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# PRODUCTION FUNCTION ANALYSIS OF SMALL SCALE BANANA FARMS IN THE RAIN FOREST BELT OF DELTA STATE, NIGERIA

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## Abstract
This study investigated the production function analysis of small-scale banana farms in the rain forest zone of Nigeria. Primary data collected from 130 banana farmers with structured questionnaire, were analysed using descrptive and inferential statistics. Multiple regression model was used to fit the production function.The test of hypothesis indicated a significant joint relationship between the selected variables and small-scale banana output in the area. The results of the study further showed that linear regression function best describes factor combination in banana production in the rain forest zone of Nigeria. Labour, fertilizer quantity,input price and educational status of farmers significantly determined banana output. Other factors such as land, credit facilities and frequency of extension contact also influenced banana output but not significantly. Factor analysis revealed that fertilizer input utilization is the most significant determinant of banana output. More quantity of labour, fertilizer and more extension training should be combined with available land to bring about more output in small-scale banana production in the rain forest zone of Nigeria. It was recommended amongst others that fertilizers should be made available to banana farmers coupled with credit facilities to purchase it and periodic workshops on its utilization.

**Keywords: Small-scale, Banana,Factor analysis,Production function,Rain forest.**

## INTRODUCTION
Banana is cultivation is favourable in most tropical regions of the world. The East African Highland Banana (EAHB) is important to Africa. It is a staple starchy food for 80 million people and important source of income (http://www.iita.org/crops/banana-plantain).
Banana is also important food crop in the rain forest and mid- altitude zones of sub-saharan Africa. It provides more than 25% of the carbohydrates and 10% of the calorie intake for millions of people in the producing regions. Banana has become a key source of revenue as they are not only traded within countries but also exported. The status change from food to food/cash crop has enhanced its importance (Ortiz and Vuylsteke, 1996). Banana production is found mainly in the southern States of Nigeria especially in Cross River and Rivers States (Arene, 1996; Ogazi 1996). A large concentration of banana production also exists in parts of Benue and Plateau State, while isolated production area are found in the Bida area of Niger State (Udensi, 1988). Banana has the potential to contribute to strengthening nation food security and decreasing rural poverty. It is important in the diet of Nigerians and in most West African countries. It is believed that Central and West Africa produce and consume more than 60% of the world's banana production (Fademi and Baiyere, 1993). One of the major problems limiting the expansion of its production in West and Central Africa include high post-harvest losses. In Nigeria, up to 40% of the harvested banana can be lost during distribution (Olorunda, 1996). Organized research activities on banana were initiated by the International Institute of Tropical Agriculture (IITA) in Nigeria as far back as 1973 and focused mainly on production systems in the low land humid forest zone of West Africa. In subsequent years, the scope of research gradually increased, initially to cover germplasm collection and the characterization and conservation of banana cultivars (Brader, 1996).

The primary concern in banana production is to address efficiency in the use of factor inputs in production process and the resulting distribution of income to those factors. Under certain assumptions, the production function can be used to derive a marginal productivity for each factor, which

implies an ideal distribution of the income generated from output among the various inputs / factors of production (Cobb and Douglas, 1928).

Banana production is an important means of livelihood among the people of Delta State, Nigeria. The banana enterprise is dominated by small-holder farmers. Yet there is information gap on key factors that underpin small-scale banana production in this area. Hence this study sought to ascertain the socio-economic factors of banana production.

Due to the importance of banana production to the Nigeria people, there is the need to accentuate the role of efficient combination of inputs in banana production. Estimating the production function of banana will reveal some technical weaknesses that need to be addressed among banana farmers for efficient combination of inputs (Gezer *et al*, 2003) and improve farmer's welfare (De, *et al*, 2001). Since banana production is key to poverty reduction and food security, there is need for strategic search for research to improve banana production. The result of the study is therefore expected to provide useful information for government plans and programmes for the development of banana sub-sector in Nigeria.

Although many experts have worked on input use in agriculture, to the best of our knowledge, no studies have been done to analyse the production function of banana farms in the rain forest zone of Delta State, Nigeria. The broad objective of this study is to conduct factor analysis in Banana production function among small-scale producers in the rain forest zone of Nigeria. The specific objectives of the study were to:

i. estimate an appropriate production function for small-scale banana farms in the study area.
ii. analyse the response of banana output to identified factors of production.

