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Backyard Farming: A Panacea for Food Security in Nigeria

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ABSTRACT This paper looks at the profitability, productivity and technical efficiency of backyard farming in Ondo State, Nigeria for its policy implications. The study was carried out in two local government areas of Ondo State, Nigeria. Data were obtained from primary sources using a set of structured questionnaire assisted with interview schedule. The multistage sampling technique was used. Data were analyzed using: descriptive statistics, net profit analysis and the stochastic frontier production function. The study revealed that backyard farming was profitable and improved consumption of essential nutrients at the family level and that; young and well educated people who took farming as secondary occupation were involved in backyard farming in the study area. The backyard farmers were relatively technically efficient with about 72 percent of them having Technical Efficiency (TE) above the mean TE of 0.875 for the study area. The study observed that educational level of the farmers, farming experience and location of farms led to decrease in TE. The TE of the backyard farmers would improve if more land is made available for this group of young farmers at locations quite close to their residential compounds and organizing training in basic farming operations for some well educated government workers who may invariably be interested in farming later in life and thus backyard farming would be a driving force in solving food security issue in Nigeria.

INTRODUCTION

The inability of Nigerian agriculture to provide adequate food in quantity and quality to feed the ever growing population has resulted into food shortages, undernourishment, malnutrition, starvation, hunger and ill-health. Nowadays, it is a common occurrence to see able bodied people scavenging for food from dustbins and left-over during social outings, while some elderly and quite healthy ones begging openly for money to buy food or out rightly begging for food in the market places and motor parks.

The food security status of Nigeria is seriously in doubt. According to World Food Council Report, a growing number of lives are being lost due to hunger and malnutrition. It was estimated that the rate of increase in the number of hungry people in the world in the 1980s was five times what it was in the 1970s. By 1989 the total number of chronically hungry people was estimated at 550 million people. The figure was over 1 billion people before 2002. Africa was reported to have experienced the largest increase in hunger cases between 1970 and 2002. Before 1991 and 1998 the number of foods insecure people declined by 76 million in China and increased by 40 million in all other developing countries, African countries inclusive (IFPR1 2002). One distressing and costly manifestation of food insecurity is malnutrition among pre-school children. It impairs children's mental and physical development, compromising their future health, productivity, and food security. Chronic child malnutrition reduces gross domestic product by 0.7 percent annually in India and 0.5 percent in China. Today, one third of the pre-school children in developing countries are malnourished. Malnutrition is a factor in more than 5 million deaths of children under the age of five annually, accounting for 20 – 25 percent of the economic impact of childhood diseases in the developing world. While pre-school deaths due to malnutrition declined by 6 percent in South Asia, it increased by 13 percent in sub-Saharan Africa (IFPRI 2002).

In Nigeria, many attempts have been made by the various governments to address the issue of increased food production in both quantity and quality. Some of these attempts have cumulated into several programmes and projects aimed at boosting agricultural production. These programmes include, The River Basin Development Authority (1974), Agricultural Development Projects (1974), Operation feed the Nation (1976) and Green Revolution Programme (1980). The central objective of these programmes was to increase food production thereby solving the problem of food insecurity and poverty.

Unfortunately most of these programmes failed to achieve the desired results due to lack of continuity in policy implementation caused by incessant changes in government and official corruption in government project execution. The implication of the failure of the programmes designed to improve agricultural development and consequently food production is that poverty in Nigeria is likely to increase as we approach the year 2010. And interestingly, Nigeria is among the eighteen poorest countries in the world in spite of her oil wealth as number six in the petroleum producing countries (OPEC).

National data indicate that the number of poor people increased from 18 million to almost 68 million between 1980 and 1996 (Longe 2005) while recent estimates indicate that over 70% of the population live below the international poverty line of $1 per day. The Nigerian food and nutrition security paints a pathetic picture as more than 70% of the population currently live in households too poor to have regular access to food they need for healthy and productive living and with the corresponding reduction of daily calorie intake probably below 2000 calorie, instead of the recommended 2500 calorie per caput per day which in still less than the Food and Agriculture Organization's (FAO) recommendation of 2718 calorie per caput per day (Igene 2006). The per caput protein intake as recommended by FAO is 55g per day, out of which 10.6g should be of animal origin. The Nigerian food balance sheet indicates that only 4.2 percent of the required animal protein is consumed (Aletor 1999). Consequently, there is serious protein – calorie - micronutrients malnutrition.

