

Profitability analysis of plantain production in Ondo East Local Government Area of Ondo State, Nigeria.

Abstract

The study looked into the profitability of plantain production in Ondo East Local Government Area of Ondo State, Nigeria. Although it is grown by smallholders in the study area, there are great potentials for the crop in that all parameters showed that it was profitable. The Gross Margin (GM) per hectare was 360536 Naira while the Net Farm Income or Profit was 288413 Naira per hectare. The Benefit Cost Ratio was 2.28 and Return on Investment was 1.28. Findings showed that respondents were mostly males, married, averagely educated and fell within economic viable age range. Most farmers planted Agbagba (87.5%) which is said to be the most dominant and much sought after by consumers, got their planting materials from previous year production (62.5%) and practiced de-suckering. Age, family size, farm size and plantain sole cropping had positive impact on the Net Farm Income of the respondents, while they had the problems of inadequate funding and lack of extension agents. The study concluded that there is need for policy makers to consider and make adequate policy preparation for plantain so that Nigeria can join other plantain exporting nations and that the crop can earn the ever scarce foreign exchange for Nigeria.

Keywords: De-suckering, Foreign exchange, Bunch quality, Formal sector and Propping.

INTRODUCTION

Plantain is an important staple food for nearly 400 million people in many developing countries, especially in Africa. {1}. Throughout history, it has provided humans with food, medicine, clothing, tools, shelter, furniture, paper and handicrafts. It could be termed the “first fruit crop” as its cultivation originated during a time when hunting and gathering was still the principal means of acquiring food. {2}.

It ranks as the fourth most important global food commodity after rice, wheat and maize in terms of gross value of production {3}

The role of plantain is becoming more important with the increasing emphasis today on diets that are low in sodium but high in potassium and vitamins. High intake of sodium has always been implicated with hypertension. Plantain is a good source of potassium and it is low in sodium. It is very rich in vitamin A, highly digestible and contains fiber, blood pressure stabilizers, calcium and phosphates for healthy skin, teeth and bones. It is also one of the few fruit sources of chromium, a nutrient vital for combating diabetes because it stimulates the metabolism of glucose {4}.

At the household levels, plantain is consumed raw, fried, boiled, roasted and can be dried and grounded into flour for other uses or as fufu,. Apart from its consumption as a staple food; plantain is also used in the food industries for the manufacture of chips, flakes, cakes, thereby creating important opportunities to the populace directly or indirectly and invariably income for small holder farmers. {5}

Global plantain production has increased by nearly 17% over the last 30 years to 39.2 million metric tonnes. With Congo been the highest producer (4,800,000), followed by Cameroon (4.5 million), Ghana(4.05 million), Colombia (3.5 million), Uganda (3.2 Million), Nigeria (3.16 Million), Philippines (3.12 million), Rwanda (3 million) , Peru (2 million) and Côte d'Ivoire (1.5 million) metric tonnes Respectively as the first 10 largest producing countries. {6}

World population is expected to hit 9 billion in 2050, and much of this increase is expected in Asia and Africa. To feed this population, food production has to increase by about 70%. Daily calorie intake per individual is also expected to increase {7}

Plantain is a crop with potentials for meeting part of this need especially in Nigeria considering the fact that it is widely consumed and rich in calories, efforts should geared towards the improvement in its production.

{8}, noted that the demand for plantain within the country is high, with supply struggling to meet demand. Therefore, there is an enormous potential for wealth generation through plantain farming, considering the demand that exists for this crop. Also, a market also exists for the export of this commodity, making it a potential foreign exchange earner. Ondo East Local Government is one of the areas in Ondo State with a prominence of plantain farming activities. But these potentials are not being exploited. From the findings of {8}, most of plantain farmers still operate on a small scale.

Plantain Production Systems

{9}, in their study on plantain cultivation in Nigeria identified plantain production systems as follows:

- Plantain/Cocoa Intercrop: where plantain is planted alongside cocoa (*Theobroma cacao*) where it serves as a nurse crop during the early stages of development. This is common in the Western States of Nigeria and in the Ikom area of Cross River State, where cocoa is an important cash crop.
- The Bush Plantain which is a complex mixture in which plantains are intercropped within any field crop such as cassava, egusi melon (*Citrullus spp.*), cocoyam (*Colocasia esculentus*) and yams. This is common in the more humid area of the rainforest belt of Nigeria.
- The Taungya Farming System in which plantains are grown with forestry species such as *Gmelina arborea* etc. The plantain serves a dual purpose of taking care of the trees and serving as source of income before the maturity of the trees. The crops are phased out once the trees are established. This is commonly practiced in Ogun, Ondo and Edo states.
- The Compound Production system: where plantains are grown in various convenient points around the compound. Bunch yield is usually high in this system and could be attributed to the application of organic matter from household wastes.
- Plantation production: This is commercial production under monoculture. This has rapidly increased in the last five years, but the management has been poor due to lack of technical know-how of owners and/or supervisors.