The null hypotheses tested in this study were**:**

**$H_0$1:** Selected production factors do not have joint significant effect on banana output in the rain forest zone of Nigeria.

**$H_0$2:** Selected production factors do not have individual significant effects on banana output in the rain forest zone of Nigeria

## MATERIALS AND METHODS

### Study Area, Sampling Procedure and Data Collection Techniques

The study was carried out in the rain forest zone of Delta State, Nigeria. This area was chosen for the study due to its suitability for banana production and the presence of good number of stake-holders in banana sub-sector. The rain forest is characterized by wet and dry seasons with evidence of evergreen vegetation. The research inquiry was targeted at the population of all small-scale banana farmers in Delta State, Nigeria. Multi stage sampling procedures was used to randomly select sample for the study in stages. This involved random selection of 5 Local Government Areas (LGA); 2 communities in each L.G.A. and 13 respondents (banana farmers) in each of the selected communities. This gave a total of 130 banana farmers that were selected for the study. Primary data were obtained using a combination of structured questionnaire and interview schedule. Questionnaire was administered to literate farmers while interview schedule was administered to illiterate banana farmers. Although 130 copies of questionnaire were administered, 120 copies were correctly filled and used for the study. This gave 92.30% respondents response performance.

### Data Analytical Framework

Data collected were subjected to descriptive and inferential statistics. Descriptive statistics including mean, percentage, tables and average were used to summaries the data so as to achieve objective (i). Regression analysis was used to estimate production function for banana. The economic model commonly used to determine the relationship between the various factors and the output in agriculture is production function model. The implicit form of production function is given by:

Q = F ( N, Ld, KP, L, F, ED, P) **..... (1)**

Where: Q is the production output, which is function of the land (Ld); the capital (K) and the labour force (Lb) used for the production of the same output.

To find out the impact of these factors on farm level production of banana in the study area,

the functional relationship is explicitly specified.

**Q = β0 + β1N + β2KP + β3LB + β4FZ + β5PR + μ..... (3)**

Where,

**Q =** Total output of banana produced, (in bunches)
**β0 =** Constant
**N** = Acreage in terms of hectares under banana crop,
**KP** = Physical capital in terms of amount spent on equipment,
**LB** = Labour in terms of man-hours spent on the farm,
**FZ** = Fertilizer use in terms of quantity of fertilizer used,
**PR** = Price of bananas,
**ED** = Level of education attained by respondent (number of years spent in school)
**μ** = Error term.

Table1 shows the description of dependent and independent variables, their symbols and expected signs

.

**Table1: Expected signs of explanatory variables in the model**

| Dependent variables | Explanatory variables | Expected signs | Explanations of relationship |
|---|---|---|---|
| Output (Q) | Acreage (N) | | Output is positively related to acreage. As more land is brought under banana production, output will increase. |
| | Physical Capital ( $Kp$) | + | Output is positively to physical capital. The more households invest in banana production, the more the output. |
| | Labor (L) | + | Output is positively related to labor, the more they increase output. |
| | Fertilizer (Fertz) | + | Output is positively related to fertilizer. The more households use fertilizer, the more they increase the output. |
| | Price (P) | + | Expected high price of bananas will make its output to increase. When the households expect an increase in price of bananas, they will be motivated to increase the output. |
| | Education level (ED) | + | Output is related to education. This means that the more households are educated, the more output they will produce. |

## RESULTS AND DISCUSSION

### Appropriate Production Function for smallscale Banana Production

The result of econometric model shows that the appropriate production function for small-scale banana farms in the study area in Table 2. The selection of the choice model was evaluated by trying different forms of production functions (linear form, semi-log form and double log form) as presented in the Table 2. The overall significant of the lead model was evaluated by the $R^2$ value. The linear regression model was chosen as the lead model based on the value of the $R^2$ (62%) appropriate and the number of significant variable in the model. The $R^2$ value indicates that 62% variation in banana output is explained by the joint effect of the independent variables that were captured in the model.

**Test of Null Hypothesis 1**

**$H_0$1:** Selected production factors do not have joint significant effect on banana output in the rain forest zone of Nigeria.

