Technology Differentials and Production Efficiency in Cassava-Based Production in Ogun State, Nigeria

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Abstract
This study was undertaken to analyse technology differential and production efficiency of traditional and modern farms cassava farmers in Nigeria, using as a case study farmers in Ogun State, which is one of the highest producers of cassava in the south-west geo-political zone. It considered the different net incomes of various farm categories and the relative levels and possible causes of the technical inefficiency as well as the nature of returns to scale between traditional and modern, small and large scale, and between mono and mixed crops cassava farmers. Ogun State is divided into four agricultural zones namely: Ilaro zone, Abeokuta zone, Ikenne zone and Ijebu zone. Two cells were randomly selected from each block. Data were collected during the field survey from 400 cassava farmers, selected through a multi-stage selection process using systematic random sampling technique. The translog stochastic frontier production function was fitted on the data. This was done using the stochastic frontiers version 4.1. Results of the study showed that cassava-based food crop production in Ogun State is characteristically carried out on smallholders production basis with a few of the farmers cultivating more than three hectares. Budgetary Analysis result revealed that traditional and modern farms made net farm profits of about (₦220,760.35 and ₦222,030.85). The estimated small and large farms' net farm profits was about ₦213,174.87 and ₦247,737.57 respectively. Also, mono and mixed crop farm generated net farm income of about ₦293,132.48 and ₦294,556.96 per annum, respectively. The finding implied that the current level of output from cassava farms can be increased by about 38% for all farms (aggregate), if all farm inputs are effectively utilized. It is thus recommended that a well monitored credit policy be put in place to enable the farmers acquire the necessary production inputs to boost their output. It is also recommended that government should intensify efforts to encourage the small-holders to improve upon their production practices.
Keywords: Technology, Efficiency, Differential, Budgetary, Stochastic

Introduction

Technology has made pertinent contributions to national progress and its usefulness has attained universal recognition both at national and international levels. In many developing countries including Nigeria, lack of appropriate technological and scientific knowledge application limits agricultural and economic progress (Adebayo 2006). In order to keep pace with the rapid rate of food demand, that is attendant upon rapid population growth and help to improve the gloomy food situation and its consequences, continuous research in food production and efficient extension services is highly desirable.

In Nigeria, modern agricultural technology has contributed significantly to agricultural development and the gap between developed and developing countries in the area of agricultural production can be attributed largely to differences in the level of technological development, adaptation and transfer process. In developed nations, there is an advanced level of technical know-how and widespread application of technological innovations resulting in high productive capability in agriculture as well as in industry (Odebode 1997).

Technology is very crucial to development. Many developed countries rely on land and labour within the existing national environment with increasing population, which invariably increased demand for more agricultural products. Technology is indispensable in the fight against hunger, food shortage, food insecurity and low productivity (Afolami 1997). It enhances agricultural production, fosters education and training, promotes information dissemination and facilitates effective utilization of natural resources.

Hence, in the development of agricultural technology, it is pertinent to consider its relevance and adaptability to farmer's environment, cropping systems, needs and aspirations of the intended beneficiaries. Abang and Agom (2004) supported this view by adding that such technology should be simple, consistent with farmer's needs have no conflict with the existing local environment and have high potential for economic returns. Therefore, agricultural technologies refer to the application of new methods or techniques to all agricultural activities such as cultivation, harvesting, storage, processing methods and marketing.

One of the agricultural problems in Nigeria, centres on the efficiency with which farmers use resources on their farms. It also borders on how the various factors that explain farm efficiency could be examined so as to improve the food production in the country. Cassava farms in Nigeria are mostly the small scale types which are characterized by very low productivity (FACU, 1992). The crucial issue in the Nigeria agriculture is that of low productivity. The problem of reducing crop productivity is important. Despite all human and material resources devoted to agriculture, productive efficiency for most crops still fall under 60% (FDA 1993; FDA 1995).

Farmers output must therefore be expanded with existing levels of conventional inputs and farm technology.

