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Analysis of Agricultural Extension Contact Effects on Rural Farming Households' Productivity in Oyo State, Nigeria

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ABSTRACT: The study examined the productivity effects of extension on rural farming households' productivity in Oyo State. A total of 360 respondents were sampled using multistage technique. Descriptive statistics and Stochastic Frontier Production Function (SFPF) were used to analyse data on the socioeconomic and input characteristics and individual farm efficiency. The results on socioeconomic aspect showed that the majority (63.1%) of the farmers were above 60 years of age while male farmers formed the majority (71.9%). About 54% percent had no formal education while cooperative members and farmers without extension contacts were in the 72.5% and 57.5% respectively. The result on input characteristics revealed that the maximum farm output was 4.20tons/ha and maximum farm size was 6.32/ha while fertilizer used was a maximum of 600kg/ha. The mean Technical Efficiency (TE) and Returns to Scale (RTS) for the farmers with and without extension contacts were (0.92 and 0.86) and (0.36 and 0.98) respectively. It was therefore concluded that farmers with extension visits acquired more skills and new technologies through extension education which in turn resulted in being relatively more efficient. It was recommended that more and trained extension agents be employed by the authority concerned in order to increase inter-farm productivity in the area.

Keywords: Productivity, Extension Effects, Rural Farming

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INTRODUCTION

Information communication, skill acquisition and information dissemination is central to agricultural productivity at any level of farming generally in the Sub-Sahara Africa and Nigeria in particular. In an effort to achieve the remarkable feat of high productivity, the vibrant role of extension activities is inevitable and this invariably stems from the governmental and non-governmental organization as attested to by Bashir *et al*. (2010) as having positive impact on crop productivity. Agriculture in Nigeria is still at its nascent stage as the majority of active farmers are about 70 percent of the population while about 65 percent of small scale farmers dominate the rural production landscape, either on the part-time basis or otherwise (Titilola and Akande, 1998). Most of the farmers are resource poor, conservative, users of crude farming implements, engage family labour, low educational status and operate on subsistence level which summarily resulted in low productivity, and more importantly, are devoid of extension contacts in sufficient number (Adegeye and Dittoh, 1985).

However, in an effort to bridge the gap between potential and real productivity in farm output

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and make food available for the teeming population of Nigerians, there is a need to enhance optimal resource use among farmers through extension activities which is critical to making information available and demonstration of new technologies for technical skill improvement among farmers. Food and Agricultural Organization (2014) defined extension as an informal educational process directed towards the rural population for the purpose of offering advice and information dissemination, to assist in solving their problem and aims at increasing the farm family efficiency, increase production and ultimately increase their standard of living markedly. Faruq *et al*.(2013) also expressed in their own view that, agricultural extension education activities engenders rapid modernization and transformation of small-holder farming in Nigeria and further highlighted the features of effective agricultural extension education as a system that will (i) transform subsistence production to commercial and market oriented production system, (ii) ensure an optimum combination of farm enterprises conducive to dynamic maximization of farm income, (iii) facilitate efficient allocation of farm and non-farm resources through better knowledge situations, (iv) necessitate effective decision-making competence and managerial efficiency, and (v) provide efficient and usable information and training system that facilitate a meaningful organization of farm production and distribution given the dynamics of the rural ecosystem.

According to Swanson and Rajalaht (2010), the term agricultural extension has changed over times. It is no longer restricted to the emphasis on technology transfer reflected by the Training and Visit (T & V) system but has moved towards broader concepts which include developing the skills and management capacities of farming families. Opportunity of skill improvement through extension activities invariably transforms into successful performance in the input transformation stages. This ranges from production through processing to marketing for eventual conversion of output to cash and moreso, purchase of other needs that are not produced by farmers. As farmers become more market oriented, extension workers need to be in a position to advise them not only on how to grow crops and raise livestock but also on converting them to cash. FAO (2013) emphasised that knowledge of farm production, produce handling, storage and packaging was essential to the performance of the farmer in the farming business.

