Full Length Research Paper

Income and factor analysis of sweet potato landrace production in Ikom agricultural zone of Cross River state, Nigeria

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This study was carried out to evaluate the income generation level and constraints of sweet potato landrace production in Ikom agricultural zone of Cross River state, Nigeria. The multi-stage sampling procedure was followed. The first stage involved the selection of Ikom agricultural zone out of Calabar and Ogoja agricultural zones, which was purposively selected. The reason is that there are a lot of farm settlements in the zone that engages in the Otere- two variety production. The second stage involved the selection of Ikom local agricultural area out of six other local government areas, which was done purposively. The area is known for the production of Otere two, a white local variety of sweet potato. Third stage involved the selection of Otere site and field crop settlement area which was done purposively because the two areas are known for the cultivation of Otere-two variety of sweet potato. There were about 120 farmers in the two areas and 75 of them were randomly selected and interviewed with semi-structured questionnaire. The data collected were analyzed with descriptive statistics, profitability and Cobb Douglas production function Model. On the aspect of profit maximization by Otere-two farmers, it was found that a profit of ₦2.71 was realized for each ₦1.00 invested in the production of the crop. The Cobb Douglas regression model results showed that costs of planting material and other inputs were positive and significantly related with gross return from Otere-two variety production. While human labour was found to have negative but significant relationship with gross return from Otere-two variety production. It was also found that factors like cost of fertilizer and transport cost were positive and negative but has no significant relationship with gross return from Otere-two variety production. Finally, it was found from the regression that the production of Otere-two variety of sweet potato by the farmers was decreasing suggesting that the production is within subsistence level.

Key words: Income, factor, sweet potato (Otere-two variety), Cross River state, Nigeria.

INTRODUCTION

Sweet potato is one of the world's most important food crops due to its high yield and nutritive value (Data and Eronico, 1987; Raemaekers, 2001). About 92% of the world's production is found in Asia (Islam et al., 2002). The crop is a short duration crop (3 - 4months) that could be cropped more than once in the year (Nwauzor et al., 2006). It is extensively cultivated in the tropical zones. The crop requires low inputs and less management. It does well on non marginal soils, giving reasonable yield than most of other root crops (Raemaekers, 2001). It ranks 7th among the world's major food crops.

In Nigeria the crop has ceased to be a "Back yard" crop or a "gap filler" (Nwauzor et al., 2006). Survey reports in Nigeria show that production, marketing and utilization have expanded in the last decades beyond its traditional

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central and riverine areas (Agboola, 1979) to almost all ecological zones in the country (Tewe et al., 2001). The crop is very much grown in Nigeria. Globally, Nigeria is the third largest producer (2.516 million metric ton) with China leading (106,197 million metric ton) followed by Uganda (2.6 million metric ton) (FAO, 2005).

The crop is grown for both human and animal consumption (Onwueme, 1978; Onwueme and Sinha, 1991). Household income is also supplemented by sales of the root tubers in local markets and to urban dwellers (Woolfe, 1992). The local varieties of sweet potato is scattered allover Nigeria which were introduced by the early colonial masters and Christian missionaries. The improved varieties which were developed by National Root Crops Research Institute, (NRCRI), Umudike, and International Institute for Tropical Agriculture (IITA), Ibadan, Nigeria have equally spread far and wide into the nooks and crannies of rural areas of Nigeria.

In spite of these improved varieties that are high yielding; some rural farmers in Nigeria, still bent on cultivating their local varieties which are available to them. May be the improved varieties are not available to them or perhaps they were not suitable for their topography. In Ikom agricultural zone of Cross River state, sweet potato is extensively cultivated here especially in swampy area after rice is being harvested. The crop is usually planted around March and harvested around June and July after rain must have set in to give way for rice production. They believe in the cultivation of their local white variety called Otere-two because the tuber from this local variety is oblong in shape and not too sweet. A tuber can weigh up to 3 kilogram. They producers consumed this crop while waiting for other root and tuber crops to mature.

Sweet potato farming inputs are land, labour, capital and management. These resources are grouped together as production unit. The primary objectives of every sweet potato (Otere-two variety) producer include profit maximization, cost minimization, the maximization of satisfaction or combination of all these (Olayide and Heady, 1982; Ezeh, 1998). The inputs required for its production are not too costly when compared to other root and tuber crops. A farmer may decide to add fertilizer or not as the traces of fertilizer applied during rice production are still available in place. The sweet potato vines are kept in nursery until planting period sets in. At harvest period, they sold a full basin (14 kg) at the price of ₦400.00.