The manifestations of some nutritional diseases (stunted growth, growth failure, marasmus) clearly indicate the serious state of food insecurity in Nigeria (Igene 2006).

Borgstrom (1968) was explicit on the importance of food when he asserted that throughout history, food has influenced the quality of human life and it has been the determining factor in the growth and survival of nations. Without an abundant, diverse, safe and wholesome supply of food, individuals and entire nations forfeit a life of hope and dignity. If this is to be averted in the case of Nigeria, a drastic step has to be taken to achieve a sustained growth in food sector output through an articulation of a food production or food self sufficiency policy package that is self sustaining and which will have the expected impact on the nutritional status of the people. One of such self-sufficiency policy packages is backyard farming.

Backyard farming involves the production of vegetables, root/tuber crops, cereals, poultry and small ruminants using the small pieces of land in the residential areas, in such quantities that will ensure that the needs of the immediate household members are guaranteed. Backyard farming, apart from ensuring the provision of food items, in fresh form to satisfy the immediate calorie and nutritional needs of the household, also performs the following functions:

- It encourages landless people (tenants and poor people) to be involved in food crop production on small-scale basis.
- Civil servants, clergymen, judges, political office holders who are interested in farming but are constrained because of the nature of the job or profession could use backyard farming to practice their love for farming.
- Backyard farming has medicinal implication. The body is exercised, while excess fat is burnt out during sweating-out in the backyard gardens.
- It ensures a productive and efficient use of leisure time rather than wasting such productive time on some social vices like drinking or womanizing.
- Small ruminants kept in the compound ensure adequate conversion of kitchen wastes into good quality meat for household consumption or future income while the wastes from these animals provide manure for the growing crops.

This paper therefore looks at the profitability, productivity and technical efficiency of backyard farming in Ondo State, Nigeria for its policy implications.

METHODOLOGY

Study Area: The study was carried out in two local government areas of Ondo State, Nigeria. The state is one of the 36 states making up the federating states of Nigeria. It has a population of about 3 million people with a land area of about 14,793,189 km^2 (Ondo State Ministry of Finance, Economic Planning and Budget 2000). The state lies entirely in the tropics between longitudes $4^0 3^1$ and 6^0 East of the Greenwich meridian and $5^0 45^1$ and $8^0 15^1$ North of the Equator and thus has a tropical climate with its

characteristic high temperature all year round, between 1500mm to 2000mm well distributed rainfall during the rainy season and dry harmattan laden wind during the dry season. This favourable climatic conditions make agricultural production a way of life in the state. About 75% of the population is engaged in farming growing both cash and food crops. The main cash crops are, cocoa, oil palm, rubber, cashew and kola nut, while the food crops are maize, cassava, yam, plantain and vegetables. Apart from farming, the people also engage in other occupations like trading, manufacturing, public service jobs and Artisan jobs. The people of the state are predominantly Yoruba and live mainly in urbanized towns and cities.

Sources, Nature and Methods of Data Collection: Data for the study were obtained mainly from primary sources using a set of structured questionnaire assisted with interview schedule to take care of the illiterate respondents. Data were collected on the socio-economic characteristics of the respondents (such as, education, household, size, age, sex, income levels, occupation, farming experience and so on.). Input – output variables involved in backyard farming (farm size, planting materials, operating expenses, labour usage, annual cost of implements and output of backyard farming in appropriate units and naira values.

Sampling Technique: The multistage sampling technique was used. The first stage was the purposive selection of the two LGAs (Okitipupa and Irele,) for having a preponderance of civil and public servants involved in backyard farming. The educated working class people in the study area are involved in backyard farming because of the love people of the area have for farming. Farming is a way of life in the study area with nearly every body, regardless of sex, education and major means of livelihood still plant one crop or the other and even rear one form of animal, poultry or small ruminant. The second stage of the sampling involved a stratified selection of residential buildings where any form of backyard farming activities is going on and lastly the third stage of the sampling was the random selection of four villages per LGA and twenty residential buildings per village. A total sample of 160 respondents was selected with only 100 copies of the questionnaire properly filled, retrieved and analyzed.

Methods of Data Analysis: The data were analyzed using:

- Descriptive statistics such as means, standard deviation, percentages to analyze the socio-economic characteristics and the production performance of backyard farming in the study area.
- Net profit analysis to analyze the profitability of backyard farming in the study area.
- Stochastic frontier production function to analyze the productivity (resource use efficiency) and the technical efficiency of the backyard farms.

