

Food Security and Productivity of Urban Food Crop Farming Households in Southern Nigeria

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Abstract

The study investigated the effect of urban food crop farming household's productivity on household food security in Cross River State, Southern Nigeria. A two-stage sampling technique was used to obtain a sample size of 217 urban food crop farmers. The data was analyzed using food security index, food insecurity/surplus gap index, head count index, productivity index and logistic regression. The result showed that 53.5% of the households were food insecure while 46.5% were food secure. The average daily per capita calorie intake for food secure households was 8732.29 kcal, which is higher than the national average; and 880.26 kcal for food insecure households, which is far lower than the national average and the recommended minimum requirement by FAO. The food insecurity gap/surplus index result showed that food secure households exceeded the calorie requirement by 218% while the food insecure households fell short of the calorie requirement by 89%. The logistic regression estimates revealed that the productivity of urban farming households had a significant and positive effect on household's food security status. This means that the higher the productivity of urban farming household's, the higher is the probability that households would be food secure. The study therefore recommends that, to reduce food insecurity in the study area government must make sure that appropriate measures should be implemented to boost farmer's productivity.

Keywords: food security, productivity, logistic regression, urban, farming household, Cross River

1. Introduction

1.1 Introduce the Problem

Before the emergence of oil as Nigeria's dominant economic sector, the agricultural sector contributed over 60 percent of Gross Domestic Product (GDP) and 90 percent of exports (United Nations Development Program [UNDP], 2009). The economic relevance of the agricultural sector has since declined, with the share of agriculture in GDP falling to 32.2 percent in the 1975–1979 periods (Adewuyi, 2002) and averaging 35 percent between 1981 and 2006. The fall of agriculture in export share has been even more precipitous. From 1960–1970, the export crop subsector contributed 58.4 percent annually on average to the total foreign exchange revenue. This declined to 5.2 percent over the period 1971–85 and then further to 3 percent from 1995–1999 (Adewuyi, 2002). Similarly, the growth of output in the agricultural sector declined from 3.8 percent in the 1987–1990 periods to

2.2 percent between 1992 and 1995 (Adewuyi, 2002). According to Muhammad-Lawal and Atte (2006), aggregate agricultural production grew only by 5.4% from 1981 - 2003. Because of this slow growth in output, Nigeria moved from a food sufficient country in the 1960s to a major importer of food in the 1980s (Fasoranti, 2006). The estimated current 3.7 percent food production growth rate cannot keep pace with the 6.5 percent food demand fueled by a high rate of population increase, moderately rapid income growth, and relatively high elasticities of expenditure for food (Egwuda 2001; Oviasogie 2005; Mellor, 1988). For instance, in 2004, local demand of five million tons of rice far outstripped the supply of three million tons, necessitating the importation of rice to meet the shortfall. The value of rice imports has continually increased from \$60 million in 1990 to \$280 million in 2001, peaking at over \$1 billion in 2008 (Akintayo, 2011). In 2002, Nigeria was one of the six largest rice importers in the world (Yusuf, 2008). As with most other crops in Nigeria, rice yields are low, averaging about 1.8 tons of paddy per hectare, compared to national potential average of 3 tons per hectare for upland system and 5 tons per hectare for the lowland system (Akintayo, 2011). In general, food crop production in Nigeria is far below potential and demand is greater than locally produced supply.