The significant value of F- statistics ($P < 0.05$) indicates overall joint significance of the explanatory variables in the model. Since the F-statistics is significant at $\alpha = 5\%$, the null hypothesis one ($H_0$1) is rejected and the alternate hypothesis which states that the selected factors have significant joint effect on small-scale banana output is upheld.

**Table 2: Production Function Selection for small-scale Banana Farms.**

| | Linear Function | | Semi – Log | | Double – Log | |
|---|---|---|---|---|---|---|
| **Variables** | **Coefficient** | **t-stat** | **Coefficient** | **t-stat** | **Coefficient** | **t-stat** |
| Constant | -3.001 | -0.197 | -52.459 | -0.471 | 1.074 | 1.625 |
| Land | 0.285 | 0.744 | 1.544 | 0.090 | 0.028 | 0.275 |
| Labour | 0.003 | 2.056* | - | - | - | - |
| Fertilizer | 0.336 | 4.430** | 32.480 | 1.910 | 0.006 | 0.058 |
| Price | 0.023 | 1.98* | 10.995 | 0.5611 | 0.144 | 12.356** |
| Educational status | 0.302 | 3.203** | 3.330 | 0.106 | 0.138 | 0.737 |
| $R^2$ | 62% | - | 26% | - | 59% | - |
| $R^2$(adj) | 60% | - | 23% | - | 58% | - |
| F. Statistic | 36.83 | - | 9.98 | - | 41.251 | - |

Source: Survey Data, 2012**.**

**Response of banana Output to the identified factors of Production.**

The result of the Response of banana output to the identified factors of Production is presented in Table 2.

**Land:** From the findings output from banana production is positive and not significant related to land as shown by the coefficient of 0.285. The positive relationship between land and banana output implies that a 1% increase in land acreage, output of banana will respond 0.285 %. This is less than proportionate increase in output of banana. This result shows that an average banana farm is in stage 2 of the production surface with respect to land input. At this stage banana output is increasing at a decreasing rate. This confirms the earlier finding of Mellor (1974), that smallscale farms will maximize output, provided they can effectively combine available resources.

**Labour:** From the result, labour is positive and has significant effect on output from banana as indicated by the coefficient 0.003 and T-value of 2.056 ($p<0.05$). This implies that as household increase hired labour by 1%, the output increase by 0.003%. In this study, majority of households surveyed hired labourers in different activities of banana production. This finding shows that banana output is increasing at a decreasing rate with an increase in labour utilization. This further shows that the banana farm in the study area is in stage 2 of the production surface with respect to labour utilization.

**Fertilizer:** Output from banana production is positively and significantly related to fertilizer utilization as shown from the findings where the coefficient is positive 0.336 and T-value is 4.430 ($P < 0.05$). This implies that a 1% increase in fertilizer utilization will result in a 0.336% increase in banana output. This shows that banana output is relatively elastic to fertilizer application.

**Price:** The output of banana production responds positively and significantly to the changes in market price of banana as shown by the coefficient of 0.023 with T-value of 1.98 ($p<0.05$). This means that a 1% increase in price of banana will translate to 0.023% increase in banana farm output/market supply. This result implies that market price of banana can stimulate small-scale production of banana.

**Educational Status:** From the results, evidence of acquisition of education by banana farmer shows a positive and significant relationship with the output of smallscale banana farmers as indicated by the coefficient of 0.030 and T-value of 3.330 ($p<0.05$). This study demonstrates that continuous education of smallscale banana farmers on improved practices, will enhance their capacity to produce more banana.

**Test of Null Hypothesis 2**.

**$H_0$2:** Selected production factors do not have individual significant effects on banana output in the rain forest zone of Nigeria.
Since the calculated T-statistics for labour (2.056), fertilizer (4.430), price (1.98) and education (3.330) are greater 1.96, the null hypothesis is rejected and the alternate hypothesis which states that there is significant relationship between labour, fertilizer, price and education and the output of small-scale banana farm, is accepted.

