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Abstract

The efficiency with which farmers use available resources is very important in agricultural production. This study examines the resource use efficiency of cassava-based mixed crop farmers in Ogun and Oyo States, Nigeria. Cross-sectional data were collected from 265 cassava-based farmers (150 in Ogun State and 115 in Oyo State) using a multistage sampling technique. Descriptive statistics, production elasticity from Cobb-Douglas production function and marginal analysis of resource utilization were some of the analytical tools used in the study. The mean farm size cultivated in Ogun State was 2.24ha while in Oyo State, it was 1.59ha. There was under-utilization fertilizer in Ogun State and land cultivated in Oyo State. Producers in the two states are inefficient in their use of resources but there exist enough potential to increase cassava output in the areas. This can be actualized by cropping larger hectares of land, regulated usage of higher quantities of fertilizers and the provision of labour saving devices which would help reduce labour requirements and enhance efficiency.

***Keywords**:* Cassava-based, efficiency, mixed crop, Nigeria and resource-use

1.0 Introduction

The term "resource" is a human-centered concept perceived to have value by humans. We can therefore talk about availability, affordability and changes in the use and distribution of resources in agriculture. While some resources like water, land remain fairly stable in their use and value, others such as agrochemical (fertilizers), labour changes in a great deal. Resource use efficiency implies how efficiently the farmer can use his resources in production process. It is very important because our resources are very limited. One way of increasing production by farmers is to efficiently use all the resources available in the production process (Mesike et al. 2009). The most productive and efficiently used inputs in farming include land, labour, seeds or plant cutting as applicable to crop like cassava and farm equipment (Olayide, 1980). Land as a resource is efficiently used through shifting cultivation practices and other cropping systems such as mixed cropping system (Okigbo, 1978), but the full potentials of land, capital and labour resources are yet to be efficiently husbanded for optimum production.

One of the major agricultural problems in Nigeria centers on the efficiency with which farmers use resources on their farms. Other problems include how the various factors that explain production efficiency could be examined so as to improve the crop production in the country. One way of approaching the problem of increasing production therefore, is to examine how efficient the farmers are using their resources, if resources use is inefficient, production can be increased by making adjustment in the use of factors of production in optimal direction. In case it is efficient, the only way for increasing production would be through the adoption of modern inputs and improved technology of production. However, what is seen in Nigeria in recent time is government efforts at trying to increase agricultural productivity so as to achieve economic development for farmers and alleviate poverty through various schemes such as microcredit programmes, increase in agricultural loan, encouraging the use of technology but considerable research on the availability, affordability and resources use efficiency of cassava based producers is observed to be very weak. The average land-holding is still less than two hectares and for most farmers, land and family labour remain the essential inputs. Land is held on a communal basis, inherited or rented; cases of outright purchase of land are rare. Access to agricultural resources such as credit, fertilizer, labour, land have been observed as constraints to increasing cassava production but the effects have not been fully documented.

Cassava, the major crop in this study is found over a wide range of edaphic and climatic conditions between 30 0N and 30 0S latitude, growing in regions from sea level to 2300m altitude, mostly in areas considered marginal for other crops: low-fertility soils, annual rainfall from < 600mm in the semiarid tropics to >1500mm in the subhumid and humid tropics (Akinpelu et al., 2011). Due to the limitation of available land for agricultural production in Nigeria, majority of the subsistence farmers practice intercropping for several years without fallow, with no definite planting pattern. The cassava value chain is constrained by low farm productivity/ high unit farm costs. Little or no fertilizers are applied. Both soil fertility and crop yields also decline over time. The need to maximize agricultural resources is therefore becoming more evident because of high population pressure and other human activities competing with agriculture for the limited available resources. Maximization of resources has not been achievable with monoculture with single harvests per season, as gains in production per unit area under this system have not been impressive in the tropical environment (IITA, 1990). Cassava cultivation for several years usually results in a decline in soil fertility. This is due to wide spacing, slow development of soil cover in the first three to four months, traditional soil tillage and clean weeding practices at the onset of the rainy season, which can result in high soil losses ; short turnaround time for soil recovery and application of small amounts of fertilizer. Although intercropping cassava with other crops is widely practiced, the patterns are location-specific, especially in the range of crop species that may be intercropped. Many still hold on to the fact that when cassava is intercropped with legumes the cassava root yield generally decreases compared to when cassava is planted alone. This is due to the competition of the component crops for light, water and nutrients. However, cassava-legume intercropping systems usually increase the land use efficiency and economic return over solely cassava.