{9}, in a study on the economic analysis of plantain production in the derived savanna zone of Osun State, Nigeria used budgetary technique to determine the net returns accruing to an average farmer and found plantain farming to be profitable in the study area. This and other measures of performance indicated that plantain production in the study area was viable and profitable. However, the influence of factors such as socio-economic characteristics of the farmers on profitability was not considered in the study.

To determine the worth of an investment in a company, investors cannot rely on a profit calculation alone. Instead, an analysis of a company's profitability is necessary to understand if the company is efficiently utilizing its resources and its capital.

The common measures used to determine profitability of an enterprise include:

- Gross Margin Analysis (GMA)
- Return on Investment (ROI)
- Return on Capital (ROC)

Gross Margin is the gross income i.e. value of production minus variable costs, expressed in terms of inputs. For example, in the case of crops it is often expressed in per hectare terms. Gross margins are calculated for specific enterprises. The value of output is subtracted from the variable and fixed costs.

Fixed Costs: These are costs that have to be paid whether production takes place or not. This means that they are types of expenses that cannot be avoided, no matter the condition of the company or the enterprise.

Fixed costs include costs of:

- Land, buildings and finance costs;
- Machinery depreciation;
- Other costs that have to be met whether or not production takes place

Variable Costs: These are costs that vary according to the level of production (i.e., increase as production increases and decrease as production decreases), and can be easily associated with specific enterprises. The services variable inputs provide usually only last for one production cycle.

Return on Investment: (ROI) measures profit in relation to costs. It is obtained by dividing the profit by investment. The investment normally includes total and variable costs.

Nigeria is one of the largest plantain producing countries in the world and despite its prominence, Nigeria does not feature among plantain exporting nations because it produces more for local consumption than for export {10}. The growing of plantain is left in the hands of subsistence farmers who account for about 80% of Nigeria's agricultural output. The crop is grown in the backyard or home stead and recently in plantations for the commercial market {11}

Since unemployment is high in Nigeria and the economy is dependent on crude petroleum as the major supplier of scarce foreign exchange, the economic policy should be reinvigorated to include potential foreign exchange earner like plantain. Plantains represent the world's second largest fruit crop with an annual production of 28,000,000 metric tons {12}. They rank as the sixth most important global food commodity after rice, wheat and maize in terms of gross value of production {12}

Plantain is a versatile food in the kitchen as well as a raw material for many popular delicacies and snacks. This reason and the growing population of Nigeria leads to an enormous increase in demand for the crop in the consumers market {11}. Among plantain products are plantain flower, chips, beer and ethanol. The ripe ones are sliced and fried in oil as "dodo". Over-ripe ones are both compacted and fried in oil as "dodo Ikire" or mixed with plantain flour to make "ekuru", a delicious local dish {11}. Plantain supply is unable to satisfy the domestic demand, hence policy makers neglect of the potentiality of the crop for export promotion. Plantain is not considered as a major crop to be planted in plantations like cocoa and other cash crops. The main plantain production comes from the plants which are components of the multi-storey cropping systems in homestead gardens, backyard farms in urban and peri-urban areas and in intercropping with food and cash crops in the outlying (distant) farms {13}, {14}. The annual output of 2.4 million metric tonnes (MT) which comes mainly from the southern states with humid and sub-humid climatic conditions, makes Nigeria the largest producer of plantain in West Africa {15}, {12}. Plantain production is becoming a significant economic activity for income generation for both large scale and small holder farmers in the country, especially for those who produce it within their home compounds or gardens. Though, the gains derivable from plantain are numerous, its level of production in Nigeria has been inconsistent and low {16}. To harness the export potential of plantain, the current level of its production must be greatly enhanced and improved. This will encompass a change in policy and optimization of limited resources available. Plantain is a foreign exchange earner to some countries. {17}, listed some countries that earn foreign exchange from plantains as Ecuador, Costa Rica, Columbia, Philippines, Honduras and Panama and Nigeria should borrow a leaf from these countries. In the same vein, plantain was becoming more and more expensive in Ondo State {18}. Yet, the products are also staple food and raw material for the emerging cottage food processing industries in Southern humid forest zone of Nigeria {19}.

