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Resource-use and efficiency of rural women smallholder Cocoyam farmers in Onitsha agricultural zone of Anambra, Nigeria

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Abstract

This study examined resource-use and efficiency of rural women smallholder cocoyam farmers in Onitsha Agricultural Zone of Anambra State. A multi-stage random sampling technique was used to select 120 respondents from Onitsha North and South Local Government Areas of the zone. Data were collected through well-structured questionnaire. The result of the regression analysis using linear model as the lead equation showed that most (labour, fertilizer used, farm size and depreciation of capital items) of the variables were strong determinants of cocoyam output at1% α- level. Results on the allocative efficiency showed that all the inputs were inefficiently allocated and were not utilized at the economic optimum level. The result of the return to scale indicated that the women cocoyam farmers were operating at the region of maximum technical efficiency.

Keywords: Resources, efficiency, smallholders and cocoyam farmers

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1.0 Introduction

Cocoyam (*Colocasia esculenta* and *Xanthosoma mafafa*) are important carbohydrate staple food in the southern and middle belt areas of the country [1]. Nigeria is the largest producer of cocoyam in the world, accounting for about 37.0% of total world output [2]. The crop is highly medicinal for diabetic patients because it has low starch content, easily digestible and contains protein more than tubers. The leaves of Colocasia esculenta have been shown to be a rich source of folic acid riboflavin, vitamins A and C, calcium, phosphorus. Cocoyam is a useful cover crop and the corms are ready to harvest in 6-9 months

The women own and plant cocoyam after the men have planted their yams, hence the crop is a woman's crop. This particular crop sustained Biafrans during the civil war in Nigeria in 1966-1970.

Regrettably, this all-important crop with all its wonderful attributes is suffering a lot of neglect and abandonment. The resource allocation to cocoyam is significantly low when compared to other crops such as yam and cassava [3]. The production of the crop has not been given priority attention probably due to its inability to earn foreign exchange and its unacceptability to the high income groups for consumption and other purposes [4]. Te production of cocoyam is labour intensive with most operations carried out manually at the traditional level [5]. When compared with most agricultural product, cocoyam cultivation is declining .

Ohiri et al. [6] had observed that in Nigeria, only 24%of the cropable land for cocoyam is under cultivation. Research has received minimal attention with respect to this crop. The problem of efficiency in the utilization of resources has been the greatest concern of production economists [7] . Hence, there is the dire need to increase and sustain the production level through productivity studies. This therefore formed the center piece of this study. This research is anchored on the specific objectives-to determine the selected socio-economic variables of the rural women farmers, to determine the productivity of various resources used in cocoyam production, to determine the resource use efficiency of the crop and to make recommendations based on research finding

In an attempt to realize selected specific objectives, the two hypotheses were tested:

Ho_1 :Output of cocoyam is positively related to labour (man days); access to credit; variable input such as fertilizer; farm size (ha) and negatively related to depreciation cost of fixed assets and Ho_2: elasticity and return to scale are equal to zero

2.0 Materials and methods

The research was conducted in Onitsha Agricultural Zone of Anambra State. The zone was purposely chosen because of the intensity of cropping of the crop in the zone [8] . The zone is located on the south-eastern part of Nigeria within latitude 5^o 38' – 6^o 47' N of equator and longitudes 6^o 36'- 7^o 21' E of the Greenwich meridian. Purposive and multistage random sampling techniques were used in the selection process. First, two blocks in the one (Onitsha South and Onitsha North) were purposively chosen. The choice is based on the intensity of cropping of cocoyam in the areas. In the second stage, two circles each were selected at random out of 17 circles in the blocks making it 4 circles.

Table-1: Selected Socio-Economic Characteristics of the Rural Women Cocoyam Farmers in Onitsha Agricultural Zone of Anambra State, Nigeria

Socio-economic	Frequency	% Distribution
Variables		
Age of respondents(Years)		
24-30	2	1.67
31-36	11	9.17
37-42	18	15.00
43-48	34	28.33
49-53	9	7.50
>53	46	38.33
Total	**120**	**100.00**
Educational Level		
Zero formal education	21	17.5
Primary school education	31	25.83
Secondary school education	37	30.84
Tertiary school education	31	25.83
Total	**120**	**100.00**
Household size		
0-4	14	11.67
4-8	35	29.17
9-12	46	38.33
>12	25	20.83
Total	**120**	**100.00**
Farming Experience(years)		
< 4	12	10.00
4-8	27	22.50
9-12	33	27.50
>12	21	17.00
Total	**120**	**100.00**
Farm size (ha)		
0.01- 0.05	54	45.00
0.06- 0.10	3	2.50
0.20 – 0.60	52	43.20
0.70- 1.00	9	7.50
>1	2	1.00
Total	**120**	**100.00**

Source: Field Survey Data, 2009

Objective I was realized with the aid of descriptive statistics like percentages, mean and frequency distribution, while objectives ii and iii were realized with multiple regression analysis.