Several studies have extensively investigated the allocative efficiencies among farmers in Nigeria with varying results. While some have found farmers as being efficient (Holden and Shifraw, 1997; Amaza and Olayemi, 1999) others showed that they were inefficient (Fafchamps, 1998; Adejobi, 2004). This study therefore attempts to assess the resources use efficiency of cassava-based farmers in a mixed cropping system in Ogun and Oyo States, Nigeria. The study also differs from other similar study in terms of the scope. For instance while Babatunde (2004) Ogunma and Nwosu (2009) respectively analysed efficiency of resource use in selected farms in Kwara State, Nigeria, and resource management of cassava-based cropping systems in Imo State, Nigeria, this study compares resource use efficiency of the cassava-based mixed cropping system of farmers in Ogun and Oyo States.

Information on the resource use availability, affordability and usage particularly among farmers in cassava-based cropping system in Nigeria is believed to be pertinent to policymakers for a number of reasons. First, it can be used to quantify suspected regional disparities and identify which areas are falling behind in the process of cassava transformation. A study like this has also become necessary since cassava is often intercropped with other crops (cassava-based production system) as the most prevalent arable cropping system in the large guinea savanna vegetation agriculture in Nigeria (FAO, 2004) but with little documentation on farmers perceptions on resource availability, affordability and utilization for policy discourse.

This study therefore provides an insight to the ways agricultural resources are use by cassava based farmers in Ogun and Oyo State, Nigeria. The specific objectives are: to examine the availability and affordability of agricultural resources in the study areas; to estimate the existing scales of operation of cassava producers in the study areas and evaluate the relative resource use efficiency of farmers.

Review of Selected Studies on Resource Use Efficiency in Mixed Farming System

Efficiency is a very important factor of productivity growth especially in developing agrarian economies, where resources are meager and opportunities for developing and adopting better technologies are dwindling. Such economies can benefit from efficiency studies which show that it is possible to raise productivity by improving efficiency without increasing the resource base or developing new technologies. Raising productivity and output of small farmers would not only increase their incomes and food security, but also stimulate the rest of the economy and contribute to broad-based food security and poverty alleviation (Lipton, 2005).

Olukosi and Erhabor (1988) characterize resources into variable and fixed resources. Variable resources include labour, seeds and fertilizers, which are normally used up in one production process. Fixed resources are more durable resources, which contribute to the production process over several production periods. They include land, machinery, farm building etc.

Efficiency of production according to Farrell (1957) can be divided into technical, allocative and economic efficiencies. Economic efficiency embodies both technical and allocative efficiencies, once the issues of technical inefficiency have been removed from the question of choosing between the set of technically efficient alternative methods of production, allocative efficiency comes to forefront (Inoni, 2007).

A farmer is allocatively efficient if production inputs are allocated according to their relative prices (Torkamani and Hardaker, 1996). According to Oh and Kim (1980), allocative efficiency is the ratio between total costs of producing a unit of output using actual factor proportions in a technically efficient manner, and total costs of producing a unit of output using optimal factor proportions in a technically efficient manner. It is important to note that, a farm using a technically efficient input combination may not be producing optimally depending on the prevailing factor prices. Thus, the allocatively efficient level of production is where the farm operates at the least – cost combination of inputs.

The condition of optimum use of input xi as predicted by the theory of equilibrium in factor markets under profit maximization is that the marginal value product (MVP) equals the price of the input (Pi). If MVP is lower than Pi the resource is over-utilized and lowering the quantity used at the current price will increase the MVP and restore optimality. On the other hand, if MVP is greater than Pi the resource is under-utilized and using more of it will bring additional gains to the producer. Allocative efficiency measure, quantifies how near an enterprise is to using the optimal combination of production inputs when the goal is to maximize profit (Richetti and Reis, 2003).

Resources have been characterized into variable and fixed resources (Olukosi and Erhabor, 1988). Variable resources include labour, seeds and fertilizers, which are normally used up in one production process. Fixed resources are more durable resources, which contribute to the production process over several production periods. They include land, machinery, farm building etc. Baumol (1977) stated that production economics is concerned with optimisation and optimisation implies efficiency. According to Mesike et al., (2009), one of the strategies for increasing agricultural production is a combination of measures designed to increase the level of farm resources as well as make efficient use of the resources already committed to the farm sector.

Fakayode et al (2008) assessed the productivities of prevalent cassava-based farms in the large Guinea Savannah ecology of Nigeria using the Total Factor Productivity (TFP). The study revealed that cassava/maize enterprise with a 4.4 TFP level as the most popular and most productive cassava-based enterprise, followed by the Cassava/Cowpea, Cassava/Maize/Guinea-corn and the Cassava/Melon systems with 4.1, 3.6 and 3.5 TFP levels respectively. Oguoma and Nwosu (2009) examined the resource-use efficiency of cassava-based mixed crop farmers in Imo State, Nigeria, the results of the relative profitability of their operations showed that the identified scales of producers are inefficient in their use of resources.

