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# EFFICIENCY OF RESOURCE USE IN SMALL SCALE COCOYAM PRODUCTION IN ENUGU STATE, NIGERIA

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***Abstract***
*The study was about efficiency in the use of resources by small scale cocoyam farmers in Igbo-Etiti Local Government Area of Enugu state, Nigeria. A structured questionnaire was used to interview 100 cocoyam farmers that were randomly selected. Information on the socio-economic characteristics of the farmers, inputs, their costs and revenue were obtained from the farmers. Descriptive statistics were used to analyse the socio-economic data, while Cobb Douglas production function was used to analyse the production data. Results indicated that majority (88%) of the farmers were young and productive and most of them (60%) were married. Female farmers (61%) dominated cocoyam farming in the study area though on small scale. Results of the estimated parameters of the production function indicated that farm size, herbicide, fertilizer and cocoyam seeds had positive coefficients of 0.161, 0.945, 0.206, and 0.440 respectively, while labour had negative coefficient of -0.079. Herbicide, cocoyam seeds and fertilizer significantly affected outputs of cocoyam at some levels of risk. Overall efficiency depicted by the sum of the coefficients of the variables used in the regression was 1.676 meaning that the farmers operated in the region of increasing return to scale. Specifically, farm size, herbicide, fertilizer and cocoyam seeds were underutilized because their respective marginal value products were more than their respective marginal factor cost. Recommendations made to improve production of cocoyam were making farm inputs such as herbicide and fertilizer available to the farmers at cheap prices; modifying land tenure system to make more land available for production of cocoyam and making improved varieties of cocoyam available to the farmers to increase yield.*
***Keywords: Female farmers, production, resources, cocoyam***

## Introduction

The two common species of cocoyam grown for food in Nigeria are *Colocacia esculentum* and *Xanthosoma sagittifolium* (Agboola, 1979). These two species originated from different regions in the world. *Colocacia esculentum* originated from Eastern India and Bangladesh from where it spread to Southern Asia and Egypt and Eastern Mediterranean and finally to East Africa and West Africa (Talwana *et al*., 2009). *Xanthosoma sagittifolium* is a native of tropical America and the Caribbean. The species got spread to Nigeria by traders.

Cocoyam is propagated by using the corm. A whole corm or cormel may be planted on mounds or ridges at a spacing of 1 metre apart. It is planted at the beginning of raining season and harvested at the end of raining season when the leaves have turned yellow. Cocoyam cultivation is not popular like cassava and yam even though it has several uses. Its production and consumption has not been as popular as cassava and yam. This was because cocoyam used to have some poisonous varieties like cassava but methods of getting rid of the poisonous element in the cocoyam was not known as in cassava. Cocoyam can be cooked for meal like yam but it has inferior taste. For these reasons, cocoyam is widely considered as standby crop that is eaten only during famine period when food stuffs are scarce (Agboola, 1979). But cocoyam possesses higher amount of protein, minerals and vitamins and its starch is more readily digested (Ezedinma, 2006). It can be processed into flour, boiled and eaten or pounded and eaten with soup. It can be fried or roasted and also processed into chips (Ume *et al*., 2016). The leaves are used as vegetable in soup preparation in many homes in Nigeria. Cocoyam is recommended for diabetic patients, the aged, children with allergy and people with intestinal disorders (Okoye, 2006).

The study was carried out because of the numerous uses of cocoyam even though it is a neglected crop among farmers and policy makers. The major objectives of the study were to describe the socioeconomic characteristics of cocoyam farmers and estimate the effects of resources use on the output of cocoyam and hence efficiency in the use of these resources.

## Materials and Methods

The study was carried out in Igbo-Etiti Local Government Area of Enugu State, Nigeria to determine efficiency of cocoyam farmers in the use of resources. Igbo- Etiti Local Government Area is among the Local Government Areas in Enugu State where cocoyam production was popular. Primary data were used for the study. The primary data were collected from the cocoyam farmers with the use of a structured questionnaire. Five settlements were randomly selected for the study. From each of the settlements, 20 cocoyam farmers were randomly selected making a total of 100 farmers for the study. Information was obtained on socioeconomic characteristics of the farmers such as age, marital status, farm size and household size. Information was also obtained on inputs and their prices, output and their prices and revenue from the farm.