In the third stage, 20 sub-circles were chosen at random from the 4 circles. Finally, six (6) respondents were randomly chosen giving a total of 120 respondents. Instrument of data and collection was via the use of pre-tested and structured questionnaire.

The multiple regression analysis was run in three functional forms i.e. linear, semi-log and double log forms

I. Linear function

$Y = b_0 + b_1 X_1 + b_2 X_2 + \ldots\ldots + b_5 X_5 + ei$

Here

MPP = b (regression co-efficient)

Elasticity bx/y

II. Semi-log function

$Y = b_0 + b_1 \text{In } X_1 + b_2 \text{In } X_2 + \ldots\ldots + b_5 \text{In } X_5 + ei$

Here: MPP=b/y

III. The Double log form

$\text{In } Y = + b_1 \text{In } X_1 + b_2 \text{In } X_2 + \ldots\ldots + b_5 \text{In } X_5 + ei$

Here: MPP= b.y/x

Elasticity = b

Table-2: Estimated production function for smallholder women cocoyam farmers in Onitsha Agricultural Zone of Anambra State Nigeria

Variables	Linear	Exponential	Semi-log	Double log
Constant	-56.31916	4.854117***	-697.341**	2.511254***
	(-1.26)	(27.44)	(-2.40)	3.03
Fertilizer(Kg)	0.7446429***	0.0036752***	143.5839***	0.8630545***
	(4.69)	(5.86)	(3.75)	(7.90)
Labour (md)	1.096334***	0.0029822*	156.9627***	0.2184238
	(2.68)	(1.85)	(2.96)	(1.44)
Farm size(ha)	153.534***	-0.0272163	101.4694**	-0.2446868***
	(4.74)	(-0.21)	(2.45)	(-2.07)
Cocoayam setts	0.0006879	-1.24E-06	45.91032**	0.1717821***
	(0.31)	(-0.14)	(2.59)	(3.39)
Depreciation	-0.0390439***	-0.000148***	-100.7454***	-0.4693984***
	(-5.27)	(-5.06)	(-4.43)	(-7.24)
R^2	0.7456	0.5469	0.6908	0.7121
R^2	0.7345	0.5271	0.6772	0.6993
F-ratio	66.83***	27.53***	50.93***	56.42***

*****: Variable significant at 1.0% level, **: Variable significant at 5.0% level**

***: Variable significant at 10.0% level, Figures in parentheses are the t-values**

In all b_1 - b_5 are the regression coefficients

Where:

Y = Output of the ith farm in Kg

X_1 = Farm size measured as total land areas (ha)

X_2 = Labour (Mandays)

X_3 = Capital input (₦)

X_4 = Fertilizer used (Kg)

X_5 = Size of cocoyam setts (Kg)

However, the choice of the best functional form was based on econometric and statistical reasons such as the statistical significance of the regression coefficient, the magnitude of the F-ratio as well as their conformity to a priori expectation.

We have the technical efficiency and the price or allocative efficiency whereby a firm is considered more technically efficient than another given the same quantities of measurable inputs. If it consistently produces a larger output, technical efficiency is the measure of a firm's success in producing maximum output from a given set of inputs.

Table-3: Marginal Physical Products (MPP) of rural women smallholder cocoyam farmers in Onitsha Agricultural Zone of Anambra State, Nigeria

Inputs	MPP	Unit Acquisition Cost (MFC) (₦)	MVP	MVP/MFC
Labour (mandays)	1.0963	500.00	548.15	1.0963
Fertilizer(Kg)	0.7446	50.00	37.23	0.7446
Cocoyam sett	0.00069	60.00	0.0414	0.00069
Farm size (ha)	153.534	2585.00	396885.39	153.534
Depreciation	-0.0390	1.36	0.0530	-0.0390

Source: Computed from Table 2

Price or allocative efficiency traditionally rests on an index of marginal products or opportunity cost. If among all inputs, the ratios are equal to one and a firm is price efficient. The optimum resource use efficiency is obtained at the point where marginal value product (MPV) is equal to the marginal factor cost (MFC). Six percent (6%) interest rate was used to obtain the opportunity cost of fixed assets and other production inputs i.e. for every one naira spent on production, there was therefore N 1,06 (Mbanaso and Obioha, 2003). Labour and some other inputs were valued at their current market prices.

Mathematically: If MVP = MFC: means efficient resource utilization

If MVP < MFC: mean over utilization of resources

If MVP > MFC: means under utilization of resources

3.0 Results and Discussion

The socio-economic variables of the rural women cocoyam farmers are presented in Table-1. The modal (38.33%) age distribution of the women farmers was 53 years and above.