Hulugalle and Ezumah (1991) and Olasantan et al. (1996) analyzed the effects of cassava-based cropping systems on earthworms and observed that these macro organisms were more active in intercropping than in monocropping systems. Natarajan and Willey (1980) states that inter-cropping systems often result in better land use efficiencies than sole cropping systems, and are usually associated with greater production of total dry matter. Land use efficiency in general was determined by calculating the land equivalent ratio (Mead and Willey, 1980). The monetary returns per ha are appreciably higher under intercropping systems, and is mainly due to the higher value of intercrops (Prabhakar et al., 1996).

Polthanee et al. (2007) in their study observed that, when cassava is intercropped with legumes the cassava root yield generally decreases compared to when cassava is planted alone. This is due to the competition of the component crops for light, water and nutrients. Polthanee et al., (2007) observed that cassava-cowpea inter-cropping increases the land use efficiency by 72-76% over sole cropping. In economic terms, cassava-cowpea inter-cropping also gave higher net returns over sole cropping. Peanut (Arachis hypogaea) is a drought tolerant crop which is suitable to intercrop with cassava in Northeast Thailand. Polthanee et al. (1998) also reported that cassava root yield and yield components were influenced by inter-cropping. But when cowpea was row and strip intercropped with cassava, it produced fodder yields of 1.7 to 2.4 tons/ha, depending on the cowpea cultivar. Inter-cropping with cowpea reduced dry matter yield and the number of cassava roots significantly and had no effect on cowpea yield but increased land use efficiency by 42-70%. For instance, inter-cropping with cowpea reduced cassava yield by 14 to 24% (Mason et al. 1986) and 19 to 38% (Mason and Leihner, 1988). However, inter-cropping cassava with cowpea resulted in 20 to 100% greater land use efficiency than for either crop grown alone (Leihner, 1983). Other studies indicated that inter-cropping cassava with cowpea increased land use efficiency by 48-56% (Mason et al., 1986).

Okoli (1996) assessed the effect of inter-cropping three cassava genotypes, of different plant archetype, with cowpea, having different growth habits and maturity regimes. Inter-cropping with cowpea reduced dry matter yield and number of cassava roots significantly. Inter-cropping cassava had no effect on cowpea yield and increased land use efficiency by 42-70%.

Aderinola *et al.,* (2006) in a study of comparative analysis of three cassava-based farming systems in Nigeria which includes: cassava-sole, cassava + maize, and cassava plus other crops, concluded that the cassava expansion program of the Nigerian Government would enjoy a boost through the promotion of the cultivation of cassava with other crops. A similar observation was observed by Chukwuji (2008).

In a study by Nweke, (1997), out of 494 fields surveyed where cassava was grown, 36%, 38% and 26% of the farmers grew the crop as sole, major and minor crop respectively. This implied that in about 74% of all cassava farms surveyed, the crop was grown as a major component (Chukwujit, 2008). The complex crop associations, as obtains in intercrop farms, serve as an insurance against crop failure, erosion control and enhance the use of available resources as well as providing more balanced diets for the farming households (Polson and Spencer, 1992; Sullivan, 2001; Alabi and Esobhawan, 2006).

2.0 Methods and Materials

Primary data were collected from the randomly selected sample of cassava-based cultivators by a structured questionnaire and personal interview method from Ogun and Oyo States in Nigeria. The two states are located in the Southwest Nigeria. Ogun State is located between latitudes $7^{o}3^{l}$ and $9^{o}12^{1}$ north of the equator and longitudes $2^{o}47^{l}$ and $4^{o}23^{l}$ east of the Meridian while Oyo State stretches from latitude 7° N to latitude 9° N and longitude 2.8° E to longitude 4.5° E. The total land area in Ogun State is 28,454 km^2 (10,986.2 sq metres), density of 196.5/km^2 (509/sq metres) with an estimated population of 6,617,720 while Oyo has a land area of 16,409.26 sq kilometers and a population of 3.7 million (NPC, 2006). Multistage sampling procedure was adopted for this study. First, Ogun and Oyo States were purposively selected in the Southwest Nigeria. In the second stage, each of the state was stratified into three Agricultural zones in line with the ADP zoning system. In the third stage, one Local Government Area (LGA) each was purposively chosen from the zones based on the intensity of cassava production. In the fourth stage, the list of producing communities within each selected LGA was collected from the ADPs and two communities were purposively selected based also on the intensity of cassava production following pilot survey of the area. Cassava based farmers from each community were identified with the assistance of the extension agents. In the fifth stage, twenty-five cassava based farmers were randomly selected from each selected community giving a total of 150 respondents per state and 300 respondents altogether for the study. However, a total of 265 respondent questionnaires (150 in Ogun and 115 in Oyo) were useful for analysis.

Model Specifications

In order to ascertain whether resources were efficiently utilized, the marginal value product (MVP) of land, seed, family labour, hired labour, fertilizer and pesticide were computed and then compared with their factor costs. Since these variables are expressed in physical quantities in the function estimated, the MVP of such are compared with their unit prices to determine the degree of efficiency in their use.