Many studies had been launched on the role of extension activities in the production of crops among small farmers and the literature is replete on this aspect of research. Ovwigho (2015) worked on the role perception and performance of agricultural extension agents in maize marketing in Delta State and concluded that performance of extension agent was good with regards to dissemination of proven varieties of maize. Also, Tariq *et al*.(2014) also researched into the role of agricultural extension agents in enhancing tomato production in District Peshawar and concluded that tomato production increased considerably by 10.39% as a result of extension inference. However, the studies did not mention anything done in the area of efficiency among farms and more so use a control experiment method on the farmers who benefitted extension visits and those who were otherwise. This study aims at evaluating the difference in efficiency performance of farmers with and without extension visits in the previous planting season. In an effort to achieve this, the study aimed at answering the following research questions: What are the socioeconomic and input characteristics of the respondents? What are the individual farm's efficiency and their determinants? What extension approach is being used among the respondents? These and many other questions are hoped to be answered through empirical analysis of the subjects under study.

Objectives of the Study

The broad objective of the study is to examine the effect of agricultural extension on rural farm households' productivity in Oyo State. The specific objectives are to:

(i) identify and describe the socioeconomic and input characteristics of rural farm households;

(ii) analyse individual farm efficiency and its determinants among farming households and;

(iii) identify extension method used among respondents.

METHODOLOGY

The study was carried out in Iwajowa Local Government Area (LGA) of Oyo State, Nigeria. The Local Government is bounded to the North by Kajola LGA, in the East by Ibarapa North LGA, in the West by Benin Republic and bounded in the South by Ogun State. The demographic characteristics of the area showed the population to be 102,980 (National Population Commission, 2006). The mean annual temperature and rainfall of the area are 27^0C and 1350mm which enhances it the attribute of bi-modal rainfall and moderately weathered soil which retains nutrients at the soil surface for successful cultivation of shallow rooted crops (Oyo State Diary, 2010). The predominant occupation of the inhabitants is farming either on subsistence or commercial level. Notable crops cultivated in the area are: maize, sorghum, yam, cassava, watermelon and cowpea as arable crops while the surviving tree crops are: shear-butter, mango, cashew, and palm tree among others. Some of the existing social groups in the area which show the level of co-operation among the people in the area which include: Farmers' Cooperative Union (FCU), Thrift and Credit Society (TCS), Youth Progressive Union (YPU) and community Development Associations.

Primary data were used in the study and it was collected through the use of questionnaire and interview schedule. Respondents used in this study were contacted and interviewed using multistage sampling procedure. Random selection of Iwajowa LGA from existing 21 LGAs in the State as extension activities touch all the existing LGAs in the State due to the vibrant activities of Oyo State Agricultural Development Programme (OYSADEP). This formed the first sampling stage. The second stage was the random selection of twelve (12) communities namely: Iganna, Iwere-Ile, Idiko-Ile, Idiko-Ago, Joloko, Itasa, Budo Musa, Ayetoro-Ile, Ijio-Meso, Shamo, Ayetoro-Ile and Ayegun from Iwajowa LGA while the third sampling stage was the random selection of 30 respondents from each of the selected 12 communities. This brought the total sampling size to 360 respondents that formed the beneficiaries and non-beneficiaries of extension contact that were reached and interviewed.