The present study therefore, is focused on analyzing resource utilization and efficiency in cassava production among cassava farmers under technology used, farm size and mono-cropping and mixed cropping production systems in Ogun State of Nigeria. The knowledge of the productivity of all farm resources will serve as a guide for adjusting resource allocation within the cassava production industry. Improvement in the level of resource-use by cassava farmers will no doubt have multiple benefits on the economy of Ogun State in particular, and the nation in general.

The broad objective of this study is to analyze the technology differentials and production efficiency in cassava production in Ogun State, Nigeria.

The specific objectives are

(i) to describe the socio-economic characteristics of cassava farmers in the study area;
(ii) estimate the net income associated with employment of production inputs by the technology used, farm size and cropping systems in the study area;
(iii) identify the factors which affect the efficiency of resource use among cassava farmers.

METHODOLOGY

Study Area and Methods of Data Collection

The empirical setting for the study is Ogun State. Both primary and secondary data were collected for this research. The primary data were gathered from a field survey using structured questionnaire. Specifically, information was sought on the cost-returns structure and input usage for the production of cassava in the study area. In this regard, sets of questionnaire that solicit basic information on cassava production in the study area were administered on respondents. In addition, the secondary data were extracted from published sources such as statistical abstracts, textbooks, journals, research reports, and bulletins obtainable from libraries and government ministries and agencies.

Sampling Techniques

A three-stage sampling procedure was used in drawing the survey respondents. Ogun State is divided into four Agricultural Divisions namely: Ilaro Zone, Abeokuta Zone, Ikenne Zone and Ijebu Zone. The first stage was to divide the Agricultural Zone into the four existing blocks, while the second stage involved in random selection of two cells from each block and the last stage involved random selection of fifty two (50) households from each of the eight (8) cells thus making a total of 400 respondents.

Methods of Data Analysis

Descriptive and inferential analytical techniques were used in this study. Descriptive analytical tools used include: frequency tables, percentages and ratio were used to describe the socio-economic and demographic characteristics, the cropping system practised by cassava farmers, and cassava production problems in the study area.

Inferential statistics such as the Budgetary Analysis was used to analyse the cost – returns structure and profitability of cassava production. Efficiency in the pattern of resource use in cassava production was determined using the Stochastic Frontier Production Function. Further, technical production functions for cassava production was estimated in two separate forms based on the technology used, the operated farm size, and the cropping system practised in the study area.

Analytical Framework/Model Specification

(i) **Net Income Analysis**

This was used to achieve specific objective (iii). The **Net Farm Income** (Profit) is calculated by deducting the total fixed cost from the farm gross margin. The mean Net Farm Income of each pair of farm was compared for significant difference using the **t-statistics**. This is perhaps the ideal way of comparing the performance of one enterprise (or group of enterprises) with another.

(ii) **Budgetary Analysis**

From the result of budgetary analysis, the following will be obtained:

(a) GM = TR – TVC ………… ..……..... ……… (1)
(b) NI = GM – TFC ………… ..……..... ……… (2)
(c) Profitability Index or Return on Sale = NI/TR ……….. ……… (3)
(d) The Rate of Return on Investment (%). ………..……… (4)
= RRI = (NI/TC) x 100 ………..……… (5)
(e) The Rate of Return on Variable Cost (%)
= RRVC = (TR – TFC)/TVC x 100 ………..……… (6)
(f) Operating Ratio = TVC/TR ……….. ……… ……... (7)

Where: (i) GM = Gross Margin; (ii) TVC = Total Variable Cost; (iii) PI = Profitability Index; (ii) TC = Total Cost; (iv) TR = Total Return; (v) NI = Total Fixed Cost

(iii) **Stochastic Frontier Production Function**

In this research, the Battese and Coelli (1995) model was applied to estimate the efficiency scores and to identify the socio-economic and institutional factors influencing technical efficiencies of cassava producers. In their model the technical inefficiency effect for the ith farmer, U_i, is obtained by truncation (at zero) of the normal distribution with mean, , and variance $^2{}_u$, such that:

$$U_i = Z_i\delta \text{ ……………………………………………………………………… (8)}$$

Where $_i$ is a vector of farm – specific explanatory variables and is a vector of unknown coefficients of the farm – specific inefficiency variables. For the investigation of the farm-specific technical efficiencies of cassava producers, the following stochastic frontier production function was estimated.

