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Full Length Research Paper

Labour use efficiency in food crop production by farmers in Ogun State, Nigeria

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This study examined the pattern (sources and contract form) of labour use and the effects on production efficiency of food crop farms in Ogun State, Nigeria. The study was based on primary data collected from a cross - section of 170 food crop farmers that were selected using a multistage sampling technique. The data were collected using structured questionnaire and analyzed using descriptive and regression (Multinomial logit, Tobit and Stochastic frontier) techniques. The study showed that majority (82.4%) of the food crop farmers were males, aged between 41 and 60 years (66.4%) and had at least primary school education (91.2%). The mean household size was five persons. The mean farm size was 1.8 ha with a mean farming experience of 25 years. The most widely used labour source for crop production in the area was household members. However, 64.1% of the farmers also recruited some hired labour. These were mostly employed on annual (46.8%) and /or job specific (33.9%) contracts. The mean labour use by farmers in the sample was 72.6 manday/ha; 34.6% of which were supplied by household members, 33.5% by labour hired on Annual Contract (AC), 14.5% by labour hired on Job Specific Contract (JSC) and the rest (10.8%) by Daily Paid Contract (DPC). The mean technical, allocative and overall economic efficiency were respectively 81.9, 42.0 and 34.4.0%. Stochastic frontier and Tobit regression analysis revealed that while the use of labour hired on DPC is associated with higher Technical Efficiency (TE), Allocative Efficiency (AE) and overall Economic Efficiency (EE) than what obtained with reliance on only household labour, the difference are not statistically significant. However, the use of labour hired on JSC is associated with significantly ($p<0.01$) higher TE but significantly ($p<0.01$) lower AE and overall EE. Similar results were obtained in respect of AC, while the use of labour saving technologies (herbicides and tractor services) were revealed to be associated with significantly ($p<0.05$) higher TE, AE and EE. The study concludes that although the use of JSC and AC could increase TE of farmers, it is at a cost of higher allocative and overall economic inefficiency. However, EE could be enhanced by increase use of labour saving technology including herbicides and tractor services. Hence the study recommends farmers should be taught the modern technology of food crop production to enhance the efficiency of production.

Key words: Food crop farms, production efficiency, Ogun State, Nigeria.

INTRODUCTION

The Nigerian economy had substantially depended on agriculture as a source of food products, raw materials for industrial sector and foreign exchange earnings (Arene and Mkpado, 2002). It is the dominant sector in the Nigeria economy and the second largest earner of foreign exchange next to the non –sustainable petroleum sector

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(Ayanwale, 2002). Agriculture, as a strong and efficient sector in the past had a multiplier effect on the nations" socio-economic and industrial fabric. This was reflected on its multifunctional nature as the largest employer of labour force, which accounted for 72.9% in 1961, 88% of export revenue with over 60% contribution to gross domestic product (GDP) (FAO (Food and Agricultural Organisation) of United Nations, 2007). These needs were however met mainly by subsistent farmers and at that time agriculture was characterized by scarce capital input, high labour supply, abundant land and simple tools (Osugiri, 1996).

Over the years, however, the relative contribution of the Nigeria agricultural sector has been declining, its contribution to export revenue decline from 43% in 1970 to 5% in 2008 (CBN, 2009). Similarly the percentage contribution of the sector raw materials to merchandise export has fallen significantly from 11% in 1965 to about 0.01% in 2003 (WDI, 2006).

In addition, the contribution of agricultural sector to the nation gross domestic product which stood at over 60% in the 60s has declined to 33.4% (Shittu, 2008). This decline has been attributed to the neglect of agricultural sector in pursuit of oil revenue, with its attendance mass movement of economically active population who hitherto engaged in agricultural sector to non-farm sector. This massive movement of predominantly young and educated members of the rural farm household has great implication on the nation agriculture. According to Shittu (2008), it leads to (a) Rapid Urbanisation (b) Demographically unbalanced population (c) Scarcity of labour (d) Low productivity in agriculture.

Human labour is about the only form of farm labour available to small holder farmers in Ogun State and Southwest of Nigeria. This form of labour accounts for up to 80% of total farm power and constitute between 80 and 90% of the cost of production in many farming systems (Awoyemi, 1981; Dvorak, 1996).

Labour plays a central and crucial role in agricultural production, particularly under small scale peasant production system. The smallholder farmers contribute the largest proportion of total domestic agricultural output in their area. Thus, the hope of continuing supply of food need of ever growing population anchors very auspiciously on human labour.

In line with the relevance of labour to agricultural production in developing countries like Nigeria, this study is designed to examine labour use and production efficiency of food crop farms in the study area.

This study is therefore designed to provide answer to the following questions: What are the different types of labour available for food crop farm households in the study area? Is there any significant difference in the production efficiency of farm household across labour use category? The study will therefore analyse labour use and production efficiency of food crop farms in the study area.