Food is a basic necessity of life. Its importance is seen in the fact that it is a basic means of sustenance and adequate food intake, in terms of quantity and quality, is a key for healthy and productive life. The importance of food is also shown in the fact that it accounts for a substantial part of a typical Nigerian household budget (Omonona & Agori, 2007). Food insecurity remains a fundamental challenge in Nigeria. The Food and Agriculture Organization (2002) enlisted Nigeria among countries faced with serious food insecurity problems. The Global Food Security Index (GFSI) of the Economist Intelligence Unit has ranked Nigeria as the 80th among 105 countries with food affordability, availability and quality. According to the Index, Nigeria recorded weak scores in the areas of Public expenditure on agricultural research and development, 0.0; presence of food safety net programs, 0.0; gross domestic product per capita, 3.0; proportion of population under global poverty line, 9.6; food consumption as a share of household expenditure, 9.6 and protein quality, 12.8 (El-Kurebe, 2012). The vision of Nigeria to have physical and economic access to food on a continuous basis has therefore continued to remain a mirage (Fakayode, Rahji, Oni, & Adeyemi, 2009; Adeyeye, 1997). As at 1986, about 14 million (16%) Nigerian was food insecure with majority being peasant farming households (Fakayode *et al.*, 2009; Abalu, 1999). Over 40% of households across all agro-ecological zones in Nigeria face the problem of severe food insecurity (Fakayode *et al.*, 2009; Mariya-Dixon *et al.*, 2004). The 2010 MDG report states that the proportion of the Nigerian population living below the hunger threshold increased from 29% to 33% between 2000 and 2009, implying little prospect of achieving the 2015 target of 14.5%. Several studies have been carried out on food security in Nigeria. They include: Omonona and Agoi (2007); Adeyemo and Kuhlmann (2009); Fakayode *et al.* (2009); Idrisa, Gwary, and Shehus (2008). Most of these studies, have focused on measuring food security using the consumption expenditure, analyzing food security among urban poor household, analyzing food security among urban households or urban farmers, and suggesting ways of solving the food problem. Little studies have been done on analyzing food security and productivity among urban food crop farmers. Hence this research will fill this gap and provide empirical information. The main objective of this paper is to assess the productivity of urban food crop farming households and its effect on household's food security status in the study area.

1.2 Review of Related Literature

1.2.1 Theoretical Literature

Measures of productivity can be divided into partial or total measures depending on the number of inputs under consideration. Total output as a ratio of some measure of labour quantity, usually mandays in developing countries, is called labour productivity (LP) and provides some notion of output per worker; while output per area of land planted is land productivity (Wiebe, Soule, Narrod, & Brenneman, 2003; Zepeda, 2001). The two previously mentioned measures are examples of single

factor productivity (SFP), defined as the ratio of a measure of output quantity to the quantity of a single input used (Diewert & Nakamura, 2005). Partial measures of productivity can be misleading because they ignore the role of other inputs in any observed output changes (Zepeda, 2001). As a result of this shortcoming, a total measure of productivity was developed. Total factor productivity (TFP) is defined as the ratio of a measure of total output quantity to a measure of the quantity of total input (Wiebe *et al.*, 2003; Zepeda, 2001). As with labour productivity, most studies on TFP are primarily targeted towards identifying the determinants of TFP in Nigeria (Ukoha, Okoye, & Emetus, 2010; Akintayo, 2011; Mbam & Edeh, 2011; Fakayode, Babatunde, & Ajao, 2008). Capalbo and Antle (1988) identified two major approaches to total factor productivity measurement, these are: the growth accounting (index number) and econometric approach. To measure urban food crop farmers productivity, this study adopts total factor productivity method.

However, diverse theories have been formulated to explain the food shortages that can happen on various geographical scales, ranging from global to individual. The most widely cited include: food availability decline (Devereux, 1993; Millman & Kates, 1990); food entitlement decline (Sen, 1981); political economy explanations (Devereux, 1993); food shortage as a disaster (Blaikie, Cannon, Davis, & Wisner, 1991); and the Sustainable Livelihoods Framework (SLF), which looks at food insecurity as an outcome of undesirable/vulnerable livelihoods. Detailed discussions on the theories and frameworks have been carried out in the literature (Devereux, 1993; Diriba, 1995). The SLF is the most appropriate approach for the study at hand, and it also captures the central ideas of other food security theories. A livelihood comprises 'the capabilities, assets (stores, resources, claims and access) and activities required for a means of living' (Chambers & Conway, 1992). Four important components of the SLF can be identified: capital assets, existing context, mediating processes and livelihood outcomes and indicators (Carney, 1998; Ellis, 2000). The interaction between these factors determines whether a household pursues a sustainable livelihood strategy or lives under vulnerability.