$$lnY = \beta_0 + \sum_{k=1}^{4} \beta_k \ln(X_{ki}) + \frac{1}{2}\sum_{k=1}^{4}\sum_{j=1}^{4} \beta_{kj} \ln(X_{ji}) + V_i - U_i \text{ ………………… (9)}$$

Where Y_i denotes total cassava output of the ith farmer in kg and X_k, k = j = 1, 2, 3, 4 are the four input variables included:

$_1$ = Land measures as total area planted to cassava in hectare,
$_2$ = Labour, for total family labour, exchange labour and hired labour used in mandays.
$_3$ = Fertilizer, as the total quantity of fertilizer used in kg; and
$_4$ = Cultivar planted in kilogram per hectare.

The V's are the random variables associated with disturbance in production and the U_i's are non-negative random variables associated with technical inefficiency of the ith farmer and are obtained by truncation (at zero) of the normal distribution with mean, , and variance $^2{}_u$ such that:

$$\mu_0 = \delta_0 + \sum_{m=1}^{9} \delta_i X_{mi} \text{ …………………………………… (10)}$$

Where $_i$ is a vector of the parameters of the inefficiency model to be estimated, and the $X_{m's}$, m = 1, 2, 3 …. 9, are the farm-specific socio-economic variables as well as the institutional factors hypothesized to influence efficiency of resource use by cassava farmers in Ogun State. In the translog frontier, the elasticity of the mean output with respect to land is also a function of the technical inefficiency effects because the model for the technical inefficiency effects is a function of land as specified in equation (3.10)

Technical inefficiency model

$_o$ = Intercept (constant)
$_{1i}$ = Purchased hybrid cultivar (kg)
$_{2i}$ = Tractor used (dummy)
$_{3i}$ = Educational level (years)
$_{4i}$ = Annual income per crop season (naira)
$_{5i}$ = Male headed (no. of persons)
$_{6i}$ = Household size (no. of persons)
$_{7i}$ = Age of the household head (year)
$_{8i}$ = Off-farm income (naira)
$_{9i}$ = Farming experience (year)
$_{10i}$ = Credit obtained (naira)

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Cassava Farmers

The descriptive statistics and frequency distribution of the farmers according to age and technology used are given in Table 1. For all farm categories, the farmers were aged ranging from 16-76 years old, with overall mean age of about 48 years. It is apparent that most of the farmers are in the active working age bracket of 20-60 years. Result of chi-square test of association between age of the household and technology used were significant. The results, however, point to the fact that relatively old household heads who are also most likely to have more farming members and experiences, tend to cultivate more cassava farms using modern technology than the younger ones.

The total household size of the respondents comprises of their wives, children and their dependants. In African setting, children and women labour constituted significant sources of labour for small scale farming. The findings revealed that the total household sizes ranging from 1 to 15 persons. The respondents with modern technology (51.9%) have 1-5 persons which is the highest modal class, while 49.2% of traditional farmers have 6-10 people in their household used for family labour. This suggests that as the household increases, the more tendencies for farmers to diversify against risk and make way for increased productivity.

Education is an indispensable tool needed to enhance technical advancement in agricultural production. It enables the farmers to adjust their input combination (especially the improved or modern inputs) towards achieving the economic optimum. Generally, most of the farmers (about 29.2%, 31.9% and 31.0%) of traditional, modern farmers and all farms holders respectively had at least primary education. However, by implication, only about (14.6%, 13.3% and 13.8%) of traditional and modern farmers and all technology farm holders respectively, are illiterate. The cassava farmers can therefore be regarded to be generally literates. The experience gained by farmers as measured by the numbers of years the farmers has been into farming has bearing on their resources used and overall management of their farms. Some of the farmers (25.4%, 29.3% and 28.0%) respectively of traditional, modern and all farm holders had between 11-20 years of farming experience. The implication is that technology used is not generally determined by the number of the years of farming experiences, rather, is a function of enlightenment, education, awareness, land, labour, and capital.