The general objective of the study is to assess the profitability of plantain farming in Ondo East Local Government Area of Ondo State. The specific objectives are to:

- (i) describe the socio-economic characteristics of the plantain producers.
- (ii) estimate the costs and returns associated with plantain production.
- (iii) determine the factors affecting profit in plantain production and to
- (iv) describe the problems associated with plantain production in the study area.

Materials and Methods

The study was carried out in Ondo East Local Government Area of Ondo State, Nigeria. The Local Government occupies an area of approximately 896 square kilometers with a population of 76,096 according to the {20}

The area lies within the rainforest zone of Nigeria with mean annual rainfall of 2000-4000mm and maximum average temperature of 30°C. There are two seasons – wet and dry. The wet season is relatively long, lasting between seven and eight months of the year, from the months of March to October. There is usually a short break around August, otherwise termed “August Break”. The dry season begins in late November and extends to February or early March, a period of approximately three months. This Local Government Area was selected because of the predominance of plantain farming activities in the area.

Data from primary source was used in this study. The primary data was obtained through the use of structured questionnaire and interview schedule. All plantain farmers in the study area comprised the total population. A two-stage sampling technique was used in drawing out the sample for this study. *First, purposive sampling was employed in selecting four (4) out of the six (6) communities within Ondo East Local Government Area which are major plantains producing areas were drawn after a preliminary survey. These include Bolorunduro, Kolawole, Gberedu and Olorunsogo. Second, twenty (20) farmers from each community were randomly selected giving a total sample size of eighty (80) farmers.*

The farmers selected were then interviewed using structured questionnaire/interview schedule.

The data collected from the respondents were analyzed using statistical tools such as

- Descriptive statistics (frequency counts, percentages and means),
- Multiple regression model and
- Budgetary technique (gross margin analysis etc.).

Specifically,

- Descriptive statistics were used to describe the socio-economic characteristics of respondents and examine their production systems.
- Multiple regression models were used to determine and identify factors affecting profitability of plantain farmers in these communities.
- Budgetary model was used to estimate the cost/returns per hectare per farmer in the study area and assess the profitability.

Model Specification

Regression Model

Regression analysis was used to determine the factors affecting net farm income in plantain production in the study area.

The regression model is represented as:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, e)$$

Where;

Y = Profit (Net Farm Income)

X₁ = Age of Farmers (in years)

X₂ = Gender

X₃ = Marital Status

X₄ = Household Size

X₅ = Farming experience (in years)

X₆ = Level of Education

X₇ = Extension Agent Visit

X_8 = Formal Training
 X_9 = Use of Agro-chemical.
 X_{10} = Farm size
 X_{11} = Use improved planting materials

X_{12} = Plantain only

X_{13} = Other crops

e = Error term

The explicit model is represented in the linear form as:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11} + b_{12}X_{12} + b_{13}X_{13} + e$$

b_0 is a constant and

$b_1 - b_{13}$ are the coefficients.

Budgetary Model

This involves the estimation of total revenue and cost of production. The Gross Margin of an enterprise is the difference between the total value of production (total revenue) and total variable cost. It is symbolically expressed as:

$$G.M = \sum TR - \sum TVC$$

Where:

GM = Gross Margin

TR = Total Revenue (Unit price of output \times Quantity of output)

TVC = Total Variable Cost (Unit price of each variable input \times Quantity of each variable input)

Profit/Net Returns = GM – TFC

Where TFC = Total fixed cost derived by depreciating fixed assets.

The depreciation was calculated using the straight line method.

Benefit-Cost-Ratio (BCR): This is the ratio of total revenue (benefits) to total cost of production.

BCR = Total revenue (Benefits) / Total cost of production

Rate of Return on Investment (ROI): This is the ratio of profit to total cost of production.

ROR = Profit / Total cost of production

Results and Discussion

Socio-economic characteristics

Gender distribution of plantain farmers

Table 1 below indicates that most of the farmers were males (86.2%), while others (13.8%) were females indicating that plantain farming is dominated by men in the study area. This agrees with the findings of {21}, which stated that more males were involved in plantain production than females.

Table1 Gender distribution of plantain farmers

Gender	Frequency	Percent
Female	11	13.8
Male	69	86.2
Total 80	100.0	

Age distribution of the respondents

The result in table 2 indicates that 12.5% of the farmers were within the age range of 61-70 years, 18.8% were within the age range of 51-60 years, 41.3% were within the

age range of 41-50 years, 20.0% were within the age range of 31-40 years and 7.5% were within the age range of 21-30 years. The result shows that most of the plantain farmers (41.3%) fell between the age range of 41-50 years. This shows that most of the farmers fell below the economic age of 50 years.