Descriptive statistics such as frequency distribution and percentages were used to analyse the socioeconomic data. Cobb-Douglas production function was used to determine the effects of resources used in cocoyam production and output of cocoyam. Cobb-Douglas functional form was used because it is popularly used in most agricultural economics research because of its simple functional form which provides for easy computation and it gives theoretically consistent and significant estimates for most of the variables used in analysis of agricultural data (Subba Reddy et.al, 2009). Explicit form of the Cobb-Douglas functional form used was specified as follows:

$\text{Log } Y = \text{Log } b_0 + b_1 \text{ Log}X_1 + b_2 \text{ Log}X_2 + b_3 \text{ Log}X_3 + b4 \text{ Log}X_4 + b5 \text{ Log}X_5 + \text{Log } e$, where;

$Y$ = Output of cocoyam in kg

$X_1$ = Cocoyam seeds in kg

$X_2$ = Labour in man days

$X_3$ = Fertilizer in kg

$X_4$ = Herbicide in litres

$X_5$ = Farm size in hectares

$b_0$ = Constant

$b_1 – b_5$ = Estimated coefficients

$e$=Error term

**Resource Use Efficiency Indicators**

Efficiency ratio was used to show level of efficiency of resource use. It was obtained as follows;

$$\frac{MVP}{MFC} \quad \text{or} \quad \frac{MVP}{PX}$$ Where;

MVP = marginal value product
MFC = marginal factor cost
$P_X$ = price of a unit of resource

Inferences were made on resource use efficiency based on the following ratios;

$\frac{MVP}{MFC}$ = 1 optimal resource use

$\frac{MVP}{MFC}$ > 1 underutilization of resources

$\frac{MVP}{MFC}$ < 1 over utilization of resources

**Results and Discussion**

The results of this study are presented and discussed under socioeconomic characteristics of the respondents, estimates of the parameters of Cobb-Douglas production function and their effects on the output of cocoyam and hence resource use efficiency of cocoyam production.

**Socioeconomic Characteristics of Cocoyam Farmers Are Presented In Table 1**

**Distribution of Farmers According to Age**

As presented in Table 1, 68 percent and 20 percent of the cocoyam farmers were in the age brackets of 21-40 years and 41-50 years respectively. This shows that most farmers in the area were in their youthful ages. They could actively grow crops that needed much energy to cultivate. This is in agreement with Audu *et al.,* (2017) who found out that most groundnut farmers were youths that possessed energy for strenuous farming activities.

**Distribution of the Respondents According to their Educational Level**

Most of the respondents had some level of formal education. Only 30 percent of them did not have formal education. The respondents that had primary school education were 50 percent, while those with secondary and tertiary levels of education were 15 percent and 5 percent respectively. Education enhances farmers' productivity because with it farmers are receptive to change. Educated farmers easily receive and adopt innovation. According to Girei *et al*. (2020) education has positive influence on farmers' adoption of improved production technologies.

**Distribution of the Respondents Based on their Marital Status**

Most of the cocoyam farmers comprising 60 percent were married as shown in Table 1. Others were widow/widower, (19%) single (16%) and divorce (5%). Married people were very active in farming because with families of varying sizes, they needed food to take care of the members. Audu, (2012) found out that most cassava farmers were married.

**Distribution of Respondents Based on Sex**

Most of the respondents comprising 61 percent were female while the rest of the respondents making 39 percent were male. Women dominated cocoyam production in the area because it is mostly planted around dwelling places. It requires less labour and men do not always compete with women in the utilization of land surrounding dwelling places.

**Distribution of the Respondents Based on Household Size**

As presented in table 1, 62 percent of the respondents had 5-8 persons in their households, while 19 percent of them had 9-12 persons. Large households could be a pool of labour which is helpful during period of critical farm operations. According to Ojemade *et al*. (2008), large household could provide family labour at low cost.

**Distribution of the Respondents Based on Farming Experience**

As shown in Table 1, about 72 percent of the cocoyam farmers had farming experience of 12-21 years while 13 percent of them had experience of 22years or over. Only 15 percent of them had experience of 5-11 years. Experience is very important in farming because farmers count on it to improve their productivity. The more experienced a farmer is, the more likely he will do better

because under such situation costly mistakes may not be repeated. This is in tandem with Nwaru, et.al, (2006) who stated that the number of years a farmer has spent in the farming business, may give an indication of the practical knowledge, he has acquired on how to cope with inherent farm production processes and marketing problems.