The farmers' level of output shows the result of application of the farm business enterprise. The value of farm output ranged from ₦4,266.00 to ₦9,500,000.00 with a mean of ₦323,730.99. The mean farm annual income is comparatively higher than the mean expenditure. This implies that income realized might be used to improve the standard of living.

Table 1: Socio-Economic Characteristics of the Respondents

Variables	Traditional Technology		Modern Technology		All technology	
	Frequency	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Age (years)						
≤ 20	1	0.8	5	1.9	6	1.5
21 - 40	34	26.2	78	28.9	112	28.0
41 – 60	72	55.4	138	51.1	210	52.5
61 – 80	23	17.7	49	18.1	72	18.0
Total	**130**	**100**	**270**	**100**	**400**	**100**
X^2cal = 1.235, df = 3, p ≤ 0.05 = 0.745 Comment: Not Significant (NS)						
Sex						
Male	105	80.8	225	83.3	330	82.5
Female	25	19.2	45	16.7	70	17.5
Total	**130**	**100**	**270**	**100**	**400**	**100**
X^2cal = 0.400, df = 1, p ≤ 0.05 = 0.527, Comment: NS						
Marital Status						
Single	14	10.8	30	11.1	44	11.0
Married	94	72.3	179	66.3	273	68.3
Divorced	7	5.4	12	4.4	19	4.8
Separated	11	8.5	30	11.1	41	10.3
Widow/Widower	4	3.1	19	7.0	23	5.8
Total	**130**	**100**	**270**	**100**	**400**	**100**
X^2cal = 3.632, df =4, p< 0.05 = 0.458 Comment: Not Significant						
Household Size						
1 – 5	54	41.5	140	51.9	194	48.5
6 – 10	64	49.2	104	38.5	168	42.0
11 – 15	12	9.2	26	9.6	38	9.5
Total	**130**	**100**	**270**	**100**	**400**	**100**
X^2cal =4.337, df = 2, p< 0.05 = 0.114 Comment: Not Significant						
Educational Level						
No formal Educ.	19	14.6	36	13.3	55	13.8
Primary School	38	29.2	86	31.9	124	31.0
Secondary School	50	38.5	112	41.5	162	40.5
Tertiary Institution	23	17.7	36	13.3	59	14.8
Total	**130**	**100.0**	**270**	**100.0**	**400**	**100.0**
X^2cal = 1.627, df = 3, p≤ 0.05 = 0.065 Comment: Significant						
Occupation						
Transporter	53	40.8	91	33.7	144	36.0
Trader	21	16.2	42	15.6	63	15.8

Artisan	9	6.9	20	7.4	29	7.3
Civil servant	19	14.6	24	8.9	43	10.8
Farming	28	21.5	92	34.1	120	30.0
fishing	-	-	1	0.4	1	0.3
Total	**130**	**100**	**270**	**100**	**400**	**100**
X^2cal = 9.020, df = 5, p≤ 0.05 = 10.8; Comment: Significant						
Farming Exp.						
≤ 10	36	27.7	67	24.8	103	25.8
11 - 20	33	25.4	79	29.3	112	28.0
21 – 30	31	23.8	57	21.1	88	22.0
31 - 40	23	17.7	44	16.3	67	16.8
41 – 50	5	3.8	19	7.0	24	6.0
Above 50	2	1.5	4	1.5	6	1.5
Total	**130**	**100**	**270**	**100**	**400**	**100**
X^2cal = 2.644, df = 3, p< 0.05 = 0.755 Comment: Significant						
Off-Farm Income						
≤ 50000	50	68.5	90	66.2	140	67.0
50001-100000	6	8.2	20	14.7	26	12.4
100001 -150000	2	2.7	10	7.4	12	5.7
150001 -200000	1	1.4	2	1.5	3	1.4
200001 – 250000	3	4.1	3	2.2	6	2.9
250001 – 300000	2	2.7	2	1.5	4	1.9
Average 300000	9	12.3	9	6.6	18	8.6
Total	**73**	**100.0**	**136**	**100**	**209**	**100**
X^2cal = 6.207, df = 6, p≤ 0.05 = 0.400. Comment: Significant						
Farm Output (₦)						
≤ 50000	17	13.1	66	24.4	83	20.8
50001-100000	20	15.4	39	14.4	59	14.8
100001 -150000	13	10.0	17	6.3	30	7.5
150001 -200000	8	6.2	14	5.2	22	5.5
200001 – 250000	22	16.9	39	14.4	61	15.3
250001 – 300000	16	12.3	21	7.8	37	9.3
Average 300000	34	26.2	74	27.4	108	27.0
Total	**130**	**100.0**	**270**	**100**	**400**	**100**
X^2cal = 9.623, df = 6, p≤ 0.05 = 0.141; Comment: Significant						