Frequency counts and percentages was used in analysing socioeconomic characteristics of respondents and the type of extension methods used by extension agents to reach out to farmers while Stochastic Frontier Production Function(SFPF) was used to determine individual farm efficiency. The stochastic frontier production frontier analysis was used to estimate the coefficient of the parameters of the production function and also to predict the technical efficiencies of the poultry farms. The production technology of the farmer was assumed to be specified by the Cobb Douglas frontier production which is defined by:

$$\text{Log } Y = \log P_0 + P_1 \log X_{1i} + P_2 \log X_{2i} + P_3 \log X_{3i} + P_4 \log X_{4i} + P_5 \log X_{5i} + V_i + U_i \quad \text{(eq. 1)}$$

where:

Y = Quantity of Output (in kg)

X_1 = Farm size (in hectares)

X_2 = Labour use (in man-days)

X_3 = Seed use (in kilogram)

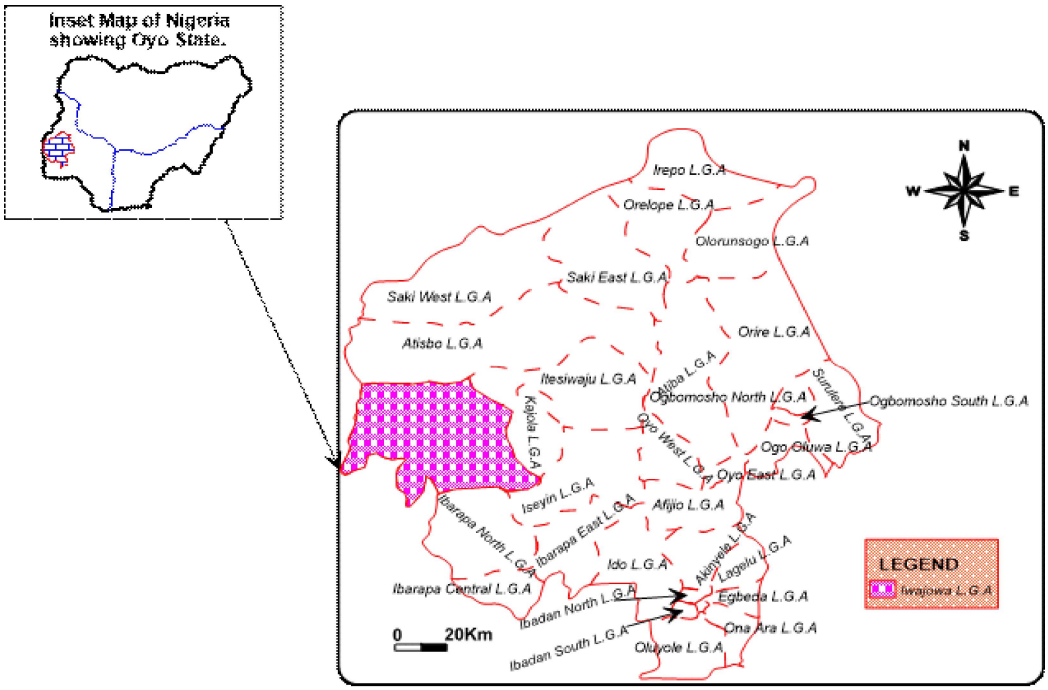

Figure 1: Map of Oyo State showing the Study Area

X_4 = Agrochemicals (in litres)
X_5 = Fertilizer use (in kilogram)
X_6 =No of Extension Contact
X_7 = Frequency of Extension Contact(in Nos)
V_i = Random errors which covers random effects on production outside the control of the decision unit and
U_i = Technical inefficiency effect which are the result of behaviour factors which could be controlled by an efficient management (Xu and Jeffrey, 1998). V's are random errors which are assumed to be independent and identically distributed normal random error having zero means and unknown variance, N (U, σ^2_v).
U's are technically inefficiency effects which are assumed to be independent of V's where U_j is defined by:

$$U_j = \delta_0 + \delta_1 Z_{ij} + + \delta_2 Z_{ij} + + \delta_3 Z_{ij} \qquad \text{(eq. 2)}$$

where Z_1, Z_2, and Z_3 represent age of farmers, years of education, and the years of experience of farmers. These are included in the model to indicate the possible influence of the farmers' socioeconomic characteristics on the technical efficiencies of the farmers. The βs, δs, σ_v^2, σ_u^2 and ϒ are unknown scalar parameters to be estimated. The variance of the parameter systematic, V and one sided U, δ_v^2 and δ_u^2 respectively and the overall model variance given as δ^2 are related thus:

$$\delta^2 = \delta u^2 + \delta v^2 \qquad \text{(eq. 3)}$$

The measure of total variation of output from the frontier which can be attributed to technical efficiency are lambda (λ) and gamma Ó (Battese and Corra, 1997). These variability measures are derived as follows:

$$\lambda = \text{So that } 0 \leq TE \leq 1 \qquad \text{(eq. 4)}$$

Test of Hypothesis

One sample t-test was used to test the hypothesis formulated in the study. The reason for the choice was the quantitative nature of the variables estimated.

RESULTS AND DISCUSSION

Socioeconomic characteristics of Rural Crop Farmers

Socioeconomic characteristics of rural crop farmers are presented in Table 1. Age of farmers shows that the majority (63.1%) are more than 60 years of age while the mean age was 65 years. This result suggests that, most of the farmers in the rural are aged. This is contrary to the demand of the farm practice most especially in the developing countries which are small scale and requires strong and agile people. Result on gender shows that about 72% of male farmers. It could be inferred from this result that farm activities requires a lot of energy which can ably be supplied by male farmers. Experience plays a significant role in farming; this helps a lot in efficient combination of input optimally. About 43% percent of farmers who are over 40 years of age represented greater proportion of the respondents. This suggests that, there is a direct relationship between the age of farmers in agricultural practices in the area and their respective ages, the mean age was 38 years. The majority (54%) of rural farmers under study had no formal education. This result still speaks volume of the deficiency that is still documentable in the area of education for the less privileged. This in most cases can result in low willingness on the part of farmers to receive extension visits hence, bereft of new and output-improving technologies.

The migrant status of respondents showed that more (62.2%) of the indigenes practised farming more than their non-indigene counterpart. This result suggests that farming is widely practised in the area and more so the traditional occupation of the people. The cropping system of respondents shows that the overwhelming majority (77.5%) practised intercropping, which inferred that farmers were inclined to maximizing the resources at their disposal to have optimal crop production. Cooperative membership result shows that most (72.5%) are members of cooperative society. This result showed that many of the farmers in the area cherished unity and self-help in kind and cash forms among their fellow farmers within the community.

About 59% of rural farmers were found to be non-members of the Farmers' Association organised in the area. It could be inferred from this result that, cooperation is still not encouraging in the area of the professional responsibility. This can result in reduction in technical information flow which may eventually affect farmers adversely. Extension education is of paramount importance to disseminating information which in turn results in good farm output. About 58% of the farmers under study were found to record null extension visits in the previous planting season. This is not good for the farming profession. This inability of farmers to benefit from extension programmes usually lead to information gap which invariably results in poor performance and attendant un-impressive output.

Input characteristics of Rural Farmers

Inputs use of farmers is pivotal to all farm activities everywhere and anywhere. Farm output of farmers in the study area was a maximum of 4.20t/ha, minimum of 0.85t/ha and an average of 1.93t/ha. The average output of farmers in the area is very low and revealed decreasing returns to scale. Farm size of respondents shows an average of 2.75ha and the respective of maximum and minimum sizes of 6.32ha and 0.41ha. It could be inferred from this result that most of the farmers in the area under investigation are small farmers who are resource poor and cultivate virtually small farm land (Adubi and Daramola, 1996).

