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# Budgetary analysis of banana (*Musa sapientum* L.) and Plantain (*Musa paradisiaca* L.) production

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**Abstract.** The study focused on budgetary analysis of banana and plantain production enterprises in Bayelsa State of Nigeria. A three-stage sampling technique was used in drawing the sample for this study. The first stage involved purposeful selection of four (4) out of the eight (8) Local Government Area (LGAs) of the State where farming activities was predominant. The LGAs were Southern Ijaw, Yenagoa, Sagbama and Ogbia. The second stage involved random selection of nine (9) villages in each of the LGAs. While the third stage involved random selection of five (5) farm households who engaged in banana and plantain based farm enterprises from each of the villages sampled. This gave a sample size of 180 farm households. The data were analyzed using mean and budgetary models. Farm holdings were on average 0.12 and 0.89 hectare for banana and plantain enterprises respectively. Net annual returns for banana and plantain enterprises were ₩47,461.11 and ₩242,690.53, respectively. Plantain enterprises had higher return to naira invested of 0.74 k. Net returns associated with banana and plantain production enterprises can be enhanced by the provision of credit/ loan, farm inputs, farm equipment, good rural roads with improved varieties of suckers as well as ensuring access to extension services and improved farming technologies by Government, Non-Governmental Organisations (NGOs) and institutions alike through genuine political will.

Keywords: Budgetary analysis, banana, plantain, production, enterprises, Bayelsa State, Nigeria.

# INTRODUCTION

Nigerian agriculture began to falter as its contribution to GDP began to decline when crude oil became a major export earner from the 1970s (Aigboktan, 2001). This situation made Nigeria a net importer of food and dependent on imported agricultural raw materials for her industrial sector (NISER, 2000). Productivity in most multiple-cropping systems under small holder farming per area in the tropics has been observed to be higher than sole cropping (Reijintjes et al., 1992). Over the years, banana (*Musa sapientum* L.) and plantain (*Musa paradisiaca* L.) have occupied a strategic position in agricultural production in Nigeria. According to Swennen (1990), Robinson (1996), Frison (1997), Nkendah and Akyeampong (2003), FDA (1999), Faturoti et al. (2007), plantain and banana are among the most important

staple food crops in the humid forest zone of west and central Africa. The foregoing was attributed to the crop contribution to food security, employment, Gross National Product and diversification of income sources in rural and urban areas. FAO (2004) stated that banana is the world's second most important fruit crop after oil palm. Comparatively, while banana is presently of higher importance in terms of world trade, plantains are rarely exported but are used locally in various forms by humans (Faturoti et al., 2007; Babatunde, 1991). In Africa, estimated 70 million people in the region depend on these crops for more than 25% of their carbohydrate and 10% of calorie intake (Ogungbe, 2005; Frison and Sharrock, 1999; Robinson, 1996; Swennen and Oritz, 1997). While the crops have high export values, 90% of the production, in the producing countries is consumed locally where they serve as staple food for more than 300 million people (Swennen et al., 2004). Thus, plantain and banana play significant role in domestic and national food security in these countries.

One major limitation identified in plantain and banana production is the fact that a vast majority of producers world-wide are small scale farmers growing the crops either for home consumption or for local markets (Faturoti et al., 2007; Esendugue, 1993; BYSG, 2003). Yet sustainable production of plantain and banana is critical to food security, rural income and employment generation, and economic growth in any given agroeconomy. It is very obvious that the yield per hectare in plantain production took a down-ward trend for almost a decade (FAO, 2011). For instance, the trend of plantain production in Nigeria between 1990 and 2009 showed that yield per hectare consistently made a down ward move from 7.54 tonnes per hectare in 1992 to 4.94 tonnes per hectare in 1999; then 5.10 tonnes in 2000 to 4.90 tonnes in 2001 and 6.31 tonnes in 2007 to 5.90 tonnes in 2008. Conversely, an unsustainable increase in the area cultivated / harvested steadily rose from 162,000 hectares in 1990 to 481,000 hectares in 2009. However, increase in price per tonne rose from ₩5,300 in 1991 to ₩116,597 in 2008 (FAO, 2011). In the same vain, plantain and banana was becoming more and more expensive in Bayelsa State (Alagoa, 1999; BYSG, 2003). Yet, the products are also staple food and raw material for the emerging cottage food processing industries in Southern humid forest zone of Nigeria (Afro News, 2003; FDA, 2000).

The broad objective of the study therefore was to determine the costs and returns in sole banana and plantain production enterprises in Bayelsa State of Nigeria, to provide farmers and researchers with base line information that will guide the formulation of agricultural policies for agricultural growth and development in the area. Results could also be applicable to similar farming systems or cropping systems in the world, particularly the humid sub-Saharan regions as the region share similar agricultural problems (Kassie et al., 1999).