**Distribution of the Respondents Based On Farm Size**

As observed in Table 1, cocoyam was produced on small parcels of land in the area. Most of the farmers comprising 70 percent, cultivated 0.4-0.8 ha of cocoyam; 21 percent cultivated 0.9-1.3 ha and only 9 percent cultivated 1.4-1.8ha. This indicates that cocoyam production was on small scale. In a similar study Audu *et al*, (2013), found that most yam farmers in Kogi State operated on small scale.

**Distribution of the Respondents Based On Methods of Acquiring Farm Land**

Most of the farmers inherited their farmlands. The number that inherited their farmlands was 80 percent of the respondents. About 10 percent, 6 percent and 4 percent of the respondents acquired their farm lands through lease, gift and purchase respectively. This observation, apparently buttressed the report of Audu (2013) that 76 percent of cassava farmers in Kogi State acquired their farm lands through inheritance.

**Distribution of the Respondents Based on Extension Visits**

Majority of the farmers representing 67 percent were not visited by extension agents. About 30 percent of the farmers had 21-40 extension agent visitations. This information portrays poor extension services in the area. The result could be low adoption of innovations and poor performance of farmers' enterprises. This is in agreement with Ezeamo *et al*., 2017) who opined that extension services delivery in Nigeria was generally poor as a result of low ratio of extension staff to farmers.

**Estimates of the Parameters of Cobb-Douglas Production Function and their Effects on the Output of Cocoyam**

The results of the estimates of Cobb-Douglas production function are shown in Table 2. The coefficient of determination ($R^2$) was 0.940. The implication is that 94 percent of the variation in the output of cocoyam was explained by the variables included in the model. The remaining 6 percent was due to error of omission that is, those variable that were not included in the model. The F-value was high (294.967) and significant at 1 percent level of probability showing the overall significance of the regression model. Coefficients of all the variables were positively signed except coefficient of labour which was negatively signed. Coefficient of herbicide was positive with a value of 0.945. It was significant at 1 percent level of probability. This means that application of more herbicide will increase the output of cocoyam. This is in agreement with studies carried out by Awoniyi and Omonona, (2007) who found positive relationship between crops outputs and herbicide and other agrochemicals.

Coefficient of fertilizer had a positive value of 0.206 and it was significant at 10 percent level of probability. The positive coefficient of fertilizer means that the use of more fertilizer will increase the output of cocoyam. In a similar study on technical efficiency of yam farmers, Audu *et al*. (2013) obtained a positive and significant coefficient of 0.007 for fertilizer.

Coefficient of cocoyam seeds was positive with a value of 0.440 and significant at 1 percent level of risk. This implies that the use of more cocoyam seeds (corm or cormel) that are healthy, the more the output of cocoyam. Audu (2012), found a positive and significant coefficient for cassava cuttings in a study on cassava in Kogi State.

**Table 1: Socioeconomic Characteristics of the Cocoyam Farmers**

| | | |
|---|---|---|
| **Age (years)** | | |
| 21 – 30 | 17 | 17.00 |
| 31 – 40 | 50 | 51.00 |
| 41 – 50 | 20 | 20.00 |
| 51 and above | 12 | 12.00 |
| **Total** | **100** | **100.00** |
| **Educational level** | | |
| No formal education | 30 | 30.00 |
| Primary School | 50 | 50.00 |
| Secondary School | 15 | 15.00 |
| Tertiary School | 5 | 5.00 |
| **Total** | **100** | **100.00** |
| **Marital Status** | | |
| Married | 60 | 60.00 |
| Widow/Widower | 19 | 19.00 |
| Single | 16 | 16.00 |
| Divorce | 5 | 5.00 |
| **Total** | **100** | **100.00** |
| **Sex** | | |
| Female | 61 | 61.00 |
| Male | 39 | 39.00 |
| **Total** | **100** | **100.00** |
| **Household size** | | |
| 1 – 4 | 19 | 19.00 |
| 5 – 8 | 62 | 62.00 |
| 9 – 12 | 19 | 19.00 |
| TOTALS | 100 | 100.00 |
| **Farming Experience (year)** | | |
| 5 – 11 | 15 | 15.00 |
| 12 – 17 | 51 | 51.00 |
| 16 – 21 | 21 | 21.00 |
| 22 and above | 13 | 13.00 |
| **TOTALS** | **100** | **100.00** |
| **Farm size (ha)** | | |
| 0.4 – 0.8 | 70 | 70.00 |
| 0.9 – 1.3 | 21 | 21.00 |
| 1.4 – 1.8 | 9 | 9.00 |
| **TOTAL** | **100** | **100.00** |
| **Methods of acquisition of farm land** | | |
| Inheritance | 80 | 80.00 |
| Lease | 10 | 10.00 |
| Gift | 6 | 6.00 |
| Purchase | 4 | 4.00 |
| **TOTALS** | **100** | **100.00** |
| **Extension visits** | | |
| No visit | 67 | 67.00 |
| 1 – 20 | 30 | 30.00 |
| 21 – 40 | 3 | 3.00 |
| **TOTALS** | **100** | **100.00** |