Result of labour used by respondents reveals 73.3mandays as mean while the maximum and minimum were 264.65 man-days and 120.5 man-days respectively. This result showed that the mean man-day is very insufficient. This problem

Table 1: Socioeconomic Characteristics of Respondents

Variable	Percentage (N= 360)	Mean
Age (in years)		
≤20	11.1	
20-60	25.8	65 years
>60	63.1	
Gender		
Male	71.9	-
Female	28.1	
Farming Experience(in years)		
≤20	23.3	
21-40	33.6	
>40	43.1	38 years
Educational Level		
No Formal Education	54.2	
Primary	30.8	-
Secondary	15.0	
Tertiary	-	
Migrant Status		
Indigene	62.2	-
Settler	37.8	
Cropping System		
Sole Cropping	18.3	
Intercropping	77.5	-
Relay Cropping	4.2	
Co-operative Membership		
Member	72.5	-
Non-member	27.5	
Membership of Farmers' Association		
Member	41.1	
Non-member	58.9	-
Extension Visit		
Yes	42.5	-
No	57.5	
Total	**100.0**	

is traceable to insufficient labour availability in the rural area as there is a keen competition on labour between agricultural sector and industrial sectors in the city. This result in rural-urban labour drifts most especially the strong and agile ones while farm work is left for the aged who are devoid of enough vigour to perform productively.

Average seed used by farmers was 15.7kg while the minimum and maximum quantities were 5kg and 30kg. The mean seed rate is relatively normal but the minimum quantity of 5% is very small, most especially for cereal crops. Use of agrochemical by farmers had an average of 8lt/ha while the minimum and maximum quantities were 4 lt/ha and 25lt/ha respectively. This result shows that the use of agrochemicals in recent times is very high which its residual effect on farm land may be disastrous in future. For instance, the prevalent use of herbicide was informed by reduction in farm labour in the rural communities while weeding remained a necessity to avoid nutrient competition, if crops must perform well and give best of expected yield.

Table 2: Input Characteristic of Rural Farmers

Variable	Minimum	Maximum	Mean
Farm output/ha (in tonnes)	0.85	4.20	1.93
Farm size (in hectares)	0.41	6.32	2.75
Labour (in man-days)	120.5	264.65	73.3
Seed rate (in kg/ha)	5.0	30.0	15.7
Agrochemicals (in litres)	4.0	25.0	8.0
Fertilizer (in kg)	0.25	600	225

Source: Field Survey, 2016.

Nutrient availability in the soil for plant uptake is significant as it is required in optimal quantity for plant's vegetative and reproductive survival. Fertilizer use among respondents was found to be a maximum of 600kg and minimum of 0.25kg while the mean quantity used was 225kg. This result indicated that farmers had enough fertilizer to use in the previous planting season. The reason for this might be availability of fertilizer through the e-wallet (Growth Enhancement Scheme) from the Ministry of Agriculture, Natural Resources and Rural Development (MANRD).

Technical Efficiency of Categorised Rural Farmers *(Pooled Data, With Extension Contacts and Without Extension Contacts)*

Technical efficiency estimate of respondents in the pooled, farmers without extension contacts and those with extension contacts are presented in Table 2. For the pooled data, Sigma (σ) value of 0.81(81%) was found to be significant at 1% and gamma (ϒ) value of 0.82(81%) with 1% level of significant revealed that, about 18 %(1-0.82=100-82) of the variation in the technical efficiency of farmers was due to technical inefficiency.

All the modelled efficiency variables were found to be significant with various signs of interest. Labour and agrochemicals were found to increase the farm output under study while farm size, seed and fertilizer was found to significantly reduce the output of farmers. Therefore, a unit increase in the number of labour and the quantity of agrochemicals used in the production season increased the farm output by 0.6706 and 0.5199 units respectively. Conversely, a unit increase in farm size, quantity of seed, and fertilizer was found to reduce farm output by the margin of 0.3104, 0.1355 and 0.0745 units respectively. Moreso, age and experience of farmers also increased farm output. The mean technical efficiency of farmer was 0.87(87%) with the respective of maximum and minimum efficiency scores of 0.93(93%) and 0.10(10%) respectively. The mean technical efficiency is 0.87(87%).