# Theoretical/conceptual framework

# **Budgetary analysis**

The use of budgetary models in agricultural economic analysis is simple and common. Budgetary analysis involves estimation of gross revenue and total cost of production period, of which the difference between the two estimates gives a measure of net income (Kainga and Seiyabo, 2012). The budgetary model enables the analyst to assess the profitability or otherwise of an agricultural production system. The model delineates the costs and revenue structure of a production system with a view to estimating its income generating potential or profitability. The guiding principle here is to add a variable input until total returns minus total cost of the input is at a maximum. That is:

$$Max \pi = Py.Y - Px.X$$
(1)

Where Py = Prevailing unit market price of output in Naira monetary value

 $\dot{Y}$  = Level of output in kg or tonnes

Px = Prevailing unit market price of variable input in monetary value

X = Level of variable input in kg or tonnes

Budgeting is a convenient method of aiding decision making in farm business management when there are only a few production alternatives that need to be considered in the decision. It is the simplest and most convenient tool of empirical analysis in the field of production economics (Thiam and Ong, 1979). Productivity in most multiple-cropping systems by small holder farmers in the tropics in terms of harvestable products per area among others has been observed to be higher than under sole cropping with the same level of management (Reijintjes et al., 1992). Okorji (1986) employed budgetary and production function models to analyze the productivity and profitability of farming in south-eastern Nigeria. Ekunwe and Ajavi (2010) and Nwaiwu et al. (2012) employed budgetary models in analyzing the profitability of plantain production in Edo State of Nigeria and Abia State of Nigeria respectively and found out that it was profitable. Fakayode et al. (2011) also in their study on assessment of plantain production in Rivers State, South-South Nigeria in the Niger Delta found out that plantain production was profitable and economically viable. Kainga (1997) and Kainga (2002) also used budgetary models in analyzing the profitability of arrack (local gin) and swamp rice production in Rivers and Bayelsa State of Nigeria, respectively. He concluded that both arrack (local gin) and swamp rice production in these areas were profitable.

Okorji (1986) in a study to compare the productivity of yam under mixed and sole cropping using budgetary model observed that output of yam per hectare, output/seed input ratio, as well as yield per yam crop stand were higher under yam sole cropping than under mixed cropping. Scarce resources of land, labour and capital were also observed to be more productive under sole cropping. The opportunity cost of producing yam under mixed cropping system was equivalent to <del>N</del>480.79 per hectare. He argued that considering that the same level of social status is attainable by adopting either of the two cropping systems, it becomes rational to adopt sole cropping with less labour and cash requirements but higher output and returns.

# MATERIALS AND METHODS

### Study area

The study was conducted in Bayelsa State of Nigeria. The State is situated between latitude 04°45'00" N and longitude 6°05'00" E (NGIA, 2012). By the 2006 census (NPC, 2006), the state had a population of 1,703,358 people spread over the land area most of which is wetland. Mean annual rainfall ranges from 2,000 to 4,000 mm and spread over 8 to 10 months of the year between the months of March and November (Oyegun, 1999). Temperature is fairly constant throughout the year over the entire state with a maximum of 30°C. Owing to its proximity to the Atlantic Ocean, the relative humidity of the state is comparatively uniform over the state, which ranges between 65 to 90% (Alagoa, 1999; Oyegun, 1999). The choice of plantain and banana farm enterprises for this study cannot be over-emphasized as the crop is one of the staple foods and one major crop in the crop mixture of the cropping system of Bayelsa State. Culturally, plantain in an average Bayelsan's meal is commonly combined in the following forms: eba/soup and boiled plantain; foofoo/soup and boiled plantain; boiled plantain and palm oil; roasted plantain and palm oil; plantain/pepper soup; and plantain pottage. In some parts of the State, certain markets and market days are dedicated to this crop exclusively (Kainga, 2013).

# Sampling technique

The period of data collection was August, 2009 to August, 2010. Farms visited were mainly matured and stabilized farms. A three stage sampling technique was used in drawing the sample for this study. The first stage involved purposeful selection of four (4) out of the eight (8) local government areas (LGAs) in Bayelsa State on the basis of predominance of farming activities. The LGAs so selected were Southern Ijaw, Yenagoa, Sagbama and Ogbia. In each of these LGAs so selected, nine (9) villages were randomly selected from a list of villages in the LGA. Finally, in each village sampled, five (5) farm households who engaged in banana and plantain based farm enterprises were randomly selected and studied. This gave a sample size of 180 farm households.