Table-4: Elasticity and Returns to scale of rural women smallholder cocoyam farmers in Onitsha Agricultural Zone of Anambra State Nigeria

Inputs	Elasticity
Labour (mandays)	1.0965
Fertilizer(Kg)	0.000000744
Cocoyam sett	2.488
Farm size (ha)	0.0007
Depreciation (₦)	0.0394
Return to scale	3.6246

Source:Computed from Table-2

This result is not in conformity with previous reports who stated that the ability of a farmer to bear risk, be innovative and be able to do normal work decreases with age. A good proportion (30.83%) of the cocoyam farmers had secondary school education. Educated farmers are

expected to be more receptive to improved farming techniques [9, 10]. A reasonable proportion (38.33%) of the women farmers had a household size of 9 and 12 persons. This has implication for the supply of labour for farm work. A fairly good proportion (27.50%) of the women cocoyam farmers had a farming experience of 9 and 12 years. Farmers count more on their experience than educational attainment in order to increase on their productivity. The result also showed that 98.2% of the respondents had cocoyam holdings of less than 1 hectare. This implies that cocoyam production is dominated by smallholders. This compares favourably with Oyadele et al., [11] who found that the average farm size of cocoyam production in Nigeria was 0.008ha.

The model estimation of cocoyam production is presented in Table-2. The result shows that output of cocoyam production was best estimated using linear function which explained 74.56% of the total variations in the output of cocoyam. The linear function model was chosen as the lead equation because of the conformity of the variables to a priori expectation and high R^2 value (0.745). The coefficient (-0.0390439) for depreciation of fixed capital items had indirect relationship with output and was significant at 1.0% level. This is in consonance with a priori expectation. It implies that a 1.0% increase in the rate of depreciation of capital items will lead to 0.04% decrease in output. The co-efficient (155.534) for farm size had a direct relationship with output and was significantly at 1.0% probability level. This shows that a 1.0% increase in farm size, would lead to 155.5% increase in output. The coefficient (1.096534) for labour had a direct relationship with output was significance at 1.0% alpha level. This implies that a 1.0% increase in labour would lead to 1.09% increase in output. This is because an improved wage rate would make labour supply to be attractive and hence increase in the output of cocoyam. The coefficient (0.0006879) for cocoyam sett had a direct relationship with output but was not statistically significant at given level. The coefficient (0.7446429) for fertilizer had a positive relationship with output and was highly significant statistically at 1.0% risk level. This result agrees with a priori expectation implying that a 1.0% increase in fertilizer would lead to 0.74% increase in cocoyam output.

The results of the estimated production function were further used to compute the marginal productivities of the resources in Table-3. For the linear function, which formed the lead equation, the Marginal Physical Product (MVP) = The relative allocative efficiency of the rural women cocoyam farmers was based on the non-classical requirement that each factor be paid equal to its Marginal Value Product (MVP) to Marginal Factor Cost (MFC) (unit acquisition cost). These were computed and the values were 1.0963; 0.7446; 0.00069; 153.534 and 0.0390 for labour. Fertilizer, size of cocoyam setts, farm size and depreciation cost, respectively. Onyenweaku and Effiong [12] showed that maximum or absolute allocative efficiency for a particular resource is reached if the efficiency ratio is greater than one, it means that less than the profit maximizing level of input is in use. Also, if the efficiency ratio is less than one, it means that more than the profit maximizing level of that particular resource is in use. The result showed that the values for labour and farm size, were more than one implying that less than the profit maximizing levels of these resources were used while the values for fertilizer, size of setts and depreciation were less than one implying that more than the profit maximizing level of the inputs were used. This suggests that all the resources were inefficiently allocated and were not utilized at the economic optimum level.

The elasticity of production shows the change in output relative to a unit change in input , for the linear function which was the lead equation, the elasticity of production = b. x/y and is presented in Table-4. The production elasticities for labour and farm size were greater than one while that of quantity of fertilizer, size of cocoyam setts and depreciation were less than one. The return to

scale was 3.6246 indicating increasing returns. This implies that women cocoyam farmers in Onitsha Agricultural Zone of Anambra State were operating at the region of maximum technical efficiency, an irrational region of production. This finding is in conformity with Mbanaso and Obioha [14] who reported that actual cases of increasing returns occur at relatively low levels of output that are characteristics of small-scale farming.

4.0 Conclusion

The research indicated that all the significant variables (farm size, labour and fertilizer) had positive influence in the quantities of cocoyam output. The result of the return to scale (3.6246) indicates that the rural women cocoyam farmers in Onitsha Agricultural Zone of Anambra State were operating at the region of maximum technical efficiency (i.e. stage 1 of the classical production function).The following recommendations can be proposed that would help to improve the efficiency o resources used in cocoyam production in the study area -the preponderance of the aged in cocoyam production in study area is worrisome because the exit of this aged population would mean cessation of the production of this all-important crop. It is therefore recommended that government policy should focus on empowering the youths and modernizing rural environment with a view to attracting agile and stronger youths.The study revealed that increase in farm size would lead to an increase in efficiency. This finding suggests that government policy would encourage measures that would make land available. There is need for re-visitation of the land use decree and cultural limitations to make more lands available to the rural women farmers. Government should as a matter of deliberate policy put in place policies that would encourage experienced farmers to remain in farming as well as expanding and sustaining the current fertilizer subsidy level while fertilizer distribution network should be completely overhauled,

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