**Source: Field survey, 2020**

Farm size was positively signed but not significant. This could be as a result of the fact that cocoyam was planted on small plot of land surrounding the dwelling places. Increase in farm size will increase the output of cocoyam all things being equal.

Labour was negatively signed and it was not significant. Most of the farmers used family labour in excess because it was readily available.

**Table 2: Estimates of the Parameters of Cobb-Douglas Production Function Showing Influence of Inputs on the Output of Cocoyam**

| Variables | Coefficients | Std Error | t-ratio |
|---|---|---|---|
| In b0 Constant (bo) | 12.905 | 0.656 | 19.159 |
| In farm size ($x_1$) | 0.161 | 0.158 | 1.023 |
| In Herbicide ($x_2$) | 0.945 | 0.026 | 36.487*** |
| In labour ($x_3$) | -0.079 | 0.132 | -0.597 |
| In fertilizer ($x_4$) | 0.206 | 0.118 | 1.741* |
| In setts ($x_5$) | 0.440 | 0.135 | 3.261*** |
| $R^2$ | 0.940 | | |

**F value: 294.967** *** **significant at 1 percent** *** significant at 10 percent**
**Source: Field survey, 2020**

**Resource Use Efficiency of Cocoyam Production**

Table 3 shows the level of efficiency in the utilization of various resources used in cocoyam production. Overall efficiency depicted by the sum of the coefficient of the inputs used in the regression was 1.676 meaning that the farmers operated in the stage of increasing return to scale. The implication is that more of these resources were needed to move production to where marginal value product would be equal to marginal factor cost that is, stage 2. Specifically, farm size, herbicide, fertilizer and seeds were underutilized because their respective marginal value products were more than their marginal factor cost. Labour was over utilized because its marginal value product was less than is marginal factor cost.

**Table 3: Resource Use Efficiency in Cocoyam Production**

| RESOURCES | APP | MPP | MVP | MFC | MVP/MFC |
|---|---|---|---|---|---|
| Farm size | 1300 | 2.26 | 1040 | 800 | 1.3 |
| Herbicide | 600 | 28.82 | 1325 | 85 | 15.60 |
| Labour | 720 | -2.00 | -920 | 1200 | -0.77 |
| Fertilizer | 425 | 8.84 | 4066 | 144 | 28.24 |
| Seeds | 410 | 19.57 | 9003 | 250 | 36.01 |

**Source: Field survey, 2020**

**Conclusion**

Socioeconomic factors such as age, level of education and ownership of land and physical inputs like fertilizer, herbicide, cocoyam seeds and land were positive in their influence on cocoyam output. These physical resources together with some of these farmers' socioeconomic attributes contributed to the production of cocoyam in the area.

Based on the findings of the study, the following recommendations were made to accelerate cocoyam production. Organic fertilizers like farm yard manure and herbicide should be made available at cheap prices so that farmers can use them to improve output of their farms. Farmers should be taught how to prepare farm yard manure on their farms. Land tenure system should be modified so that more land could be made available for cocoyam production in distant farm lands instead of land surrounding dwelling places mostly used for its production currently. Improved varieties of cocoyam should be developed by our research institutes so that the yield can go up. People should be educated on the uses of cocoyam so that its consumption rate can go up. Popularity of the crop is waning resulting in its current low demand and consequently decrease rate of cultivation among the farmers.

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