The MVP of resource provides a framework for policy decision on resource adjustment (Adeyemo and Kuhlmann, 2009). The magnitude of the MVP was compared with acquisition price which is the marginal factor cost (MFC) of the input in order to determine whether to increase or reduce the level of the factor used. The divergence between the acquisition price of the input and its MVP indicates the scope of resource adjustment necessary to attain economic optimum. A given resource is optimally allocated when there is no divergence between its MVP and the MFC of the resource input.

$MV\ P_{xi} = MPP_{xi}\ .\ P_{yi} = P_{xi}$ or MFC ---(1)

Where

MVP_{xi}= Marginal Value Product of input xi

MPP_{xi} = Marginal Physical Product of input Xi gives information about the additional output response to an additional input change at the margin or the change in output resulting from a unit increment or unit change in variable input. It measures the amount that total output increases or decreases as input increases.

P_{yi} = Price of output i

P_{xi} = Unit price of specific input = MFC

MFC = marginal factor cost of input used

$MPP_{xi} = dy/d_{Xi}$ = change in quantity of output/change in the quantity of input used

The regression coefficients, which are equal to the elasticity coefficients in Cobb-Douglas production function (equation 3) was used to measure the returns-to-scale of farmer's production.

$$\text{Log}\ \pi^* = b_0 + b_1 logX_1 + b_i\, logX_i^*\ (i = 2 - - - 5) + biDi(i = - - - 2) + U \text{----------} (2)$$

Π* = Normalized profit (profit divided by geometric weighted average price in naira per unit of farm output (p_o) expressed as a function of the quantity of one fixed input (X_1) and the cost of other specified variable inputs such as X_2, X_3, X_4 X_5 of production (adapted from Babatunde, 2004)

X_1 = land area cultivated in hectares

X_2^* = labour cost in naira per day divided by Po

X_3^* = planting material in naira divided by Po

X_4^* = agrochemical (fertilizer) costs in naira divided by Po

X_5^* = cost of herbicide divided by Po

D_i = dummy variable to capture the scale of operation (i =1 for small scale cassava-based operation and 0 otherwise, i =2, for medium-scale cassava-based operation and 0 otherwise, i =3 assuming zero value for the excluded large-scale group which was used as base scale cassava-based operation).

U = Error term which is assumed to be normally distributed with constant variance

bo, $b_{1,}$ bi are parameters to be estimated.

When b_1 +b_2 + ——— + b_5 equal one, there is constant returns to scale, above one indicates increasing returns to scale, and less than one indicates decreasing returns to scale.

Marginal Analysis of Resource Utilisation: This is necessary to determine resource use efficiency of some of the inputs used by the farmers following Oguoma and Nwosu (2009); Shehu et al.,(2007). The allocative resource use efficiency is specified as:

r = MVP/ MFC --(3)

Where

MVP = Marginal Value Product

MFC = Marginal Factor Cost of input (Unit Price of Input)

r = Resources use efficiency

The decision rule is that, when the ratio "r" is:

r = 1 or MVP_{xi} = MFC_{xi}, means optimum utilization of resource (that is, farmer maximizes profit because of the optimum utilization of resources)

If r < 1 or MVP_{xi} < MFC_{xi}, it means over-utilization of resources by cassava farmers (that is, there is indication that more than profit maximization level if inputs are being utilized, suggesting that a reduction in the use of that input is required to increase efficiency).

If $r > 1$ or $MVP_{xi} > MFC_{xi}$, it means under utilization of resources (that is, there is an indication that less than profit maximization level of the resources are being utilized and therefore, efficiency could be increased by an increased use of that particular input).

The required level of input reduction or increase to attain profit maximization was estimated following Oguoma and Nwosu (2009) as:

$$D_{ij} = (1 - r) \times 100 ---------------------------------- (4)$$

Where,

D_{ij} is the required percentage change to attain allocative efficiency or the percentage deviation from optimal use of the i^{th} input for the j^{th} scale of operation. A negative value implies that an increased use of that input was needed, while a positive value signaled that the reduction of that input was called for. A zero percentage indicated that the maximum or absolute efficiency was achieved.