Table 2: Age distribution of plantain

Age distribution	Frequency	Percent
21 – 30	6	7.5
31 – 40	16	20.0
41 – 50	33	41.3
51 – 60	15	18.8
61 – 70	10	12.5
Total	80	100.0

Marital Status of the respondents

Table 3 below indicates that 66.3% of the farmers were married, 18.8% were widows, 10.0% were divorced and 5.0% were singles. This shows that most of the farmers were married (91.3%). The state of being married confers stability and the urge to provide on the plantain farmer.

Table 3: Marital Status of plantain farmers

Marital Status	Frequency	Percent (%)
Single	4	5.0
Married	53	66.3
Widow	15	18.8
Divorced	8	10.0
Total	80	100.0

Educational distribution of plantain farmers

Table 4 below shows that most of the farmers had primary education (42.5%) while 20.0% have no formal education. (32.5%) had secondary education and (5%) having completed tertiary education. The result shows that most of the plantain farmers were educated and this attribute could help in adoption of new innovations.

Table 4: Level of education of plantain farmers.

Educational Level	Frequency	Percent (%)
No formal	16	20.0
Primary	34	42.5
Secondary	26	32.5
Tertiary	4	5.0
Total	80	100.0

Farming experience of the respondents

Table 5 below shows that most of the farmers (53.3%) had farming experience of between 11 -20 years while 30.0%, had 1 – 10 years of experience, 10.0% had

experience of between 21-30years and 8.8% had experience of between 31 – 40 years. This indicates most of the farmers had enough experience in plantain farming; Experience becomes valuable when complex problems arise and also in adoption of innovations.

Table 5: Farming Experience of plantain farmers.

Farming Experience (yrs.)	Frequency	Percent (%)
1 – 10	24	30.0
11 – 20	41	51.3
21 – 30	8	10.0
31 – 40	7	8.8
Total	80	100.0

Varieties of planting materials of the respondents

Table 6 shows that the most farmers planted Agbagba (87.5%)(*Musa spp.*) which is said to be the most dominant plantain variety in Nigeria and much sought after by consumers. 12.2% planted dwarf hybrid and 1.3% planted Ishitim.

Table 6: Variety of plantain planted farmers.

Variety used	Frequency	Percent (%)
Agbagba (<i>Musa spp.</i>)	70	87.5
Ishitim	1	1.3
Dwarf hybrid	9	12.2
Total	80	100.0

Table 7: Improved planting materials used by the respondents

Table 7 below shows that most farmers (80%) used improved planting materials and 20% did not. The use of improved planting materials enhances improved production and profitability.

Distribution of improved planting materials used by plantain farmers.

Use improved planting materials (suckers)	Frequency	Percent (%)
No	16	20.0
Yes	64	80.0

Source of planting materials of the respondents

Table 8 shows sources from which farmers got their planting materials from. Most farmers got their planting materials from previous year production (62.5%) while some sourced theirs through gift (25.0%) and others(12.5%)purchased planting materials. Using previous year's production reduced cost of production and increases level of profitability.

Table 8: Distribution of source of sucker used by plantain farmers.

Source of sucker	Frequency	Percent (%)
Purchase	10	12.5
Gift	20	25.0
Previous year	50	62.5
Total	80	100.0

Farm practices adopted by the respondents.

Table 9 shows that all the plantain farmers in the study area practiced de-suckering which involved removal of excess suckers to prevent overcrowding and enhancing the bunch quality. More farmers, (50%) used recommended spacing by the extension agents. All the plantain farmers (100%) weeded naturally and 7.5% used organic fertilizer while 92.5% relied on the natural fertility of the soil. Also, most farmers did not use Agrochemicals (67.5%). One farmer used irrigation and most of them did practice propping. Propping became essential when the weight of the bunch became too heavy for the stem to carry.

Table 9: Distribution of Farm practices adopted by plantain Farmers

Farm Practices	Frequency	Percent
De-suckering	80	100.0
Recommended Spacing	40	50.0
Application of Fertilizer	6	7.5
Agrochemicals	26	32.5
Irrigation	1	1.3
Propping	26	32.5
Total	****	****

(***Multiple responses)

Costs and Returns

Two major categories of costs were involved in plantain production. These were fixed and variable costs. Fixed costs (FC) referred to those costs that did not vary with the level of production and included costs incurred on machetes, files, hoes, wheelbarrows etc while variable cost (VC) referred to those costs that varied with output. These included those on land clearing, planting, fertilizers etc. The total cost (TC) summed up the total fixed cost (TFC) and total variable cost (TVC).