Stochastic Frontier Production Function and Model Specification: The Stochastic Frontier Production Function (SFPF) in efficiency studies is employed in this study. In the SFPF, the error term is assumed to have two components parts V and U. The V covers the random effects (random errors) on the production and they are outside the control of the decision unit while the U measures the technical inefficiency effects, which are behavior factors that come under the control of the decision unit. They are controllable errors if efficient management is put in. The Stochastic frontier approach is generally preferred for agricultural research for the following reasons. The inherent variability of agricultural productions due to interplay of weather, soil, pests, diseases and environmental failures and many firms are small family-owned enterprises where keeping of accurate records is not always a priority hence available data on production are subject to measurement errors.

The Stochastic frontier production function model is specified as:

$$Yi = f(Xib)+\varepsilon_i$$

Where, Y is output in a specified unit, X denotes the actual input vector, b is the vector of production function parameters and μ_i is the error term that is decomposed into two component parts, V and U. The V is a normal random variable that is independently and identically distributed (iid) with mean zero and constant variance (σ^2). It is introduced to capture the white noise in the production, which are due to factors that are not within the influence of the producers. It is independent of U. The U is a non-negative one-sided truncation at zero with the normal distribution (Tadesse and Krishnamoorthy 1997). It measures the technical inefficiency relative to the frontier production function, which is attributed to controllable factors (technical inefficiency). It is half normal, identically and independently distributed with zero mean and constant variance.

The variances of the random errors (σ_v^2) and that of the technical inefficiency effects (σ_u^2) and overall model variance (s^2) are related thus: $\sigma^2 = \sigma_u^2 + \sigma_v^2$

And the ratio: $\gamma = \sigma_u^2 / \sigma^2$ is called gamma. It measures the total variation of output from the frontier, which can be attributed to technical inefficiency.

The Technical Efficiency (TE) of an individual firm is defined in terms of the observed output (Yi) to the corresponding frontier output (Y^*). The Y* is maximum output achievable given the existing technology and assuming 100 percent efficiency. It is denoted as:

$Yi^* = f(X_i\beta) + Vi$, that is,

$TE = Yi / Yi^*$

Also the TE can be estimated by using the expectation of U_i conditioned on the random variable (V-U) as shown by Battese and Coelli (1988), that is

$$TE = \frac{f(X_i\beta) + V_i - U_i}{f(X_i\beta) + V_i}$$

And that $0 \leq TE \leq 1$

For this study, the production technology of the backyard farms was assumed with a cobb-douglas production function of the form:

$Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + V - U$

where,

Y = Value of Output of Backyard farm (₦), X_1 = Age of Respondents

X_2 = Farm size of Backyard farm (ha), X_3 = Family Labour (man-days), X_4 = Hired Labour (man-days), X_5 = Operating Expenses

X_6 = Annual Cost of Implements, V = Random errors as previously defined and U = Technical inefficiency effects as previously defined.

The Technical inefficiency effects (U) was defined by:

$U = \delta_o + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3$

Where, Z_1 = Educational level of the farmers measured in number of years spent in school, Z_2 = Backyard farming experience in years, and Z_3 = Location of farm (measured as dummy variable)

The inefficiency model and variables were included so that the effects of these variables could be studied on the technical efficiencies of the backyard farmers. β and δ are scalar parameters to be estimated. The estimates for all the parameters of the SFPF are obtained using the *Program Frontier Version 4.1c* (Coelli 1994)

Two different models were specified. Model 1 assumed that the traditional response function was an adequate representation of the stochastic frontier model and there were no inefficiency effects in the production process, that is, H_o: $\gamma = 0$. Model 2 assumed that inefficiency effects were present and involved all the parameters estimated, that is, H_a: $\gamma \neq 0$. This is the full frontier production function, which involves no restrictions. It thus assumed that the traditional response function was not an adequate representation of the stochastic frontier model. In model 1, the measure of the variation in the backyard farm output that were due to technical inefficiency effects was assumed to be zero, that is, $\gamma = 0$ and that any variation in output was due only to stochastic error. Whereas model 2, assumed that gamma was not zero, ($\gamma \neq 0$) and that variations in output were both due to technical inefficiency effects (which could be controlled with efficient management of both human and material resources) and random error which did not come under the control of the efficient management.

Various tests of hypothesis on the significance of the parameters of the frontier model were conducted using the student's t-ratio and generalized likelihood ratio tests.