Table 3 further presents result on farmers without extension contacts which forms 57.5% of the entire farmers under study. Gamma (ϒ), 0.76(76%) showed that about 24% of variation in technical efficiency was due to technical inefficiency and some uncontrollable environmental factors while sigma (σ), 1.18(118%) was found to be significant at 1%. Labour and agrochemicals were found to increase the efficiency of farmers in this category significantly, while, the efficiency of farmers was also significantly decreased by farm size, seed, and fertilizer. A unit increase in labour significantly increased the efficiency of farmers by 0.7435 units. It could be inferred from this result that with additional labour, there is an increase in farmer's efficiency, that is to say, there is more room to improve farm output with a marginal increase in labour use. Farm size, seed and fertilizer had inverse relationship with farmers' efficiency. Therefore, a unit increase in farm size, seed, and fertilizer leads on the average to the respective decrease in efficiency by 0.3479,

0.2017, and 0.6780 units. That is to infer that, marginal increase in the quantity of farm size, seed and fertilizer will be counter-productive. It has been overused already and any attempt to add more may lower farmer's efficiency frontier. Age and experience were also found to increase farmers' efficiency. A unit increase in age and experience of farmers will on the average leads to 1.5508 and 1.1459 increase in efficiency. With advanced age and experience, the frontier of efficiency attained by farmers increased among farmers without extension contacts in the previous season. The mean technical efficiency is 0.86(86%).

Result presented in Table 3 for farmers with extension contacts showed the values for sigma and gamma (Υ) as 0.83(83%) and sigma (σ) as 0.028(2.8%), also found to be significant at 1% level. Farm size, labour, and seed used were found to significantly increase the efficiency of farmers. A unit increase in farm size leads on the average to 0.1615 unit increase in the efficiency status of farmers. With more hectares of land cultivated, more output is achievable. Also, with a unit increase in labour use, there is 0.4487 unit increase in efficiency suggesting that, with more labour added in the production process, more output was feasible, while a unit increase in seed raised the level of efficiency of farmers by 0.9925 unit. It could also be inferred from this result that with marginal increase in the quantity of seed used, more output would be recorded. The mean technical efficiency is 0.92(92%).

Table 3: Maximum Likelihood Estimate (MLE) of Technical Efficiency of Rural Farmers

Variable		Pooled Data		Without Ext. Contacts		With Extension Contacts	
		Coefficient	T-ratio	Coefficient	T-ratio	Coefficient	T-ratio
Constant		3.7956***	4.46	0.3438***	3.38	3.8668***	6.44
Farm size	X_1	-0.3104***	-5.33	-0.3479***	-5.75	0.1615*	1.93
Labour use	X_2	0.6706**	2.59	0.7435***	3.13	0.4487**	2.63
Seed use	X_3	-0.1355**	-2.75	-0.2017***	-3.62	0.9924*	1.54
Agrochem.	X_4	0.5199***	5.69	0.1452	0.41	-0.6549	-0.95
Fertilizer	X_5	-0.0745**	-2.28	-0.6780*	-1.86	0.0294	0.28
Inefficiency variable							
Constant	δ_0	0.5747**	2.71	0.2181*	1.53	2.1581**	2.09
Age	δ_1	-1.3819**	-2.81	-1.5508***	5.77	-0.3470	-1.37
Education	δ_2	0.0105	0.08	0.1369	1.07	-0.1243**	-2.66
Experience	δ_3	-1.5968**	2.73	-1.1459***	-3.30	-0.2227**	-2.52
Diagnostics							
Gamma(Υ)		0.8267***	18.83	0.7601***	106.5	0.8322***	40.39
Sigma(σ)		0.8098***	18.36	1.1885***	6.24	0.0275***	15.2
Likel. ratio		256.2		299.9		100.9	
Log likehdfxn		-124.72		-196.72		-607.8	
Statistics							
Sample Size		360		207		153	
Mean TE eff.		0.87		0.86		0.92	
Max. TE eff.		0.93		0.96		0.99	
Min. TE eff.		0.10		0.09		0.63	

Source: Field Survey, 2016.