## CONCLUSION AND RECOMMENDATIONS

In this study, the production function of small-scale banana farms in the rain forest zone of Delta state, Nigeria, was analyzed. The essence is to ascertain the factors that significantly influence the output of small-scale banana farms in the study area. In the light of the findings of the study the following major conclusion were drawn. Labour significantly influenced banana output. Fertilizer application significantly increased banana output. Level of educational status banana farmer made them knowledgeable about the type of improved practices to adopt in order to have bountiful harvest of the banana. There is sufficient evidence to conclude that the average small-scale banana farm surveyed is in stage 2 (rational stage) in the production surface with respect to labour and fertilizer. The implication of all these is that banana producers, in the study area can still increase the quantity of labour and fertilizer utilization. Also if farmers are encouraged by appropriate price policy, the will respond by producing and supplying more banana products. This study has demonstrated that any development plan for banana production should emphasize the significant factors in the smallscale banana production function. Based on the findings the following recommendations were made:

It was recommended amongst others:

1. That fertilizers should be made available to banana farmers coupled with credit facilities and periodic workshops on improved production methods**.**
2. The Government should make sure that micro- finance banks grant loans to banana farmers with little interest in order to expand banana production scale since more capital are needed for expansion.
3. The Banana producers should have frequent contact with extension officers for more education on improved production practices.
4. There should be standardization measures to standardize and stabilize banana price.

## REFERENCES.


Arene, O.B.C. 1996. Plantain and Banana Production in south eastern Nigeria. Proc. Regional Workshop on Plantain and Banana Production and Research in West and Central Africa. Onne, Nigeria 23-27, September. p.56.

Banaeian, N. And Zangenneh,.M.(2011) Estimating Production Function of Walnut Production in Iran using Cobb-Douglas Method; in Agricultura Tropica Et Subtropica, 44(4) 177- 189.

Brader, L. 1996. Foreword. Proc. Regional Workshop on Plantain and Banana Production and Research in West and Central Africa. Onne. Nigeria 23-27, September.p. 1

Clayton, (1964), "*Agrarian Development in Peasant Economics*", Pergaman Press, London.

Cohen, A.J and Harcourt, G.C. (2003) Retrospectives: ''Whatever Happened to the Cambridge Capital Theory Controversies'' journal of Economics perspectives, 17 (1), pp.199-214

Daly (1997) ''Forum on Georgescu-Roegen'' versus Solow/stiglitz. Ecological Economics 22 (3): 261-36

Fademi, O.A. and Baiyeri, K.P. 1993. Plantain and Banana nematodes in southwesern and middle belt states of Nigeria. Infomusa 2: 13-14

HASS. (1993)Statistics of Hawaiian Agriculture: 1992. Honolulu: HASS

Hayami Y., Vernon W. R. (1971), "*Agricultural Development: an International Perspective*", The Johns Hopkins Press, Baltimore and London.

IITA. (2018) Banana and Plantain http://www.iita.org/crops/banana-plantain

International Programs Center, US Census Bureau, population Division 2005.

Macours,K., Swinnen,J.F.M, (1997).”*Causes of output decline in economic transition: The case of Central and Eastern European Agriculture*”. Working paper, No 11, June 1997.

Malassis. (1975), “*Agriculture and the Development Process*”. The Unesco Press. Paris.

Mbithi, L.M., ( 2000), “*Effects of Agricultural Policy on Maize Production in Kenya*” Ph D. Thesis, University of Gent.

Mellor J.W., (1974), “The *Economics of agricultural development*”, Cornell University Press, Ithaka and New York.

Ogazi, P.O. 1996 Plantain: Production, Processing and Utilization. Paman and Associates, Okigwe.

Olorunda, A.O. 1996. Overview of *Musa* research in postharvest technology at the Department of Food Technology, University of Ibadan. Proc. Regional Workshop on Plantain and Research in West and Central Africa. Onne, Nigeria 23-27, September. p. 75-76.

Ortiz, R., and Vuylsteke, D. 1996. Improving plantain and banana- based systems. Proc. Regional Workshop on Plantain and Banana Production and Research in West and Central Africa. Onne, Nigeria, 25-27 September. p. 2-7

Schultz, T. W. 1965,” *Economic Crises in world Agriculture*”, The University of Michigan Press

Udensi, N. 1988. Pest and disease of plantains and bananas. Proc. Animal Conference of Horticultural Society of Nigeria. P. 229-234