characteristics of the Respondents

The socio-economic characteristics of the respondents described in this study include age, sex, marital status, educational level, household size and farming experience. As revealed in Table 1, majority (79.8%) of the respondents were within the age range of 21 – 50

years with a mean age of 42 years. This implies that the respondents were young and active in farming. More so, majority (84.5%) of the respondents were male and married, respectively, meaning that men were more into yam production while procreation of new generation will not be a problem for future farming activities in the study area. In terms of educational level of the respondents, majority (53.5%) of the respondents had no formal education with only 23.8% attaining primary education, 11.9% attained secondary education while 10.7% attained tertiary education implying that the educational level of the respondents in the study area was low. This finding is in agreement with Balami et al. (2011) who posited that lack of education could have a negative effect on the adoption of innovations and consequently, productivity of farmers. The majority (75.0%) of the respondents had household size ranging from 1 – 10 with a mean household size of 6 people. In addition, majority (59.5%) of the respondents had farming experience of more than 15 years implying that they have been into farming activities over long period of time.

Table 1: Socio-economic Characteristics of the Respondents

Variables	Frequency	Percentage
AGE (years)		
21-30	8	9.5
31-41	33	39.3
41-50	26	31.0
51-60	17	20.2
SEX		
Male	71	84.5
Female	13	15.5
MARITAL STATUS		
Single	6	7.1
Married	71	84.5
Divorced	2	2.4
Widowed	5	6.0
EDUCATION		
Non Formal	45	53.5
Primary school	20	23.8
Secondary school	10	11.9
Tertiary	9	10.7
HOUSEHOLD SIZE		
	36	42.9
6 – 10	27	32.1
11 – 15	16	19.0
> 15	5	6.0
FARMING EXPERIENCE		
1 – 5	3	3.6
6 – 10	9	10.7
11 – 15	22	26.2
> 15	50	59.5
TOTAL	84	100

Effective Method of Extension Service Delivery

There are different methods used by the extension agents to effectively deliver extension services to farmers. Table 2 revealed the effectiveness of the extension methods used in the study area for extension service delivery. As revealed in the Table, majority (80.9%) of the respondents indicated group method (such as result demonstration, Small Plot Adoption Techniques (SPAT), general meeting, lectures, group discussion and excursions) as the effective method of extension services delivery on yam production followed by 63.1% of the respondents who indicated individual method (such as farm and home visits, office calls and telephone calls) as the effective method of extension service delivery in the study area. However, 50.0% of the respondents indicated mass method (such as radio, television and print media) as effective method of dissemination of information and other services to farmers on yam production

Table 2: Respondents' Effective Method of Extension Services Delivery

	Very Effective	Effective	Not Effective
Individual Method	17 (20.2)	36 (42.9)	31 (36.9)
Group Method	17 (20.2)	51 (60.7)	16 (19.1)
Mass Method	12 (14.3)	30 (35.7)	50 (50.0)

Number in parenthesis is the frequency percentages

Technical Efficiency of Yam Production

The technical efficiency of yam production in the study area was achieved using Stochastic Frontier Approach. The estimated parameters of the Cobb-Douglas are presented in Table 3. The t–value of the sigma square was 5.23 and statistically significant at 1% probability level. This indicates a good fit and correctness of the distributed assumption specified as the composite error term. The gamma value of 1.72 was statistically significant at 10% implying that variations in the output of yam farmers were due to indifferences in their technical inefficiencies. The technical efficiency result revealed that t–value for labour (7.29), yam sett (2.71) and agro-chemical (2.11) were positive and statistically significant. This suggests that more output of yam would be obtained from the use of additional quantities of these variables 'everything being equal'. The significance of these variables could be attributed to their importance in crop production in the sense that a shortage would have negative effect on production. The estimated coefficient of the inefficient function provides some explanation for the relative efficiency levels among individual farmers. Since the dependent variable of the function represents inefficiency, a positive sign of an estimated parameter implies that the associated variable has a negative effect on efficiency and a negative sign indicates the reverse. Therefore, the coefficient for experience (-0.987), extension contact (-0.170) and sex (-0.261) were negative and significantly related to technical efficiency at 1% and 5% level of probability as appropriate. This implies that with a unit increase in experience, extension contact and gender of the respondents, there is corresponding increase in technical efficiency of the respondents in yam production. More so, positive coefficients of education (0.459), age (0.491), farm size (0.464) and household size (0.393) implied that respondents' technical efficiency decrease with an increase in education, age, farm size and household size of the respondents.