The Otere-two farmers are more or less subsistence farmers who believe in household production first while excess of the production is sold in the local markets for cash. There is need to investigate into the profitability of this local white variety and perhaps ascertain the factors influencing it production. Although no much information have been made on this issue. An attempt is therefore made to evaluate the cost and income implications of white local variety of sweet potato in Ikom agricultural zone of Cross River state, Nigeria.

METHODOLOGY

The study area: The study was carried out in Ikom agricultural zone of Cross River state, Nigeria. The state has an area of 17,802 km with a population of over 2 million people. The state is bounded by states like Benue in the North, Abia and Ebonyi in the west, Akwa Ibom in the south while it has an international boundary with Republic of Cameroon in the east. The major occupation of the rural dwellers is farming and fishing. The state is made up of three agricultural zones namely; Calabar, Ikom, and Ogoja agricultural zones. Ikom agricultural zone is a tropical rainfall area and is known for it abundant food supply in arable and cash crops production. Cocoa product dealers are very much prominent in this area. The zone is made up of six local government areas namely Abi, Yakurr, Obubura, and Etung. Others are Ikom urban and Boki local government areas. These local government areas are made up of several communities and villages.

Sampling procedure

The multi-stage sampling procedure was followed. The first stage involved the selection of Ikom agricultural zone which was purposively selected. The reason is that there are abundant supply of arable and cash crops in the area. Beside there are a lot of farm settlements in the zone. The second stage involved the selection of Ikom local agricultural area which was done purposively. The area is known for the production of Otere two, a local variety of sweet potato in the zone. Third stage involved the selection of Otere site and field crop settlement area which was done purposively because the two areas are known for the production of Otere-two variety of sweet potato.

There were about 120 farmers in the two areas selected but 75 of them were randomly selected and interviewed with semi-structured questionnaire. The data sought and collected were on age of the farmers, measured in years, farming experience was measured in years, hire farm size was in hectares, household size was in number, educational level, measured in years and cost of planting materials was measured in bundles and valued Naira. Others include labour record, were measured in man- day but were valued in Naira, transport, was valued in Naira, tools for cultivation, were valued in Naira and were depreciated using straight line method, rent on land, and unit of measurement of yields was in Kilogram, yield record, and farm gate price were valued in Naira.

Analytical techniques

The tools used for the analysis include descriptive statistics, profitability and Cobb Douglas function models. The profitability model (Ogbonna and Ezedinma, 2005; Ogbonna et al., 2006) is specified as follows:

$$NR = GR - TC \quad ...... (1)$$
$$R/₦ = NR/T \quad .... (2)$$

Where,

NR = Net return, measured in Nigerian currency, the naira (₦)
GR = Gross return, measured in Nigerian currency, the naira (₦),—
TC = Total cost, measured in Nigerian currency, the naira (₦)
R/N = Return per naira, measured in percentage (%).

The choice of Cobb Douglas function was based on its fitness to agricultural production (Barman, 1993; Ezeh, 1998; Barman and Chaudhury 2000; Barman et al., 2002; Onyenweaku and Nwaru, 2005). The model is specified in logarithmic form as;

$$\text{Log } Y = \text{Log } B + a_1 \text{Log } X_1 + \ldots + a_n \text{Log } X_n \ldots\ldots\ldots (3)$$

The specified implicit form was:

$$Y = F(X_1, X_2, X_3, X_4, X_5, e)\ldots\ldots\ldots\ldots (4)$$

Where;

Y = Gross return, measured in Nigerian currency, the naira (₦)

X_1 = Cost of planting material, measured in Nigerian currency, the naira (₦)

X_2 = Cost of fertilizer (NPK 15:15:15), measured in Nigerian currency, the naira (₦)

X_3 = Cost of transport, measured in Nigerian currency, the naira (₦)

X_4 = Cost of human labour, measured in Nigerian currency, the naira (₦)

X_5 = Cost of other inputs (depreciation on farm implements, and family labour, and rent on land), measured in Nigerian currency, the naira (₦)

B = constant

e = Error terms.