# Data analysis

The data were analyzed using mean and budgetary models. The costs and returns associated with the banana and plantain production enterprises was achieved by means of budgetary models, mainly enterprise budgeting.

#### Model specification

#### Budgetary model

A budgetary model was used to prepare costs and returns budget associated with plantain and banana farm enterprises with a view to determining the profitability or otherwise, of each enterprise and the returns derivable to the factors of production to be employed. The budgetary model employed in the analysis of the data was defined mathematically as follows:

$$\pi_{ij} = \sum_{j=1}^{m} \sum_{i=1}^{n} P_{ij} Y_{ij} - TC_{ij}$$
(2)

#### Where

 $TT_{ij}$  = Net Annual Returns or Net Farm Income associated with the jth cropping system of the ith farm household in Naira;

 $P_{ij}$  = Price per unit of output of the jth cropping system of the ith farm Household in Naira;

 $Y_{ij}$  = Output level of the jth cropping system of the ith farm household in tonnes;

 $TC_{ij}$  = Total costs of producing output level of the jth Cropping system by the ith farm household in Naira;

i = 1, 2, 3, ..., n; j = 1, 2, 3..., mBut

$$TC_{ij} = \sum_{j=1}^{m} \sum_{i=1}^{n} D_{ij}X_{ij} + F_{ij}$$
(3)

Where

 $D_{ij}$  = unit price of the ith input employed in the jth cropping system in Naira

 $X_{ij}$  = Level of the ith input employed in the jth cropping system in kg or Number

 $F_{ij}$  = Fixed costs producing output in the jth cropping system by the ith farm household in Naira.

In this study,  $F_{ij}$  include fixed costs such as rent, interest on borrowed capital or opportunity cost of equity capital, and depreciation of the value of farm tools and implements employed in farm production. Thus,  $TT_{ij}$  not only represent profit which is return to entrepreneurship but also return to operators' management input (Allison-Oguru, 2004).

#### **RESULTS AND DISCUSSION**

#### Farm holdings and output per hectare

The average farm size was 0.89 and 0.12 hectares for plantain sole and banana sole farm enterprises,

Table 1. Cost and return in banana production per hectare (n = 180).

Quantity	Total value (₩)
4 tons at 98,982	395,928.30
	28,687.06
	8,708.35
80 man	127,844.30
64 man	126,006.40
	291,246.10
	104,682.20
	56 711 24
	509.81
	57,221.05
	47,461.11
	1.14
	14%
	Quantity 4 tons at 98,982 80 man 64 man

Source: Field Survey Data 2009/2010.

respectively. In spite of the socio-cultural and economic importance attached to plantain and banana crops, farm sizes allocated to these crops wassmall. The average farm size for plantain was earlier reported as 0.7 ha (Kainga and Seiyabo, 2012) and in similar farming system as 0.8 ha (Dzomeku et al, 2011) and 0.86 ha (Fakayode et al, 2011). In terms of output per hectare, result showed that mean output per hectare for plantain sole and banana sole was 6 and 4 ton, respectively.

#### Distance of farm to nearest home and market

Most of the farms surveyed were observed to be located at considerable distance away from farm household operational base. The average distance by land and rivers/rivulets from farm to home was 4.62 km while average distance from farm to market where products were sold was 15.05 km. The long distance between farm and farm household/market locations was attributable to severe pressure on land adjacent to the farming communities as well as the search for choice land away from the immediate vicinity of the farming communities in the area. Farmers thus build temporary farm structures where they remain for a short period depending on the farm operation.

# Costs and returns analysis of banana and plantain production enterprises

The profitability of banana and plantain production

enterprises is presented in Tables 1 and 2, respectively.

# Profitability of banana farms

In banana production (Table 1), the results showed that the total cost of labour in relation to total cost of production was higher than all other cost items. It accounted for a total of ₩253,850.70. A split of this amount shows that the amount incurred on hired labour was ₩126,006.40 while the estimated opportunity cost of family labour was ₩127,844.30. The total cost of labour was 72.8% of total cost of production. The least in terms of the variable cost items was transport. A total of ₩8,708.35 was incurred on transport. The high transport cost shows that farmers cover far distances to both farms and markets. The high cost of labour input was attributed to the high labour price that was compared to earnings of oil company workers in the study area. As a result, the available labour becomes very expensive for farmers to hire. Table 1 indicated that the total revenue from banana production was ₩395,928.30 at ₩98,982 per ton, while the total variable cost incurred in banana farms was ₩291,246.10. Thus, the gross margin realized from banana farms was ₩104,682.20. Furthermore, net farm income analysis showed that, total fixed cost incurred was ₩57,221.05 which include fixed assets depreciation and rent on land. The total cost of production was ₩348,467.15. While net farm income realized from banana production was ₩47,461.11. The benefit/cost ratio was determined to be 1.14, while rate of return on capital invested was 14%. This shows that the farmer

Table 2. Cost and return in plantain production per hectare (n = 180).