Source: Field Survey, 2012

Estimated Net Farm Income from Cassava Production per hectare

The seemingly higher mean gross income generated by modern farms compared to traditional farms could be the result the more intensive use of resources by the former group of farm than the later. Across all farms, average gross revenue of ₦221,495.59 was generated. The net farm incomes generated by the cassava producers were estimated and given as the difference between the gross/total revenue from production and the sum of the variable and fixed costs per hectare and are as presented in Tables 2 and 3 for traditional and modern farmers, farm size and cropping pattern categories respectively.

Across all farms, total variable cost and total fixed cost of about ₦54,279.14 and ₦47,956.25 were estimated respectively. This gave an average net farm income over average total cost of production per hectare; about ₦216.65 return on investment was made per hectare. This implies that for each ₦1.00 spent for production about ₦216.65 was made as net farm income.

According to farm categories, small farms made an average total cost of production of ₦96,710.50 and average total net farm income of about ₦213,174.87. This represents a percentage net farm income over cost of production of about ₦220.42. Large farms on the other hand incurred an average total cost of production of about ₦247,737.57. This represents a percentage net farm income over cost of production of about ₦174.14. This indicates that the small farms do not only made marginally higher gross farm income but also made higher returns for each naira spent on production than large farms. In other words, small farms appear to be more profitable, when viewed from the point of return on investment in the short run.

Similarly, on the basis of cropping pattern, mixed crop farms incurred an average total cost of production of about ₦103,073.76 and made an average net farm income of about ₦294,556.96. This represents a percentage return of about ₦285.77. In the same vein, mono-crop farm incurred an average production cost of about ₦94,995.99 and made average net farm income of about ₦308.56 return on investment. The implication is that mixed crop farms appear to be more profitable than mono-crop farms. This is expected because there is more intensive use of resources in mixed crop farms than in mono-crop production systems. A number of authors, (Polson and Spencer 1992; Manyong *et al* (1999); Sullivan 2001), have acknowledged the supremacy of mixed crop farms over mono-crop farms resource use and factor productivity.

Table 2: **Net Farm Income Analysis per Hectare (Traditional & Modern Technology)**

Revenue/cost items (₦)	Traditional Technology	Modern technology	All farms
Gross Revenue	320,363.73	325,352.27	323730.99
Production Expenses			
Variable Cost			
Cassava cutting	2,809.85	3,429.13	3,214.65
Fertilizer	3,446.47	3,071.90	3,202.46
Other agro-chemical	4,723.07	6,763.04	6,079.20
Labour			
Family labour	21,322.07	19,625.34	20,209.54
Hired labour	4,803.76	4,282.52	4,454.94
Tractor hire services	8,230.08	5,457.84	6,446.05
Transportation	10,744.08	10,636.22	10,672.30
Total Variable Cost	56,079.18	53,265.99	54,279.14
Fixed Costs			
Interest on loans	12,359.90	21,668.15	18,687.08
Fixed asset depreciation	4,999.83	3,507.87	3,992.76
Rent on land	26,164.47	24,879.41	25,276.42
Total Fixed Cost	43,524.20	50,055.43	47,956.25
Total Cost per hectare	99,603.38	103,321.42	102,235.40
Net (return) Farm Income	220,760.35	222,030.85	221495.59
% Net Return over Tc/ha	221.63	214.89	216.65