The generalized likelihood ratio is defined by the chi-square distribution, χ^2

$\chi^2 = -2$ in (L(Ho) / L(Ha)) …….. (Battese et al. 1993)

Where L (Ho) is the value of the likelihood function for the frontier model I in which parameter restriction specified by the null hypothesis (Ho) was imposed such that,

Ho: $\gamma=0$, that is, there were no technical inefficiency effects in the production operations of the yam farms. L (Ha) is the value of the likelihood function for model 2 in which there were no restrictions that is, $\gamma \neq 0$ indicating there were technical inefficiency effects in the production operations. The χ^2 has a mixed chi-square distribution with the degree of freedom (df) equals to the number of parameter restrictions. If the computed chi-square (χ^2) is less than or equal to the tabulated chi-square the null hypothesis (H_0) is accepted and rejected if chi-square computed is greater than chi-square tabulated.

RESULT AND DISCUSSION

***Summary Statistics of Variables*:** The summary statistics of variables involved in the study is presented in Table 1.

Table 1: Summary statistics of variables of backyard farming.

Variables	*Details*	*Percent*	*Mean*	*Std dev*
Age (years)	< 50	94	30	12
Marital status	Single	56	-	-
Educational level	≥Secondary School Education	96	-	-
Major occupation	Non farming Jobs	98	-	-
Farming experience (years	≤10	78	8	4
Location of farms	Residential compounds	89	-	-
Chance for expansion	Yes	57	-	-
Farm size	Small-scale	100	0.05	0.06
Family labour (man-day)			43	22
Hired labour (man-day)			12	13

The mean age of 30 years with about 94% of the respondents falling below 50 years old indicates that young people are dominating backyard farming. This finding negates the a-priori assertion that small-scale farmers in Nigeria are old and ageing (Ajibefun and Abdulkadri 1999). About 56% of the respondents were single, indicating that unmarried people were more involved in backyard farming than married people. The backyard farmers were well educated with about 96% having secondary school education and above. This finding also runs counter to a-priori expectation of low educational level of Nigerian farmers (Adesimi 1988). The major occupational distribution of the respondents revealed that about 98% of them had non-farming jobs as their major occupations. A break down of the major occupations of the respondents revealed they were civil/public servants, Artisans, political office holders and business men who had farming as a hobby and could only practice it within the vicinity of their residential compounds. The relatively young single and fairly well educated people involved in backyard farming, have significant implication for agricultural development in Nigeria. If the principle under which this category of people could get involved in agricultural production is well harnessed it could lead to a sustainable policy that will ensure increased food crop production and thus guarantee food security for Nigeria.

Backyard farming is still new with about 78% of the backyard farmers having less than 10 years of backyard farming experience in the study area. While the mean farming experience was 8years with a standard deviation of 4 years. The average farm size was 0.05ha with standard deviation of 0.06ha. The operators of backyard farms cultivated small plots of land either because that was the only available piece of land within their residential compounds or that the available resources could not accommodate more than that. The study observed that family labour was mostly used in backyard farming with average family labour of 43 man-days against 12 man-days of hired labour. Most of the family man-days used were those that would have been wasted on watching television or telling unproductive stories. The operating expenses and total cost were low when compared with the value of farm output of ₦47373.35

Profitability Analysis: Table 2 presents the profitability analysis of backyard farming in the study area.

Table 2: Profitability analysis

Variables	*₦*
Operating expenses	10142.70
Hired labour cost	4908.00
Annual cost of Implements	396.35
Total Cost	15447.05
Value of farm output	47373.35
Net Revenue (Profit)	31926.30

The cost variables were mainly operating expenses, (cost of planting materials, fertilizer and agro-chemicals) Hired labour cost and annual cost of implements with operating expenses accounting for about 66% of the total cost. The average profit (Net Revenue) was ₦ 31926.30 representing about 67% value of farm output, indicating that backyard farming was very profitable in the study area. Therefore, investing in backyard farming could improve the income base of the household apart from ensuring adequate food items is taking at the right time and very fresh form.

Stochastic Frontier Production Function Analysis: The estimates of the SFPF models are presented in Table 3.