These variables were expected to positively influence the increase in gross returns of farmers who engage in Otere-two variety productions.

The problem of multicollinearity: To ascertain the problem, a zero order correlation matrix for all explanatory variables was obtained for this production function. The correlation coefficient between a pair of explanatory variable was treated seriously if it was greater than 0.8 following (Heady and Dillion, 1961; Barman et al., 2002).

RESULTS AND DISCUSSION Socio-

economic profile of Otere-two farmers

In Ikom local government area of Ikom agricultural zone of Cross River state, the results on socio- economic status are shown in Table 1. The average age of Otere-two (a local variety of sweet potato) farmers were 43 years. These Otere-two farmers fall within the active age group which shows that introduction of high yielding variety of sweet potato could be adopted by this active age class. The average household size of Otere-two farmers was 7 persons. This implies that the farmers have many mouths to feed and the same time it could assist in the reduction of total cost of production through participation in labour operations. The average year of schooling was 6 years, implying that the average Otere-two farmers attempted primary education. This could lead to increase in production of Otere-two local variety of sweet potato in the study area. The average hire farm size in hectare was 0.296 hectare. This implies that the small size of the farm could mean that the production of

Table 1. Socio- economic profile of Otere-two farmers in Ikom agricultural zone of Cross River State.

Variable	Average
Age (Year)	43
Household size (Number)	7
Farming experience (Year)	5.2
Education (Year)	6
Hired farm size (Hectare)	0.296

Source: Field survey, 2006

Otere-two is for family use while excess is sold for cash and not necessarily for profit maximization but maximization of satisfaction (Olayide and Heady 1982, Ezeh, 1998). The Otere-two farmers in the study area have 5.2 years farming experience. This may lead to increase in production of the crop.

Profitability of Otere-two variety of sweet potato

The overall production cost of Otere-two variety of sweet potato was ₦7, 229.87 ($55.61) (Table 2) . The cost of planting materials accounted for 36.65% of the total cost of production. This is the most important aspect of the production of Otere-two local variety of Sweet potato because without it production will not hold. The higher the planting material, the more yields that may be obtain if other production constraints are held constant. Other major costs item influencing the production of Otere-two variety were cost of fertilizer (20.98%), transport cost (17.09%) and human labour (11.99%) respectively. These four cost inputs seem to be the major production constraints in Otere-two production in the study area. However, in spite of the level of production cost of Otere-two variety, they farmers realized an average gross and net return of ₦19599.71 ($150.77) and ₦12369.84 ($95.15) respectively. This shows a return per naira of 171%. This implies that they farmers realize a profit of ₦2.71 for each ₦1.00 spent in the cause of production of Otere-two local variety.

Productivity of Otere-two variety of sweet potato

The regression analysis was done for the entire sample with the specified functional model. The coefficients and estimated values of different parameters in the model are given in Table 3 and discussed. The level of production coefficients was found to be for different variables. It is clear that the coefficients of the cost of planting materials (X_1) and cost of other inputs were 0.2792 and 0.1800 which were positive but significant at 5 and 1% level with gross return respectively. This indicates that if cost of

Table 2. Profitability in sweet potato (Otere-two variety) production in Ikom agricultural zone of Cross Rivers state.

Variable	Quantity/ha	Unit cost(₦)	Value (₦)	Percentage
Gross return (GR)				
Yield (kg)/₦	686	28.57	19599.71	
Variable cost (₦)				
Human labour (MD)	3	289.00	867.00	11.99
Fertilizer (Kg)	20	75.84	1516.70	20.98
Transportation			1235.33	17.09
Planting material (bundle)	53	50.00	2650.00	36.65
Total variable cost (TVC)			6269.03	
Fixed cost(FC)				
Rent			500.00	6.92
Depreciation (tools, family labor)			460.84	6.37
Total fixed cost (TFC)			960.84	
Total cost (TC)			7229.87	100.00
Net return (NR) (GR-TC)			12369.84	
Return per Naira (R/N) %			271	

Source: Field survey, 2006.

Table 3. Summary of regression results.