To test the hypothesis that the various scales of Cassava farmers were equally efficient in resource allocation. Their mean allocative efficiency indices were compared using the Z-test at 1% probability level, specified as:

$$Z_{cal} = \frac{K_i - K_j}{\sqrt{\left(S_i{}^2 + S^2{}_j / n_i + n_j\right)}} ----------------------------(5)$$

Where:

Z_{cal} = Z score

K_i and k_j = Mean efficiency ratios for each category

s_i^2 and s_j^2 = Variance of efficiency ratios in resource use by the corresponding category

n_i and n_j = Sample size of the respective categories

In line with Oguoma and Nwosu (2009), a pair of scale of operations is said to have equal allocative efficiency, if the mean values for all the inputs obtained for r were equal. That is

$$K_1 = K_2 = K_3 ------------------------------- (6)$$

Where

K_1 = mean allocative efficiency of small scale cassava base farm

K_2 = allocative efficiency of medium scale cassava based farm

K_3 = allocative efficiency of large scale cassava based farm

3.0 Results and Discussions

Distribution of Labour Used on Cassava Farm

The mean number of family members and hired labour that work on cassava farm was 2.55 and 6.07 respectively (Tables 1 and 2). The highest number of family labour that is available to farmers in Ogun was three while those in Oyo is seven. About 32.1 percent of farmers in Oyo had more than three family members who work in the family farm. Results show that cassava farmers in Oyo make use of family labour than their counterparts in Ogun. In order to make up for the shortfall in the supply of family labour, farmers in Ogun make use of hired labour (mean =7.61) than their counterparts in Oyo State (mean = 3.94). The results also show a significant difference between both states at one percent for use of family labour and hired labour in production. This suggests that farmers in Oyo have more access to cheap family labour than those in Ogun State.

Land Cultivated by Cassava-based farmers in Ogun and Oyo States

Land is the most important input for agricultural production but it is generally believed to be abundant relative to other inputs. Nigerian farms are classified into small scale, medium scale and large scale. According to Upton (1972) farm sizes classification of less than 5ha should be classified as small, between 5ha and 10ha as medium, and more than 10ha as large scale. Going by the classification Upton (1972) about 92.83 percent of all farm holdings by the respondents in the study was classified as small scale farms and the remaining 7.17 percent as medium, while none was classified as large farm. This study therefore adapted the classification of Babatunde (2004) classification of farm size of 0.01-1.0ha, 1.1-2.0ha and above 2.0ha as small, medium and large farm respectively. Although the average farm size in Ogun was estimated as 2.24ha and that of Oyo was 3.40ha, the mean farm size cultivated however were 2.24ha and 1.59ha in Ogun and Oyo respectively (Table 2). There is a significant difference between both states at one percent for land owned and land cultivated. About 71.4 and 54.8 percent of the cassava-based farming population have small farm holdings (<1ha) in Ogun and Oyo respectively. Similarly, the highest proportion of the cassava- based farmers in Ogun (90.0 percent) and Oyo (49.6

percent) were cultivating small farm holdings (≤1ha).This corroborates the widely reported view that small-scale farmers constitute the nerve-centre of food production in Nigeria (Olayide and Heady, 1998).

Table 1: Distribution of by Number of Labour Used on Cassava Farm

Family Labour	**Ogun**	**Oyo**	**Pooled (Ogun and Oyo)**
1	0 (0.0)	34 (29.6)	34 (12.8)
2	94 (62.7)	25 (21.7)	119 (44.9)
3	56 (37.3)	18 (15.7)	74 (27.9)
4	0 (0.0)	16 (13.9)	16 (6.0)
5	0 (0.0)	15 (13.0)	15 (5.7)
6	0 (0.0)	6 (5.2)	6 (2.3)
7	0 (0.0)	1 (0.9)	1 (0.4)
Total	150 (100.0)	115 (100.0)	265 (100.0)
Mean	2.37	2.78	2.55
Standard Deviation	0.49	1.63	1.55
t-statistics	-2.61***		
Hired Labour	**Distribution of Respondents by Number of Hired Labour Used**		
None	37(24.17)	33 (28.7)	70(26.4)
1	9(6.0)	12(10.4)	21(7.9)
2	16(10.7)	12(10.4)	28(10.6)
3	5(3.3)	12(10.4)	17(6.4)
4	7(4.7)	15(13.0)	22(8.3)
5	8(5.3)	12(10.4)	20(7.5)
6	9(6.0)	8(7.0)	17(6.4)
7	25(16.7)	6(5.2)	3(11.7)
>8	34(22.67)	5(4.4)	39(14.72)
Total	150(100)	115(100)	265
Mean	7.61	3.94	6.07
Standard Deviation	5.93	2.09	5.05
t-statistics	16.79***		

Note: Values in parenthesis are in percent and those outside, the frequency

***Significance at 1% level

Source: Computed from Field Survey data 2011

Cassava Farmers Cropping Practice with Major Reasons

Agricultural production is confronted with the challenges of identifying management options that will maximize productivity of compatible crops in traditional cropping system. Cassava grows on marginal lands where cereals and other crops do not grow well. It can tolerate drought and can grow in low-nutrient soils (Gobeze et al., 2005). Cassava has relatively high productivity on marginal soils, flexible harvest dates and its consumed where drought, poverty, and malnutrition are often prevalent (Dixon et al., 2005). However, a sole crop of cassava, which is considered a long-season crop, does not efficiently use the available resources (land, light, water and nutrients) during its early growth stages due to its slow initial development. A short-duration second crop may be inter-planted to make more efficient use of these growth factors.