1.2.2 Empirical Literature

Numerous researches have been done on food security and productivity. This section will focus on reviewing related literature on food security and food productivity. Muhammad-Lawal and Omotesho (2008) highlighted the place of cereals in farming household food security in Kwara State. The study showed that more than 60% of the total households in the study area are food in secure. Cereals provide 34% of the farming household total calorie intake and 47% of protein supply, respectively. Idrisa *et al.* (2008) analyzed food security status among farming households in Jere Local Government Area (LGA) of Borno state in north-eastern Nigeria. Primary data were collected from 120 households selected through multistage sampling procedure. Major findings of this study indicated that the incidence of food insecurity was high among the age bracket of 40-49 years (27.5%) but the depth and severity was higher (0.24 and 0.41 respectively) among the age group of 50 years and above. Fakayode *et al.* (2009) examined the food security situations of the Nigerian's major farm households using Ekiti State, as a case study. The study comprised a random sample of 160 farm households selected across 16 villages in the two Agricultural Development Project (ADP) zones of Ekiti State. Results showed that only 12.2% of the farm households were food secure, 43.6% were food insecure with hunger (moderate) and 8.3% were food insecure with hunger (Severe). Cassava, yam and their products were shown to contribute immensely to the food security status of the farm households. Adeyemo and Kuhlman (2009) evaluated the efficiency of resource use in urban food crop production. The results showed that the average revenue for urban food crop production was N51, 294 per hectare with gross margin of N23, 688. This means that food crop production in urban areas is profitable. However, there was disequilibrium in resource use, as planting seeds and agrochemicals were used efficiently as against land and labour that were inefficiently used. In general, urban food crop production is yet to attain an optimum level of combination of resources. Liverpool-Tasie, Kuku, and Ajibola (2011) assess the nature and scope of agricultural productivity, food security, and social capital in Nigeria, while also laying the groundwork for investigating the

interrelationships among them. The literature reveals the pervasive inefficiency of Nigerian farmers as most smallholder farmers produce significantly below their production frontiers. As a result, they produce less than optimal levels of output as revealed by studies of productivity (mostly land productivity). The vast majority of Nigerians are reported to be food insecure as revealed by studies on availability, utilization, and access to food. Umoh and Yusuf (2009) examine poverty and resource-use efficiency (productivity) among rural farmers in Obubra, Cross River State, Nigeria. The Lorenz curve and Gini coefficient was used to measure the depth of poverty among farmers; and Production function was used to measure the productivity (or resource-use efficiency) of different classes of poor farmers and non poor farmers. Findings reveal that poverty is more severe in female-headed households than male-headed ones. Productivity estimates show that the moderately poor farmers were more efficient in the used of most resources than the core poor and the non poor. Generally, all groups of the farmers were inefficient in the use of every input except labour. Ojo (2004) studied labour productivity and technical efficiency of farmers in food crop production in Nigeria, in four local government areas in Ekiti State, Nigeria. Data were collected from 200 yam farmers' using multi-stage sampling technique. Data was analyzed using descriptive statistics and stochastic frontier production function. Results showed that labour from family source was mostly used in yam production and yam production was in small-scale category. Labour for land preparation and maintenance with farm, distance and farming experience showed negative decreasing function to the factors and reduced yam output. The technical efficiency analysis confirmed the presence of technical inefficiency effects in yam production as shown by the significant gamma value of 0.917.