METHODOLOGY

The study was carried out in Ogun State, Nigeria. A multistage sampling procedure was employed to select the respondents for the study. The State was divided into four agricultural zones by the Ogun State Agricultural Development Programme (OGADEP), these are Abeokuta zone, Ikenne, Ilaro and Ijebu-Ode zone. In the first stage of the sampling procedure, 50% of blocks in the Four Agricultural Development Zones (ADPs-Abeokuta, Ilaro, Ikenne and Ijebu-Ode) were randomly selected. Thus, in the first stage a total of 10 blocks were selected. In the second stage, 25% of cells from each selected block were randomly selected [Within each selected block there were between four and eight (4 and 8) cells per block] making a total of 17 cells. This was followed by random selection of two (2) sub cells from each cell making 34 sub cells. In the final stage, five (5) farm households were randomly selected given a total of 170 farm households, whose household heads were interviewed. Primary data on household"s farm activities used for the study were collected with the aid of questionnaire. They were then analyzed using descriptive statistics, multiple regression analysis and multinomial Logit model.

Data analysis

Descriptive and quantitative methods (stochastic frontier function, Tobit regression model and multinomial model.) were employed for the analyses of data for the study.

Stochastic frontier cost function

Following Yu et al. (2012) and Amaza and Olayemi (2001), Cobb-Douglas cost frontier function for the farm households in the study areas specified as;

$$C = f(Ps, Q, \acute{\alpha}) \quad \text{(Implicit)} \qquad (1)$$

$$\ln C = \acute{\alpha}_0 + \acute{\alpha}_1 \ln P_1 + \acute{\alpha}_2 \ln P_2 + \acute{\alpha}_3 \ln P_3 + \ldots$$

$$+ \acute{\alpha}_6 \ln P_6 + \acute{\alpha}_7 \ln Q + Vi - Ui \qquad (2)$$

Where:
C = Total Production cost per farm household
$\acute{\alpha}_0$ = Constant. P_1 = Rent (₦); P_2 = Wage rate (₦)
P_3 = Average price of planting materials (₦); P_4 = Fertilizer price/kg (₦)
P_5 = Herbicide price/litre (₦); P_6 = average rate of tractor hiring per hectare (₦)
Q = Value of Output (₦); $\acute{\alpha}$ = parameters to be estimated.

The estimated cost inefficiency model is presented thus:

$$C^I = \alpha_0 + \alpha_1 S_1 + \alpha_2 S_2 + \alpha_1 S_3 + \alpha_4 S_4 + \alpha_5 S_5 + \ldots\ldots + \alpha_{10} S_{10} \qquad (3)$$

Where;

C^I = Cost Inefficiency
S_1 = Sex (1 if male, 0 otherwise);
S_2 = Age of farmer (years)
S_3 = Marital status (1 if married, 0 otherwise); S_4 = Farming Experience (years)
S_5 = Labour type (1 if hired, 0 otherwise)
S_6 = Contract type (1 if daily contract, 0 otherwise)
S_7 = Contract type (1 if job specific contract, 0 otherwise)
S_8 = Contract type (1 if annual contract, 0 otherwise)
α = parameter to be estimated.

The farm level economic efficiency (EE) was obtained using the relationship;

EE = 1/ Cost efficiency (4)

Hence economic efficiency (EE) is the inverse of Cost efficiency (CE). While farm level allocative efficiency (AE) was obtained using the relationship;

Allocative Efficiency (AE) = EE/ TE (5)

Tobit regression model

The model was used to determine the effect of farm specific and socio-economic characteristics on the efficiency of the farms. Tobit regression model specified below based on Charvas et al. (2005) and Loureiro (2009)

$Y = \beta 0 + \beta iXji + Ui$ (implicit) (6)

$Y = \beta o + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} +$.....

$+ \beta_{10} X_{10i}$ (Explicit) (7)

Where:
Y = Technical efficiency values for each household
X_1 = Age of the farmer (year), X_2 = Sex of the farmer (males=1, female=0)
X_3 = Educational level, X_4 = Farm size (ha), X_5 = Farming experience (year)
X_6 = Contract type (daily paid contract=1, other=0), X_7 = Contract type (job specific contract=1, other=0), X_8 = Contract type (annual contract=1, other=0), X_9 = Use herbicide (Yes=1, No=0)
X_{10} = use of tractor (Yes=1, No=0), β"s = Parameter to be estimated
Ui = Error term

Similar Tobit regression model were specified for allocation and economic efficiency respectively.