The choice of model for further econometric and economic analyses was based on the test

Table 3: Estimates of stochastic frontier production function

Variables	*Model 1 (OLS)*	*Model 2 (MLE)*
General Model		
Constant	1.75 (0.25)	1.82 (0.23)
Age of farmer	0.06 (0.12)	0.21 (0.11)
Farm size	0.14 (0.08)	*0.32 (0.09)
Family labour	0.47 (0.12)	*0.37 (0.10)
Hired labour	0.08 (0.04)	0.05 (0.04)
Operating expenses	0.27 (0.05)	*0.19 (0.05)
Annual cost of Implements	0.21 (0.07)	*0.17 (0.07)
Inefficiency Model		
Constant	0	-3.54 (2.04)
Educational level	0	0.15 (0.08)
farming experience	0	*0.12 (0.05)
Location of farm	0	0.23 (0.12)
Variance Parameters		
Sigma squared	0.14	*0.17 (0.08)
Gamma	0	*0.88 (0.09)
Log likelihood function	26.57	33.01
Technical Efficiency		
Mean TE	-	0.875
Min. TE	-	0.500
Max. TE	-	0.975

* Estimate is significant at 5 percent level of significance
Figures in parentheses are standard errors

for presence of technical inefficiency effects using the generalized likelihood ratio test. The test confirmed that there were presence of technical inefficiency effects in backyard farming production activities, that is, the gamma coefficient (γ) was significantly different from zero ($\gamma \neq 0$) as confirmed by the computed test statistic, chi-square (χ^2) that was greater than the tabulated chi square at 5 percent level of significance and degree of freedom of 5. Therefore, model 2 was chosen for further econometric and economic analyses.

Productivity Analysis: The estimated coefficients in the general model of model 2 were used for the productivity (resource use efficiency) analysis. The estimated coefficients of the included variables in the model (elasticties of production because the algebraic functional form was the cobb-douglas form) were all positive and each was between zero and unity. This implies a direct relationship between output and each of the variable inputs and that the allocation of the variable inputs was in the stage of efficient allocation in the production function. This finding corroborated the a-priori assertion that resources allocation is efficient in small-scale agricultural production in the developing countries (Ojo and Ajibefun 2000). The return to scale (RTS) analysis is presented in Table 4.

Table 4: Return to scale analysis

Variables	*Elasticity of Production*
Age of farmer	0.21
Farm size	0.32
Family labour	0.37
Hired labour	0.05
Operating expenses	0.19
Annual cost of Implements	0.17
RTS	1.31
Max. TE	-0.975

The RTS was 1.309, that is, it was greater than unity and thus implies that backyard farming was in the irrational stage of the production function and efforts should be geared towards moving production under backyard farming towards stage 11 of the production function by intensifying and expanding the use of all the variables of the production function model.

Technical Efficiency (TE) Analysis: The TE of the backyard farmers varied significantly between 0.500 and 0.975 with a mean TE of 0.875. The significance of the TE was confirmed by a student's t-ratio test of significance at 5 percent level in which the computed t-ratio was 9.76 and thus greater than the tabulated t-ratio at 5 percent level of significance. Also, the gamma's estimated standard error of 0.091 was less than half of the estimated gamma coefficient of 0.884.

The study also showed that the backyard farmers were relatively technically efficient with about 72 percent of them having TE above the mean TE of 0.875 for the study area.

The study observed that the variables of educational level of the farmers, farming experience and location of the backyard farms led to decrease in TE as shown by the positive sign on the estimated coefficients of the variables in the inefficiency model. This situation is contrary to a-priori expectation that farmers' level of education and farming experience would increase the farmers' level of TE (Ojo and Ajibefun 2000, Ajibefun and Daramola 1999). This situation may be due to the following reasons:

- *Educational Level of Backyard Farmers:* Over 96 percent of the backyard farmers attended secondary school and above, implying that they would be involved in one government job or the other and even many of them were into some non-governmental organizations (NGO's) thereby leading to reduction in attention paid to farming works.
- *Farming Experience:* Over 78 percent of the backyard farmers had farming experience of

less than ten years, indicating that the farmers had small farming experience. In fact many of them went into backyard farming because of what their neighbours were making from their backyard farms and the realization of the effects on such families consumption and real income levels.

- *Location of Backyard Farms:* The study observed that about 89 percent of the backyard farmers had their farms in their residential compounds, whereas, in Nigeria there are only small spaces left in the residential compounds after building the houses. Therefore only small pieces of land are farmed (mean farm size of 0.05 ha with standard deviation of 0.06 ha) and as such no meaningful investment could be done at the present level of backyard farming in the study area.

CONCLUSION

The study revealed that backyard farming was profitable and improved consumption of essential nutrients at the family level. The backyard farmers were relatively technically efficient with about 72 percent of them having TE above the mean TE of 0.875 for the study area. The TE of the backyard farmers would improve if more land is made available for this group of farmers at locations quite close to their residential compounds and organizing training in basic farming operations for some well educated government workers who may invariably be interested in farming later in life.

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