Results in Table 3 show that in the study areas, cassava is associated with mixed cropping systems in line with Chukwuji (2008) findings that cassava in the southwestern Nigeria is traditionally grown in combination with an average of three crops. The predominant crop that cassava was mostly intercropped with are maize by 92.67 percent and 77.39 percent respondents in Ogun and Oyo respectively, while few farmers grew cassava as a sole crop, 5.33 percent and 17.39 percent in Ogun and Oyo respectively. Cassava was also intercropped with other crops such as yam, cocoyam, melon, cowpea, pepper and vegetables such as okro, tomatoes in the study area. The major reason given for intercropping cassava with other crops was to improve income by 88.67 percent and 91.31percent of respondents in Ogun and Oyo respectively, while maximum use of land was the least reason given for intercropping cassava with other crops by 6.67 percent and 1.74 percent in Ogun and Oyo respectively.

Table 2: Distribution of Cassava-based farmers by Farm Size Owned and Cultivated

Farm Size (ha)	Definition	Ogun	Oyo	Pooled (Ogun and Oyo)
0.01-1.0	Small farm	43(28.67)	43(37.39)	86(32.45)
1.1-2.0	Medium farm	56(37.33)	23(20.00)	79(29.81)
> 2.0	Large farm	51(34.00)	49(42.61)	100(37.74)
	Total	150(100.00)	115(100.00)	265(100.00)
	Mean	2.355	3.396	2.806
	Standard deviation	1.846	4.252	3.162
	t-stat	14.449***		
		Size of Farm Land Cultivated		
0.01-1.0	Small farm	45(71.43)	63(54.78)	108(40.75)
1.1-2.0	Medium farm	61(40.67)	32(27.83)	93(35.09)
> 2.0	Large farm	44 (29.33)	20(17.39)	64(24.15)
	Total	150 (100.00)	115(100.00)	265(100.00)
	Mean	2.2427	Mean=1.5883	Mean=1.9587;
	Standard deviation	1.8148	1.4428	SD =1.6922
	t-stat	18.843***		

Note: Values in parenthesis are in percentage and those outside, the frequency

***Significance at 1% level

Table 3: Cropping Practices Adopted by Farmers with Major Reasons

Cropping System	Ogun	Oyo	Pooled (Ogun and Oyo)
Sole Cassava	8 (5.33)	20 (17.39)	28 (10.57)
Cassava + Maize/Guinea corn	139 (92.67)	89 (77.39)	213 (80.38)
Cassava + Melon	18 (12.00)	3 (2.61)	18 (6.79)
Cassava + Yam	22 (14.67)	3 (2.61)	25 (9.43)
Cassava + Cocoyam	8 (5.33)	0 (0.00)	8 (3.02)
Cassava + Cowpea	2 (1.33)	4 (3.48)	6 (2.26)
Cassava + vegetable	13 (8.67)	0 (0.00)	13 (4.91)
Cassava + Pepper	16 (10.67)	2 (1.74)	16 (6.04)
Main reasons for intercropping			
Improved income	133 (88.67)	105(91.31)	238 (89.81)
Increased fertility	2(1.33)	3(2.61)	5(1.89)
Prevention against crop failure	5(3.33)	5(4.35)	10(3.77)

Maximum use of land	10(6.67)	2(1.74)	12(4.53)

Note: Values in parenthesis are in percentage and those outside the frequency (multiple responses)

Source Field Survey 2011

Farmers' Perception on the Availability and Affordability of Agricultural Resources

The availability of labour affects the use of farm land in the traditional farming system. Although family members contribute the bulk of labour input, where hired labour is used, cost of labour often exceeds 70 percent of total cost of production (Ogungbugbe, 1997). Table 4 presents the farmers' perception on availability and affordability of agricultural resources. In Ogun State, some 40 percent of the farmers agreed that land was very available and affordable for cassava enterprise while 39.1percent did in Oyo State. Some 40 percent and 32.2 percent of respondents in both Ogun and Oyo States agreed that family labour was just available and affordable while 31.3 and 33.9 percent of the respondents were of the views that agreed that hired labour was just available but not affordable in Ogun and Oyo States respectively. Further, agrochemicals (pesticides, herbicides and fertilizers) were just available but not affordable in Ogun, while they were just available and affordable in Oyo. Also, planting materials were said to be very available and very affordable by 61.3percent respondents in Ogun but were said to be just available and affordable in Oyo. It is notable that majority of farmers in Ogun (80 percent) and some 46.1 percent farmers in Oyo State did not have access to loan. In addition, it was observed that 38.7 percent of the respondents in Ogun and 45.2 percent respondents in Oyo State signified that agricultural machinery was neither available nor affordable to them. The results therefore suggest that most productive resources were neither adequately available nor affordable for the farmers.