Variable	Parameter estimate	t-value
Intercept	6.6631	(7.75)***
Planting material cost(X_1)	0.2792	(2.02)**
Fertilizer cost (X_2)	0.0419	(0.62)
Transportation cost (X_3)	-0.0007	(-0.01)
Human labour (X_4)	-0.0575	(-1.90)*
Other inputs cost (X_5)	0.1800	(3.65)***
R^2	0.296	
F-value	5.80***	
Number of observation	75	

planting materials and cost of other inputs were increased in Otere-two variety production by 5 and 1%, there would be an increase in gross return of Otere-two variety production by 0.2792 and 0.1800% respectively.

The coefficient of human labour was negative (-0.0575) but significant at 10% which implies that if the cost of human labour was increased in Otere-two variety production, there would be a decrease in gross return by -0.0575%. This comes to mine that Otere-two farmers were over utilizing labour as they combine both hire and family labour. The average hire farm size as shown earlier was low and at such labour employed by the Otere-two farmers were in excess. More returns could be realized if the farmers could readjust their labour demand with their house hold size. The coefficient of the cost of fertilizer was neither significant nor negative; this implies that the Otere-two farmers were rational in allocating this

input which is perhaps a necessary factor for break even in Otere-two variety production. The input is used most inefficiently as the result shows no significant relationship with the gross return. There is need to reallocate this input to derive more returns.

The coefficient of the cost of transportation was non-significant but negative. This suggests excessive use of this input in the production of Otere-two variety. The recent hike in fuel price in Nigeria may have led to this effect. The farmers may have to readjust their expenses in transportation if more profit is to be derived. The sum of regression coefficient was 0.44. This was lower than unity, which implied that there was a decreasing return to scale in Otere- two variety production in the study area, which could be attributed to low, hired farm size as found earlier. The coefficient of multiple determinations (R^2) was 0.296. This implies that the explanatory variables used in the model specification were fairly important, and at such 30% of variation in the Otere-two variety production was explained by them. However, the larger the R^2 value is the more important the regression equation is in characterizing the endogenous variable (Gomez and Gomez, 1984; Barman *et al*, 2002). The F -value was observed to be 5.80 and highly significant at 1%. It was also found that the inter-correlation between independent variable was low. Correlation were not more than 0.8 (Table 4), thus satisfying the criterion for non-serious of serious of multicollinearity (Heady and Dillion, 1961;

Conclusion

Generally the socio-economic status of Otere-two far-

Table 4. Zero order correlation Matrix of variables for studied Otere-two variety in Ikom agricultural zone in cross Rivers state.

Variables	Y	X_1	X_2	X_3	X_4	X_5
Y	1.000	-0.779	0.112	-0.214	0.066	-0.025
X_1		1.000	-0.527	-0.062	-0.205	-0.324
X_2			1.000	-0.245	0.103	0.160
X_3				1.000	-0.040	0.129
X_4					1.000	-0.243
X_5						1.000

Dhawan and Bansal, 1977; Barman, 1993; Barman et al., 2002; Onyenweaku and Nwaru, 2005).

farmers in the Ikom agricultural zone, found that the farmers were 43 years old on average, had 7 persons per household, 5.2 years of farming experience, and 6 years in education. The size of hired farm on average was 0.296 hectare. On the aspect of profit maximization by Otere-two farmers, it was found that the total production cost was ₦7229.87 while gross and net return were N19599.71 and ₦12369.84 respectively. A profit of ₦2.71 was realized for every ₦1.00 invested in the production of the crop. The summary of regression analysis was found that cost of planting materials and cost of other inputs were the major factors contributing positively to increase in gross return in the production of Otere-two variety, while cost of human labour tend to decrease the gross return. The other inputs like cost of fertilizer and transport were being over utilized by the Otere-two variety farmers. Thus, the cost of planting material (sweet potato vines) which shows positive relationship with gross return can be improved by introducing a high yielding variety to the farmers to boost their economic base and welfare. With a better high yielding variety that has land area coverage; labour input in weeding can be reduced. We therefore, suggest that human labour and transportation which showed negative relationship with gross return from Otere-two variety production requires serious attention by government if this particular variety of sweet potato is to go beyond subsistence level of production. The planting materials, other input cost, human labour, fertilizer and transport costs could also be subsidize by government through provision of credit facilities to reduce cost and facilitate the production of Otere-two variety of sweet potato as this area prefer this variety of sweet potato.

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