2. Materials and Methods

2.1 The Study Area

Cross River State occupies an area of about 22,342.176 square kilometers (Quarterly News Letter of the Ministry of Local Government Affairs, Cross River State, 2006). It is located on Latitude $5^{\circ} 25^{\circ}N$ and longitude $25^{\circ} 0^{\circ} E$. The soils of Cross River State are ultisol and alfisol but predominantly ultisol, suitable for pineapple production. Cross River State is bounded on the North by Benue State, South by Bight of Bonny, and in the East by Ebonyi and Abia States, while in the West by Republic of Cameroun (Menakaya & Floyd, 1978). About 2,888,966 people inhabit the area, of which the Efiks, Ejaghams and Bekwarras are the major ethnic groups (Agbor, 2007). Cross River State has the largest rainforest covering about 7,290 square kilometers. It is described as one of Africa's largest remaining virgin forest harboring as many as five million species of animals, insects and plants. The state is located within the evergreen rainforest zone. There are two distinct climate seasons in the area, rainy season, from March to October and dry season from November to February. The annual rainfall varies from 2,942mm to 3,424mm. The average temperature is about $28^{\circ}C$. Cross River State is characterized by the presence of numerous ecological and zoo-geographically important high gradient streams, rapids and waterfalls. Fishing and subsistence agriculture are the main occupations of the people. Crops grown in the locality include rice, maize, yam, cassava, pineapple, plantain, banana, oil palm, rubber and cocoa among others (Agbor, 2007).

2.2 Sampling Procedure and Sampling Size

The population of this study comprise of all urban food crop farming households in Cross River State. Urban food crop farmers are those farmers who cultivated crops like vegetables, root and tubers, and staple crops with one growing season. A two stage sampling technique was used in selecting the sample. The first stage involved the random sampling of three urban areas out of eight major urban areas in Cross River State. The eight urban areas were arranged in an alphabetical order and assign a number to each of them. These numbers were written in separate piece of papers and were put into a basket, then thoroughly mixed. The researcher blindfolded himself, dip his hand into the basket and pick out a number. This process continued until three urban areas were selected namely: Calabar,

Ugep, and Ikom. In stage two, a snowball sampling technique was employed to select urban food crop farmers in each urban area. With this approach, the researcher initially contacted few respondents and then asked them whether they know anybody practicing urban farming activities in their residence to recruit future subjects from among the acquaintances. This was done mainly because it was near impossible to get the exact number of urban food crop farmers in each town. The sample size calculator was used to determine the total number of urban farmers that will be interviewed in order to get result that reflect the target population. Sixty seven (67) farmers were interviewed in Calabar, ninety six (96) in Ikom, and Fifty seven (57) in Ugep, using the confidence level of 95% and confidence interval of 12%, 10%, and 13% respectively. A total of 220 urban food crops farmers were sampled in the study area. Out of 220 urban farmers selected for this study, 217 supplied complete data that were used in the analysis.

2.3 Method of Data Analysis

2.3.1 Measuring Food Security

In assessing food security at the household level, a food security index was constructed. This involved two steps: identification and aggregation process. This method has been applied in several studies whose main focus was to determine the food security status of households (Omotesho, Adewumi, Muhammad-Lawal, & Ayinde, 2006; Asogwa and Umeh, 2012; and Amaza, Abdoulaye, Kwaghe, & Tegbaru, 2009). The identification process defines the minimum level of nutrition (calories) necessary to maintain healthy living; this is the food security line. The FAO recommended minimum daily energy requirement per adult equivalent is 2250kcal; therefore this value defines the food security line for the study. Households which are below the food security line are classified as food-insecure households while those households that are above are classify as food-secured households. Aggregation on the other hand involves estimating the daily per capita calorie consumption of each household. To do this, the estimated daily calorie supply of the households was divided by the household size adjusted for adult equivalents using the consumption factor for age – sex categories in Table 1. Household calorie supply was estimated using food nutrient composition in Table 2.

$$\text{Food security index (Z)} = \frac{\text{Household's daily per capita calorie supply}}{\text{Recommended daily per capita calorie requirement}} \quad (1)$$