Resource use Efficiency of Cassava-based Farming System in Ogun and Oyo States

One way of increasing production by the small farmers is to efficiently use all the resources available in the production process. However, farmers output is elastic with respect to the age of the farmers, level of education, number of extension contact, membership of social groups, fertilizer application and farm size. This implied that a change in the level of any of these variables will result in more than proportionate change in farmers output. Nonetheless, the inelasticity of variables such as hired labour, quantity of seed used, agrochemical and level of capital is a clear indication of the fact that increments in such farm inputs do not necessarily translate to corresponding change in farmers output.

Table 4: Farm Resource Availability and Affordability

Resources	Very available and affordable	Very available but not affordable	Just available and affordable	Just available but not affordable	Not available but affordable	Neither available nor affordable
			Ogun State			
Land	60(40.0)	27(18.0)	41(27.3)	8(5.3)	1(0.7)	5(3.3)
Labour (family)	33(22.0)	4(2.7)	60(40.0)	5(3.3)	13(8.7)	16(10.7)
Labour (hired)	29(19.3)	19(12.7)	30(20.0)	47(31.3)	6(4.0)	10(6.7)
herbicide	10(6.7)	19(12.7)	25(16.7)	49(32.7)	5(3.3)	31(20.7)
Pesticide	10(6.7)	18(12.0)	16(10.7)	59(39.3)	59(3.3)	30(20.0)
Fertilizer	15(10.0)	18(12.00)	15(10)	60(40.00)	6(4.0)	28(18.7)
Cassava stem	92(61.3)	3(2.0)	43(28.7)	2(1.3)	1(0.7)	09.00)
Loan	1(0.7)	0(0.00)	291.3)	3(2.0)	17(11.3)	120(80.0)
machinery	10(6.7)	2(1.3)	3(2.00	29(19.3)	39(26.0)	58(38.7)
			Oyo State			
Land	24(20.9)	16(13.9)	45(39.1)	4(3.5)	1(0.9)	4(3.5)
Labour (family)	11(9.6)	1(0.9)	37(32.2)	15(13)	3(2.6)	25(21.7)
Labour (hired)	1(0.9)	9(7.8)	36(31.3)	39(33.9)	5(4.3)	4(3.5)
herbicide	2(1.7)	4(3.5)	40(34.8)	27(23.5)	4(3.5)	3(2.6)
Pesticide	0(0.00)	5(4.3)	37.32.2)	21(18.3)	3(2.6)	7(6.1)
Fertilizer	1(0.9)	2(1.7)	39(33.9)	25(21.7)	3(2.6)	21(18.3)
Cassava stem	58(50.4)	5(4.3)	22(19.1)	5(4.3)	0(0.00)	6(5.2)
Loan	1(0.9)	1(0.9)	14(12.2)	17(14.8)	10(8.7)	53(46.1)
machinery	1(0.9)	0(0.00)	19(16.5)	9(7.8)	13(11.3)	52(45.2)

Note: Figures in parenthesis are in percentage and those outside represent the frequency of farmer's affirmative responses
Source: Data from field Survey, 2011

Production elasticity values in Table 5 shows that farmers outputs with respect to inputs used in Ogun and Oyo States are inelastic indicating that, a change in the level of any of these variables will also result in less than proportionate change in farmer's cassava's output. Hence, the need for optimum and effective deployment of farm inputs alongside sustainable agricultural practices. The Returns to Scale (RTS) on the other hand calculated as the sum of individual production inputs elasticities of 0.6717 in Ogun State and 0.4429 in Oyo implied that there is decreasing returns- to- scale by 0.67 and 0.44 respectively in farm in Ogun and Oyo States.

The results from Table 4.15 shows that except for agrochemical (fertilizers usage) in Ogun State and land cultivated in Oyo State that are under-utilized, all other production inputs (herbicides, labour, cassava-cuttings (cassava sticks) were over-utilized. This means that increase in the use of fertilizer in Ogun State and area of land cultivated in Oyo State will lead to further increase in output.

The hypothesis that the various scales of cassava operators were equally efficient in their resources allocation were rejected in the study areas - Ogun and Oyo States when examined in relation to the mean efficiency index (Table 6). The computed Z-scores for each pair of cassava producers was found to be significantly different from their critical Z-value at 1% leading to the rejection of the null hypothesis in each case.