Maximum likelihood estimate of the parameters of the stochastic frontier cost functions

The result shows that all the co-efficient of the stochastic cost function conform to the *a-prior* expectation; they have positive signs. This implies that as these factors increased, total production cost increase ceteris paribus. The sigma squared was significant ($p<0.1$) different attesting to the good fit of the model. The variance ratio (gamma) estimated revealed that there was occurrence of cost inefficiency effects among the farm household as confirmed by the significance of gamma value of 0.699 ($p<0.1$). This implies that about 70% variation in total production cost of households is due to the difference in their cost efficiencies. The constant term 6.0759 was significant ($p<0.1$). This is because the expenses on fixed factors of production such as land, farm machineries and tools would keep running whether or not production takes place. Specifically, the coefficient of land rent (0.3611), fertilizer price (0.0556) and tractor services (0.0343) were positive and each was significant at 1% level of significance. Although, the existence of cost inefficiency was highly significant, many of the farm specific variables that are included to explain the sources of inefficiency were insignificant, except for age and contract type dummy (Table 1).

Tobit estimates of determinants of the efficiency of food crop farms

The Tobit regression model was used to identify the factors influencing the efficiency of food crop production in the study area. The maximum likelihood estimates of the Tobit regression model and the sigma square result of the model are significant ($p<0.01$), attesting to the good fit of the model. Ten explanatory variables were considered in the model, out of which four variables significantly determined the technical efficiency, six variables significantly determined allocative efficiency while three variables significantly determined economic efficiency (Table 2).

Technical efficiency

Estimate of the parameters of Tobit regression model revealed that all the estimated coefficients of the variables were positive except age and educational level (Table 3). The positive coefficient of farm size, farming experience, off - farm income and contract types imply that as the percentage of each of these variables increased there is likelihood of percentage increase in food crop production.

The age of farmer significantly ($p<0.01$) but negatively influenced technical efficiency, this implies that the older the farmer, the lower the likelihood of being technically efficient. The coefficient of farming experience is positively significant ($p<0.01$), this showed that the more experienced the farmer in the art of food crop production, the higher the probability of being technically efficient. The result further showed that farmers using job specific

Table 1. Farm households" cost efficiency.

Variables	Coefficient	Std. Error	t – value
Constant	6.0759	0.6670	9.10
Rent (N)	0.3611***	0.0448	8.06
Wage (N)	0.05198	0.05864	0.886
Price of planting material (N)	0.0019	0.0166	0.110
Price of Fertilizer (N)	0.0556***	0.0182	3.05
Price of Herbicide (N)	0.0077	0.0139	0.55
Tractor service(N)	0.0343***	0.0126	2.72
Output (N)	0.1222***	0.0366	3.34
Sigma-squared	0.2251***	0.0392	5.74
Gamma	0.6990***	0.2730	2.56
Inefficiency Model			
Sex	-0.0210	0.1352	-0.15
Age	0.0106**	0.0048	2.20
Marital status(married=1,others =0)	- 0.2415	0.1530	-1.58
Farming experience (years)	-0.0019	0.0041	- 0.46
Labour type (Hired = 1,household = 0)	0.1933	0.2690	0.72
Contract type (Daily Contract =1,others= 0)	-0.2184	0.2842	-0.76
Contract type(Job Specific Contract =1,others= 0)	0.2119	0.2158	0.98
Contract type(Annual Contract=1,others= 0)	0.4656**	0.2183	2.13
Log likelihood function = -0.9986			

***Coefficients significant at 1%**Coefficients significant at 5%; *Coefficients significant at 10%. Source: Computed from Field survey data, 2011.

Table 2. Distribution of food crop farmers by technical, allocative and economic efficiency.

Efficiency (%)	Technical efficiency					Allocative efficiency					Economic efficiency				
	Family	Daily Paid Contract	Job Specific Contract	Annual Contract	%	Family	Daily Paid Contract	Job Specific Contract	Annual Contract	%	Family	Daily Paid Contract	Job Specific Contract	Annual Contract	%
< 40	2	0	0	3	2.94	17	5	20	30	12.94	31	13	31	41	68.24
41 – 60	4	0	0	2	3.53	10	8	8	11	26.47	19	8	3	2	18.82
61 – 80	16	6	2	15	22.94	12	9	5	1	32.35	7	3	3	1	8.24
81 – 100	39	21	36	24	70.59	22	5	5	2	28.24	4	3	1	0	4.70
Total	61	27	38	44	100.0	61	27	38	44	100.0	61	27	38	44	100.0
Mean	0.80	0.83	0.92	0.76	-	0.63	0.60	0.47	0.39	-	0.45	0.47	0.36	0.32	-
Minimum	0.14	0.69	0.88	0.24	-	0.35	0.30	0.17	0.23	-	0.33	0.21	0.16	0.19	-
Maximum	0.92	0.90	0.94	0.91	-	0.99	0.99	0.90	0.99	-	0.85	0.84	0.82	0.78	-

Source: Computed from field survey data, 2011.