Source: Field Survey, 2012

Table 3: **Net Farm Income Analysis by Farm Size and Cropping Pattern**

Revenue/cost item (₦)	Small Farm	Large Farm	Mono Cropping	Mixed Cropping
Gross Revenue	309,885.37	386,805.51	388,132.07	397,630.72
Production Expenses				
Variable Cost				
Cassava cutting	3,479.31	1,972.22	3,760.41	3,0477.47
Fertilizer	3,194.96	3,270.00	3,470.00	3,157.88
Other agro-chemical	4,869.33	13,325.59	7,318.47	5,821.02
Labour				
Family labour	22,142.59	10,186.33	10,350.46	22,683.54
Hired labour	4,905.15	2,264.38	1,510.28	5,149.44
Tractor hire services	6,703.21	4,500.00	12,058.49	5,319.31
Transportation	12,042.80	1,157.14	4,166.66	11,122.70
Total Variable Cost	57,337.35	36,675.66	42,634.77	56,310.68
Fixed costs				
Interest on loans	10,55.10	71,247.43	32,350.19	17,502.19
Fixed asset depreciation	4,405.55	2,112.25	2,949.06	4,253.68
Rent on land	24,412.50	29,032.60	26,065.57	25,016.21
Total fixed cost	39,373.15	102,392.28	52,364.82	46,772.08
Total cost per hectare	96,710.50	139,067.94	94,999.59	103,073.76
Net (return) farm income	312,174.87	247,737.57	293,132.48	294,556.96
% Net return over Tc/ha	220.42	178.14	308.56	285.77

Source: Field Survey 2012.

Stochastic Frontier and Inefficiency Model for Different Farm Categories

It is important to note that Technical Efficiency (TE) can only be estimated if the inefficient efforts are stochastic and has particular distributional specification (Battesse and Coelli, 1996). One of the assumptions, made in this study is that the U*i* is negative truncations of the $N(O,\sigma^2)$ with half normal distribution. In order to confirm the assumed distribution, a kernel density function is plotted in Limdep (Green, 2000) with a truncated half normal distribution of the inefficiency measuring variable. This is an indication that the assumption that U_i is non-negative truncated half normal distribution is probably correct. Technical Efficiency (TE) is calculated using the conditional expectation of the stochastic equation, condition of the composed error ($e_i=v_i–u_i$), and evaluated using the estimated parameter presented in Tables 4.

Most of the variables that determined inefficiencies are also statistically significant. It is evident that the estimates of γ is 0.660 and 0.679; and σ^2 is 1.348 and 2.019 respectively for traditional and modern technology farms categories and they are significantly different from zero, indicating a good fit and correctness of the specified distribution assumption. Lamda (λ) is the ratio of variances of $U(\sigma_u)$ to variance of $V(\sigma_v)$ and is an indication that the one sided error term U dominates the symmetric error v, so variation in actual cassava yield comes from differences in farmer's practice rather than random variability. Gamma (γ) $=\sigma^2_u/(\sigma^2_u+\sigma^2_v)$ is also a measure of level of the inefficiency of the variance parameter, it ranges between 0 and 1. For the translog model, gamma γ is estimated at 0.660 for traditional farms, which can be interpreted as follows: 66.0 percent of random variation in cassava production is explained by inefficiency.

In Table 4, the analysis reports on sources of inefficiency were estimated in the model. A negative sign of the parameter of inefficiencies means that the variables reduce technical efficiency, while positive sign increases technical in efficiency. The results on table 4.43 revealed the use of tractors for land preparation, the number of years in school, annual income, male headed households size, farm experiences and credit obtained have negative signs, and therefore reduce technical inefficiency (or increase technical efficiency). These results seem plausible. It is important to note that these coefficients should not be directly interpreted and hence marginal effects using the formula recommended by Battesse and Coelli (1993).