Table 5: Resource Use Efficiency of Cassava-based Farmers

Inputs	Ogun State					Oyo State					Pooled (Ogun and Oyo)				
	EP	MPP	MVP	MFC	r	EP	MPP	MFC	MVP	r	EP	MPP	MFC	MVP	r
Land cultivated (ha)	-0.0690	-0.023	-0.909	5,328.18	-0.00017	-0.1423	0.021	12,189.86	0.191	1.566	-0.0869	0.080	9,802.21	2.147	0.000219
Labour(N/manday)	0.2093	-0.219	-8.653	1,438.61	-0.00601	0.0868	-0.830	1,308.20	-7.733	-0.0059	0.1319	-1.030	1,388.93	-27.645	-0.0199
Herbicide (N/litre)	0.1116	12.657	500.078	1,194.07	0.4188	0.3700	-5.033	913.50	-46.872	-0.0513	0.3013	-4.010	1,071.32	-107.628	-0.1004
Agrochemical (fertilizer N/kg)	0.4198	3.935	155.471	99.47	1.5630	0.1284	-33.897	87.93	-315.679	-3.5901	0.3932	-21.187	94.03	-568.659	-6.0477
Planting material (N/bundle*)	0 .5178	1.455	57.487	252.37	0.2278	0 .3048	-15.721	229.52	-146.408	-0.638	0.3082	-2.107	243.64	-56.551	-0.232
Return to Scale (RTS),	0.6717		Mean allocative efficiency		**0.4407**	0.4429		Mean allocative efficiency		**-0.5439**	1.0477		Mean allocative efficiency		**-1.2800**

Note: Ep = elasticity of production, MFC = unit price of input, r = resource use efficiency, * a bundle contains about 50 cassava sticks of 1m and between 50 to 60 bundles are required to plant I ha of land depending on the planting space.

Source: Data obtained from field survey 2011

Table 6: Results of the Z-test for resource use efficiency of various scales operators

Pair of scale operators	Computed Z-score	Critical Z-value at 1% level of significance	Decision
		Ogun State	
Small scale versus medium scale	-1.89	0.059	Accept
Small scale versus large scale	-0.80	0.425	Reject
Medium scale versus large scale	0.81	0.417	Reject
		Oyo State	
Small scale versus medium scale	1.79	0.073	Accept
Small scale versus large scale	1.74	0.082	Accept
Medium scale versus large scale	0.05	0.963	Reject
		Pooled (Ogun and Oyo)	
Small scale versus medium scale	-0.25	0.805	Reject
Small scale versus large scale	0.88	0.379	Reject
Medium scale versus large scale	1.33	0.260	Reject

Source: Computed from the data obtained from field survey 2011

Results from Table 7 shows that cassava farmers in Ogun State can attain allocative efficiency by increasing their use of fertilizer by 56.30% and reduce the use of other inputs such as area of land cultivated by 100.02%, labour by 100.62%, herbicides by 58.12%, and planting material by 77.22%. On the other hand, Oyo State farmers can attain allocative efficiency by increasing their area of land cultivated by 56.60% and a reduction in labour use by 199.59%, herbicides by 105.13%, fertilizer use by 459.01% and plant cuttings by 163.80%

Table 7: Percentage Change to Attain Allocative Efficiency

Inputs	Ogun State	Oyo State	Pooled (Ogun and Oyo)
Land	100.02	-56.60	99.98
Labour	100.60	100.59	101.99
Herbicide	58.12	105.13	110.04
Agrochemical (fertilizer)	-56.30	459.01	704.77
Planting Materials (cassava sticks or cuttings)	77.22	163.80	123.20

Note: Percentage change to attain allocative efficiency = (1-r) x 100 where r is resource use efficiency.
Source: Computed from the data obtained from field survey 2011

4.0 Conclusion and Recommendations

This study examined resource-use efficiency among cassava- based mixed cropping farmers in Ogun and Oyo States. The result indicates that some degree of inefficiency exist among cassava farmers in Oyo and Ogun States. The level of inefficiency was least among cassava producers in Oyo than those in Ogun State. Cassava production has a decreasing return-to-scale in Ogun and Oyo States though profitable in both States. In Ogun State, production inputs such as land, labour, herbicides and planting material (cassava sticks or cuttings) are over-utilized while fertilizer was under-utilized. In Oyo State, apart from land which was under-utilized, all other inputs were over-utilized meaning that opportunities still exists to increase output by increasing the level of these inputs.

To attain allocative efficiency by cassava-based mixed cropping farmers in Oyo and Ogun States, farmers should make some necessary adjustments in their use of production resources. Farmers in Ogun State should increase their use of fertilizer by 56.30% and reduce the use of other inputs such as the land area cultivated by 100.02%, labour by 100.62%, herbicide by 58.12%, planting material (cassava cuttings or sticks) by 77.22%. On the other hand, Oyo State farmers can attain allocative efficiency by increasing land area cultivated by 56.60% and reduce labour by 199.59%, herbicides by 105.13%, fertilizer by 459.01% and planted cuttings by 163.80%. In addition, farmers who want to go into cassava-based mixed cropping system should be encouraged on the need to combine their production with leguminous crops such as cowpea so as to save costs from other inputs

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