Table 3. Tobit estimates of determinant of production efficiency of food crop farmers.

	Technical efficiency			Allocative efficiency			Economic efficiency		
Variables	**Coefficient**	**Std. Error**	**t- ratio**	**Coefficient**	**Std. Error**	**t- ratio**	**Coefficient**	**Std. Error**	**t- ratio**
Constant	0.8157	0.0380	21.47	0.7256	0.1025	7.08	0.6803	0.0655	10.39
Age (years)	-0.0038***	0.0008	-4.75	0.0059***	0.0021	2.81	-0.0033***	0.0013	-2.53
Sex	0.0401**	0.0173	2.32	-0.0390	0.0467	-0.84	0.0090***	0.0030	3.00
Educational level	-0.00017	0.0014	-0.12	0.0014	0.0038	0.37	-0.0066***	0.0024	-2.75
Farm size (ha)	0.0025	0.0025	1.00	-0.0095	0.0066	-1.44	-0.0141***	0.0046	-3.06
Farming experience (yrs)	0.0060***	0.0006	10.00	-0.0070***	0.0015	-4.67	0.0005	0.0009	0.56
Off farm income (₦)	0.7623E-07	0.5048E-07	1.51	-0.1053E-06	0.1360E-06	-0.77	-0.2601E-08	0.8689E-07	-0.30
Contract type (DP C =1,others= 0)	0.0226	0.0193	1.17	0.0076	0.0519	0.15	0.0379	0.0332	1.14
Contract type(JS C=1,others= 0)	0.1182***	0.0177	6.68	-0.2384***	0.0477	-5.00	-0.1111***	0.0305	-3.64
Contract type(A C=1,others= 0)	0.0060	0.0177	0.34	-0.1496***	0.0477	-3.14	-0.1281***	0.0305	-4.20
Tractor service	-0.0185	0.0261	-0.71	-0.1482**	0.0704	-2.11	-0.1382**	0.0649	-2.13
Herbicide (litre)	0.0144	0.0175	0.82	0.0811**	0.0373	2.17	-0.0833**	0.0386	-2.16
Sigma – squared	0.0801***	0.0044	18.20	0.2161***	0.0119	18.16	0.1505***	0.0082	18.35
Log likelihood function =	183.42			18.79			80.69		

***Coefficients significant at 1%; **Coefficients significant at 5%;*Coefficients significant at 10%. Source: Computed from field Survey Data, 2011.

contract type of labour were more technically efficient than non-users (Table 3).

Allocative efficiency

Farming experience, job specific contract type (JSC), annual contract type (AC), use of tractor and herbicides were found to have negative significant relationship with Allocative efficiency except age ($p<0.01$). The sign of farming experience variable seems to be contrary to expectation; however, this may be due to the unwillingness to adopt new production technology. The use of contract labour conform to a priori expectation, this may be attributed to the high cost of sourcing and engaging this labour, it may also be due to the inefficient utilization of this annual contract labour types as job to be done are not given timeframe for execution (Table 3).

Economic efficiency

Economic efficiency is the ability to produce a given level of output at the minimum cost. Among variables considered, JSC, AC and the use of labour saving technologies (herbicides and tractor) were negatively significant with economic efficiency. The result showed that user of JSC types of labour was less economically efficient than non-users; this may probably be due to the resulting high cost incurred in carrying out all the farm activities separately. Also, users of AC labour type were less economically efficient than non–uses, although this does not conform to expectation but might be due to the cost implication of the terms of agreement in using annual contract labour which are often excluded in production cost such as housing, feeding and welfares.

CONCLUSION AND RECOMMENDATION

Labour wise, the result revealed that the use of labour hired on DPC is associated with higher TE, AE and EE than what is obtainable with reliance on household labour, but the differences are not statistically significant. However, the use of labour hired on JSC and AC are associated with significantly higher TE but lower AE and EE, while the use of labour saving technology is significantly associated with higher TE, AE and EE. The analysis further showed that maximum Technical and Allocative efficiency are not yet achieved probably because most of the sampled farm household carried out food production under situations involving the use of inefficient tools and inferior production technology. The distribution of technical efficiency indices revealed that the present technology being used by the sampled

farm households is inferior and a superior technology is needed which could be applied to improve and enhanced food crop output. Based on the findings of this study, the following recommendations were made:

- Farmers should be taught the modern technology of food crop production to enhance the efficiency of production.
- Relevant policies should be targeted at assisting experienced food crop farmers with a view to increasing food crop production.
- Farmers should take cognisance of cost of maintaining hired contract labour (feeding, housing and transportation) as this add considerably to overall labour cost and impacted negatively on the profit made on food crop production in the study area.

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