Cost and return items	Quantity	Total value (₩)
Total revenue	6 tons at 94,923.8	569,543.30
Variable costs		
Plantain suckers		25,244.73
Transport		4,171.23
Family labour	208 man	125,555.42
Hired labour	160 man	114,660.34
Total variable cost		269,631.72
Gross margin		299,911.58
Fixed costs		
Fixed asset dep.		56.711.24
Rent on land		509.80
Total fixed cost		57,221.05
Net farm income		242,690.53
Benefit-cost ratio (total revenue / total cost of production)		1.74
Rate of return on capital invested (net farm income/ total cost of production)		74%

realized about 0.14 k for every \$1.00 invested. This shows that banana production in the study area was profitable. However, since rate of return on capital invested was only 14%, banana farms could not be said to be economically viable.

#### Profitability of plantain farms

Similarly in plantain production (Table 2), a total of ₩114,660.34 and ₩125,555.42 were incurred on hired and family labour, respectively. This amounted to a total labour cost of ₦240,215.76 which accounted for 73.5% of the total cost of production. Also least in the variable cost items for plantain production was transport which was ₩4,171.23. This was followed by the cost of suckers which was estimated at ₩25,244.73. The results show that cost of all variable items for plantain was lower than that of the banana. The result further showed that the total revenue from plantain production was ₩569,543.30 at ₩94,923.8 per ton, while the total variable cost incurred was ₩269,631.72. Thus, the gross margin realized from plantain farms was ₩299,911.58. The total cost of production was ₩326,852.70. Similarly, with the total fixed cost incurred. net farm income of ₩242.690.53 was realized. Net income per hectare of plantain farmers in a previous study was ₩223,420.00 (Kainga and Seiyabo, 2012). The findings of profitability in plantain production were in agreement with Ekunwe and Ajayi (2010) who found that plantain production was profitable. They found that net farm income in plantain production with other crops was ₩203,139.40 per hectare with return per naira as 37.7%, implying that for every one naira invested a profit of 37 kobo was realized, while total revenue from only plantain was ₩223,214.00. It has been argued that mixed cropping is more advantageous than sole cropping, in terms of returns to factor endowment of resource poor farmers in Niger Delta area of Nigeria where cultivable land is a limiting factor. However, net income yielded in sole plantain per hectare in the study showed that sole cropping could as much as possible generate net returns which could be a basis of agroeconomic growth and development ceteris paribus. For instance, earlier studies have shown that net annual return per hectare of mixed cropping enterprises involving plantain by small-holder farmers in Central Niger Delta of Nigeria was in the range \$76,662.08 to \$112, 523.25, while sole cropping of plantain yielded ₩76, 331.00 net return per hectare. Furthermore, total cost of sole plantain was ₩127,422.12 while total revenue was ₩312,000.00, with net return of ₩184,577.88, at an average of 2.5 hectare (Allison-Oguru et al., 2008). The benefit/cost ratio was determined to be 1.74, while rate of return on capital invested was 74%. This shows that for every naira invested 0.74 k will be realized. Thus, the return on capital invested indicates that if the farmers surveyed were granted a bank loan at the prevailing annual interest rate of 21%, return from the farm enterprises would have been adequate to repay both the principal sum and accrued interest and still realize a net financial benefit for every naira borrowed. The finding on rate of return on capital invested was also in agreement with Fakayode et al. (2011) who found out that rate of return on capital invested in plantain production was 73%. Therefore, it can be argued that plantain production is economically viable in the study area.

#### CONCLUSION AND RECOMMENDATIONS

The aim of this study was to determine the costs and returns in sole banana and plantain production enterprises in Bayelsa State of Nigeria. The study showed that both banana and plantain farm enterprises were profitable. However, plantain production enterprises were more profitable than banana production enterprises. In terms of size, farm holdings in the area were on average 0.12 hectare for banana and 0.89 hectare for plantain farm enterprises. The estimated net annual returns for banana and plantain production enterprises were ₩47,461.11 and ₩242,690.53, respectively. However, plantain farm enterprises were viable with benefit/cost ratio of 1.74. This shows that for every naira invested 0.74 k will be realized. Rate of return on capital invested of 74% showed that plantain farms were economically viable. However, this was not so in banana farms as rate of return on capital invested was only 14%. Given the necessary agro-economic environment sole cropping in banana and plantain could generate dependable farm returns.

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