From the results of the cost and returns analysis below, the average variable cost was estimated to be ₦153, 019/ha annually while the total fixed cost was ₦72, 123/ha per annum, bringing the total cost of production to ₦225, 142/ha per annum.

The total revenue was valued at ₦513, 555/ha per annum. This gave a net farm income of ₦288, 413/ha, per annum, indicating that plantain production was profitable. The benefit cost ratio gave a value of 2.28 indicating that the business is viable in the study area. Also, the return on investment was calculated to be 1.28 implying that for every ₦1 invested in plantain production, a return of ₦1.28 and a profit of ₦0.28 per every ₦1 invested. This result implies that plantain farming is a profitable venture in the study area.

Table 10: Cost and Returns of Plantain Farmers.

Items	Total (₦)
Average Total Revenue (TR)	PQ 513555

Average Total Variable cost (TVC)		153019
Gross Margin (GM)	TR – TVC	360536
Average Total fixed cost (TFC)		72123
Profit/Net Returns	GM – TFC	288413
BCR	TR/TC	2.28
ROI	NFI/TC	1.28

Factors affecting profit in plantain production in the study area

A regression model is good if its R^2 is high; F statistic is significant and some variables are significant.

According to table 11 below, R^2 was 68.4% which is relatively high. It also indicated that 68.4% of the variability in the system/model was explained by the independent variables while others were exogenous to the model. The F-statistic was 12.5 and significant at 1%.

Gender was significant at 10% but its coefficient was negative, indicating that being male/female had negative impact on the Net Farm Income (NFI) and that males had relative advantage over females in plantain production. Age was significant at 10% level and its impact was positive. This shows that as the respondent advance in age, their experience affected NFI positively. Family size also had positive impact on NFI, indicating that family labor could help increase NFI. Application of agrochemical was also significant at 5% but had negative coefficient, indicating that the use of agrochemical had negative impact on NFI. Too much use of agrochemical increases the total cost, thereby reducing the Net Farm Income.

Also, farm size is significant at 10%, indicating that the size of the farm of respondent affects NFI positively, the larger the size of the farm the lower the cost of production and the higher the net farm income. The use of improved planting material was significant at 10% but had a negative impact on the Net Farm income. Plantain only was significant at 1% and had positive impact on NFI, indicating that planting plantain only increases Net Farm Income.

**Table 11: Factors affecting Net Farm Income.
(Regression Results)**

Model	T	Sig.
(Constant)	.086	.932
Gender	-1.991	.050***
Age	1.905	.061***
Marital Status	-.966	.337
Family / household size	3.657	.000*
Level of Education	1.648	.103
Farming experience	-.920	.361
Formal training	1.151	.253

Number of extension visit	.255	.800
Application of Agrochemicals	-2.540	.013**
Farm size	2.383	.020**
Use improved planting materials	-1.938	.056***
Plantain only	4.433	.000*
Other crops	.242	.809

R square = 0.684

Significant at 1%, **Significant at 5%,Significant at 10%**

Problems encountered by plantain farmers.

Table 12 indicates problems encountered by plantain farmers in the study area. It shows that most farmers were faced with the problem of inadequate finance and provision of credit facilities. This is a major problem to the Nigerian Agricultural sector where the budgetary provision made to the sector was always very poor thereby denying the farmers of necessary funds needed for production. Other problem was poor extension agent visitation which is related with the problem of poor funding by the formal sector.

Table 12: Distribution of problems encountered by plantain farmers.

Constraints	Frequency	Percentage (%)
Pest and disease	10	10.0
Inadequate finance and Credit facilities	76	76.0
Poor extension Agent	61	61.0
Wind damage	13	13.0
Fertilizer Availability	10	10.0

Conclusion

Plantain (*Musa spp.*) is grown by smallholders in the study area but all parameters of profitability like the Net Farm Returns, the Benefit Cost Ratio and the Return on Investment showed that it was profitable; hence there are great potentials for expansion. The study highlighted the need for policy makers to consider and make adequate policy preparation for plantain so that Nigeria can join other exporting nations like Ecuador, Costa Rica, Columbia, Philippines, Honduras and Panama so that the crop can earn the ever scarce foreign exchange for Nigeria. Since most farmers were faced with the problem of inadequate finance and provision of credit facilities, effort should be geared towards the provision of necessary funds needed for production by the formal sector.

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