Table 4: **Technical Efficiency Analysis for Traditional and Modern Technology used by the Respondents**

Model Variables	Parameters	Traditional Technology		Modern Technology		All Farms	
Stochastic Frontier Variables		Coefficients	Standard Error	Coefficients	Standard Error	Coefficients	Standard Error
Intercept	α_o	44.923**	15.521	17.718***	1.056	19.044***	1.228
Lnfertilizer	α_1	*	2.392	1.495	0.982	0.428	0.983
Lncultivar	α_2	-1.004	3.362	-0.865***	0.278	-0.697***	0.241
Lnlabour	α_3	-	1.403	-0.592**	0.276	-0.841***	0.281
Ln(fertilizer)^2	α_4	8.708***	0.364	-0.216	0.216	-0.254	0.191
Ln(cultivars)^2	α_5	1.184	0.206	0.003	0.010	0.008	0.009
Ln(labour)^2	α_6	0.125	0.038	0.013	0.024	0.017	0.021
Ln(fertilizer)Ln(cultivar	α_7	0.595***	0.256	0.018	0.057	-0.005	0.057
s)		0.006	0.124	-0.125	0.097	0.034	0.083
Ln(fertilizer)Ln(labour)	α_8	0.061	0.152	0.086***	0.029	0.065**	0.026
Ln(cultivars)Ln(labour)	α_9	0.115	0.033	-0.003	0.023	-0.001	0.019
Ln(Land)	α_{10}	-0.165					
		0.032					
Inefficiency Variables							
Constant	δ_o	1.147	1.082	2.292***	0.712	1.507**	0.595
Purchased hybrid	δ_1	0.002	0.001	0.147	0.982	0.010	0.002
cultivar	δ_2	-0.095**	0.004	-0.333***	0.002	-0.037***	0.002
Tractor used	δ_3	-0.645**	0.312	-0.053**	0.168	-0.140	0.139
School year	δ_4	-0.008	0.013	0.018	0.001	0.090	0.001
Annual income person	δ_5	-0.027	0.074	0.199***	0.070	0.132**	0.054
Male headed	δ_6	-0.056	0.078	-0.075	0.064	-0.079	0.052
Household size	δ_7	0.040	0.025	-0.057	0.018	0.013	0.016
Age of the household	δ_8	0.002*	0.001	-0.082	0.009	0.012*	0.006
head	δ_9	-0.030	0.021	0.023	0.017	0.037	0.015
Off farm income	δ_{10}	-0.062	0.401	-0.020***	0.003	-0.020***	0.005
Farming experience							
Credit obtained							
Sigma-squared	$\sigma^2=\sigma^2_v+\sigma^2_u$	1.348***	0.400	2.019***	0.318	2.095***	0.240
Gamma	$\gamma=\sigma^2_u/\sigma^2$	0.660***	0.141	0.679***	0.069	0.646***	0.066
Log likelihood function	L(Hi)	-172.879		-420.120		619.150	
Mean Technical Efficiency	XTE	0.495		0.394		0.450	

*Note: Variables in parenthesis are quadratic structure in translog stochastic frontier model to bring about negativity in order to reduce technical inefficiency. It is obtained by partial differentiation of technical efficiency indicator. *** = Significant ($p\leq0.01$); ** = Significant ($p\leq0.05$); * = Significant ($p \leq 0.10$)*

Source: Field Survey, 2012

CONCLUSION AND RECOMMENDATIONS

The study concludes that modern technology cassava-based farmers are relatively more economically and technically efficient than traditional technology farmers. Traditional farmers do not have absolute allocative efficiency in the use of labour and intermediate materials due to inability to adopt improved technology or failure to keep appropriate records of inputs that are required in cassava production. The result of the budgetary analysis revealed a higher farm income for the modern cassava farms compared with traditional cassava farms that had a lower value.

The result of the study shows that cassava production in Ogun State is characteristically on small holder production bases, with a few of the farms being merely more than three hectares. Mixed cropping predominates over sole cropping with the former serving to stabilize the income of the farmers. Although there was evidence of sub-optimal use of resources by the farmers, the results of the study suggest that modern, large and mixed crop farmers are more productive and technically more efficient than traditional, small and mono crop farmers. It is recommended that government should intensify effort to encourage the small holders and traditional farmers to improve upon their production practices, since the food security of the nation, and success of the new non-oil export drive by the government depends on them in the short run.

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