Table 3: Stochastic Estimates of Respondents' Technical Efficiency in Yam Production

Variables	Parameters	Coefficients	Standard error	
Efficiency factors				
Contact	[illegible]	0.819	0.487	1.68^{NS}
Farm size (X_1)	[illegible]$_1$	0.971	0.937	1.04^{NS}
Labour (X_2)	[illegible]$_2$	0.371	0.051	7.29***
Yam seed (X_3)	[illegible]$_3$	0.157	0.058	2.71***
Fertilizer (X_4)	[illegible]$_4$	0.230	0.199	1.15^{NS}
Agro-chemical (X_5)	[illegible]	0.388	0.350	2.11**
Inefficiency factors				
Constant	[illegible]	-0.331	0.103	-3.21***
Education (Z_1)	[illegible]$_1$	0.459	0.158	2.89***
Age (Z_2)	[illegible]$_2$	0.491	0.178	2.75***
Farm size (Z_3)	[illegible]$_3$	0.464	0.135	3.44***
Experience (Z_4)	[illegible]$_4$	-0.987	0.121	-8.15***
Household size (Z_5)	[illegible]	0.393	0.191	2.05**
Extension contact (Z_6)	[illegible]	-0.170	0.078	-2.18**
Sex (Z_7)	[illegible]	-0.261	0.029	-8.83***
Diagnosis statistics				
Sigma-square [illegible]		0.771	0.147	5.23***
Gamma [illegible]		0.868	0.505	1.72*
Log likelihood estimates		0.517		
LR Test		0.431		

*****implies significant at 1%, **significant at 5% & *significant at 10% probability level**

Efficiency Estimates of the Respondents

As shown in Table 4, the technical efficiency of the sampled yam farmers was less than one (less than 100%), implying that all the farmers in the study area were producing below maximum efficiency frontier of 0.973 (97.3%). The mean technical efficiency was 0.915 implying that on the average, farmers in the study area were able to obtain 91.5% yam output from a given mix of production inputs. Although, farmers were relatively efficient, there is still room to increase their efficiency in yam production with about 8.5% efficiency gap from optimum (100%) level of production.

Table 4: Efficiency Distribution of the Respondents

Efficiency Class	Frequency	Percentage
< 0.71	3	3.6
[illegible]	4	4.8
0.81 – 0.90	8	9.6
0.91 – 1.00	69	82.0
Total	84	100.0
Mean	0.914	
Maximum value	0.973	
Minimum value	0.312	

Constraints Faced by Respondents in Yam Production

The problems faced by the respondents in the study area are presented in Table 5. As shown in the Table, majority (63.1%) of the respondents indicated inadequate capital as their main constraint to yam production. This is followed by low price of the produce (48.8%). This finding is in agreement with the work of Balami et al. (2011) who reported on the factors militating against the realization of potentials of food crops production including yam in sub-Saharan Africa. The problems according to them are poor access to credit, high cost of farm inputs, problem of pest and diseases, and inadequate access to markets. Other constraints indicated by the respondents are inadequate labour (26.2%), poor accessible road to major markets (14.3%) and problem of pest and diseases (11.9%).

Table 5: Distribution of Respondents According to Production Problems

Constraints	Frequency*	Percentage
Inadequate capital	53	63.1
Low price of produce	41	48.8
Inadequate labour	22	26.2
Non accessible road	12	14.3
Pest and disease	10	11.9

***Multiple Responses**

CONCLUSION

Based on the findings emanating from this study, the respondents in the study area are males, married and in age range of most active yam production. They are generally small-scale farmers with fairly large household size. This study showed that group method of extension services is the most effective means of extension service delivery on yam production. The yam farmers were relatively efficient but there is still room to increase their efficiency to reach optimum level of production. However, in spite of the abundant agricultural potentials in the study area, full exploitation of the resources is yet to be realized especially on yam production. Determinants of technical efficiency were labour, yam seed and agro-chemical, while that of technical inefficiencies includes experience, extension contact, sex, education, age, farm size and household size. Inadequate capital, low price of produce and inadequate labour were some of the constraints faced by the respondents.

RECOMMENDATIONS

Based on the results of this study yam production can be increased tremendously in Nigeria through full utilization of all available human and material resources. However, the following recommendations were put forward:

i. Yam farmers should be encouraged to use machineries such as tractors to complement shortage of labour in their farm operation. Where outright purchase is impossible because of limited fund, they should form cooperatives societies to access the machineries.

ii. Financial institutions such as banks and insurance company should be established in the area to mobilize fund and give out loans to farmers. This will go a long way in helping them to purchase new innovative materials for increase output and income as well as standards of living.

iii. Infrastructures such as accessible roads, storage facilities, electricity, clinics, etc should be provided by relevant stakeholders in the rural areas to facilitate farming activities.

iv. Government or Non-Governmental organizations should assist the farmers in stabilizing the prices of agricultural produce. This can be achieved through price selling or buying for strategic reserve to stabilize price.

v. Yam Farmers should be encouraged by extension agents to use pesticide, herbicides and other agrochemicals to manage pest and diseases both in the field and during storage.

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