Input Elasticity and Return to Scale of Categorical Farmers With and Without Extension Contacts

The elasticity mean values of output with respect to the inputs are estimated at the values of the means of the resources in the cases of the pooled data, without extension contacts and with extension contacts in Table 4. The elasticity of mean value of farm output of the pooled data with respect to farm size, labour use, seed use, agrochemicals, and fertilizer for the pooled data are -0.31, 0.67, -0.14, 0.52, and -0.07 respectively. Likewise, for the farmers without extension contacts in the previous season, the elasticity of mean value of output were 0.35, 0.74, -0.20, 0.15, and -0.68 while the elasticity of mean of farm output are 0.16, 0.45, 0.99, -0.65, and 0.03 respectively. The RTS for the pooled data, without extension contacts and with extension contact are 0.67, 0.36 and 0.98 respectively. Farmers for the pooled data operate in the stage II of the production surface. The farmers are using the resources at their disposal optimally for optimum output. However, farmers without extension contacts operate at stage I on the production surface. This shows that there is still room for improvement for the farmers under null extension contact if information gap created by the lack of extension education is given a prime attention. Moreover, the chance of adopting new technologies and skill acquisition will be of a tremendous advantage that will launch them on the higher efficiency frontier.

Table 4: Input Elasticity and Returns to Scale of Categorical Farmers With and Without Extension Contacts

Variable	RTS (Pooled Data)	RTS (Without Extension Contact)	RTS (With Extension Contacts)
Farm size	-0.31	0.35	0.16
Labour use	0.67	0.74	0.45
Seed use	-0.14	-0.20	0.99
Agrochemicals	0.52	0.15	-0.65
Fertilizer	-0.07	-0.68	0.03
Total	**0.67**	**0.36**	**0.98**

Source: Field Survey, 2016.

Table 5: Frequency Distribution of Technical Efficiency Estimates

TE Range	Pooled Data	Without Ext. Contacts	With Ext. Contacts
	Percentage (N=360)	Percentage (N=207)	Percentage (N=153)
≤20	1.1	1.4	-
21-30	-	-	-
31-40	-	-	-
41-50	-	71.9	-
51-60	-	1.5	-
61-70	1.9	5.4	3.9
71-80	8.6	19.8	7.8
81-90	75.4	-	18.4
>90	13.0	-	69.9
Total	**100.0**	**100.0**	**100.0**

Source: Field Survey, 2016.

Contacts and With Extension Contacts

The distribution of technical efficiency in Table 5 shows that the technical efficiency skewed heavily in the 0.81 and 0.90 range for the pooled data representing 75.4% of the total sampled farmers. For the farmers without extension contacts, the technical efficiency score clustered within the range of 41-50 representing 71.9% while for the farmers with extension contacts the technical efficiency scores clustered within the range of more than 90.

Test of Hypothesis

The relationship between the farm output and the number of extension contacts among rural farmers in the planting season is presented in Table 6. The t-values were found to be very significant in both cases this translates into the level of significance at 1% level; null hypothesis was dropped while the alternative was chosen. The result suggests that there was a significant relationship between the quantity of farm output and the number of extension contacts recorded in the just ended planting season.

Table 6: Hypothesis Testing on the Significant Relationship between Farm Output and Extension Contacts

Variable	T-value	Df	Sig. (2-Tailed)	Mean Difference
Extension contacts	20.376	359	0.000	7.10
Farm output	12.768			3085.40

CONCLUSION AND RECOMMENDATIONS

The study evaluated the influence of extension contacts on the productivity of farmers and found that, farmers with extension contacts were more efficient than their counterparts who were not. This suggests strongly that farmers with extension contacts received education from extension agents coupled with availability of output enhanced technologies, and sequel to this was improvement in their skills. This, however, gave room to their ability to combine inputs optimally, which in turn resulted in higher input. Based on this, it could be recommended that:

1. More extension agents must be recruited in order to bridge the extension-farmer gap in terms of imparting output improving education.
2. Quality inputs, education, and new technologies must be made available to farmers timely.

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