Additionally, food insecurity gap index, food surplus gap index and the headcount ratio of food security were calculated for the sample households based on the food security index (Z). The food insecurity gap (P) measures the extent to which food insecure households on average fall below the food security line and the food surplus gap (S) measures the extent by which food secure households exceeded the food security line. The Headcount index (H) measures the percentage of sampled household that are food insecure/secure. The Head count ratio, food insecurity gap, and food surplus gap is defined as:

- Headcount index (H_{fi}) = $\frac{M}{N}$ (2)

- Headcount index (H_{fs}) = $\frac{L}{N}$ (3)

- Food insecurity gap index (P) = $\frac{1}{M} \sum_{i=1}^m G_i$ where $G_i = \left(\frac{Y_i - R}{R}\right)$ (4)

- Food surplus gap index (S) = $\frac{1}{L} \sum_{i=1}^L G_i$ where $G_i = \left(\frac{Y_i - R}{R}\right)$ (5)

Where M = number of food insecure households; N = total number of households in the sample; L = number of food secure households; G_i = daily per capita calorie deficiency or surplus for ith household; H_{fs} = headcount index for food secured households; H_{fi} = headcount index for food

insecured households; Y_i = daily per capita calorie consumption on food item of i th households; R = recommended daily per capita calorie requirement.

Table 1. Nutritional (calorie-based) equivalent scales.

Years of age	Male	Female
0-1	0.27	0.27
2-3	0.45	0.45
4-6	0.61	0.61
7-9	0.73	0.73
10 – 12	0.86	0.78
13 – 15	0.96	0.83
16 – 19	1.02	0.77
20 and above	1.00	0.73

Source: Adapted from Federal Office of Statistics [FOS] (2004)

Table 2. Nutrient composition

Food Item	Energy (kcal/kg)	Proteins(g)
Maize	3600	90
Rice	3500	60
Millet & Sorghum	3500	100
Cowpea	3300	210
Groundnut	5500	230
Soybean	4000	330
Cassava, fresh	1500	10
Cassava, flour	3400	20
Yam, Flesh	1100	20
Yam, flour	3200	40
Beef	2250	147.29
Fish	1320	87.98
Egg	938	110

Source: Adapted from Omotesho *et al.*, (2006)

2.3.2 Measuring Productivity

To assess the productivity of urban food crop farmers, the following productivity index was used.

$$Productivity = \frac{Total\ output\ of\ crops\ produce\ (value\ in\ naira)}{Total\ cost\ of\ variable\ input\ used\ in\ production\ (Naira)}$$

To determine the effect of urban food crop farming household productivity on household food security, the logistic regression model was estimated. The implicit form of the model is expressed as:

$$Z_i = \beta X_i + U \quad (6)$$

Z_i = Household food security status (food secure households =1, food insecure households = 0)

X_i = Vector of explanatory variables

U = Error term

β = Vector of the parameter estimates

Xs are explanatory variables and are defined as follows: X_1 = Productivity of urban food crop farmers; X_2 = Farm size (ha); X_3 = Labour (mandays); X_4 = Capital (number of farm equipments own)

3. Results and Discussion

Table 3 present the summary statistics of the food security indices among the sampled households. Based on the recommended daily calorie intake of 2250 kcal, it was observed that 53.5% of the households were food insecure and 46.5% were food secure. This result does not agrees with Babatunde, Omotesho and Sholotan, (2007); Idrisa *et al.*, (2008); and Muhammad-Lawal and Omotesho, (2008) as two third of the households in these study were not food secured. The reason might be because of the study location, these authors investigated food insecurity status of rural farming households while this research focus on urban farming households. Also, most of the urban food crop farmers were not full time farmers. Farming was not seen as their only source of income and livelihood. Urban farming was only done in part time basis, as many household heads were business men/women, civil servants, traders, etc. Unlike the rural farming households were farming is the major source of income and livelihood.

The average daily per capita calorie intake in the study area was 4538.89 kcal. This is higher than the recommended minimum daily calorie requirement by FAO and also higher than the national average of 2700 kcal (Babatunde *et al.*, 2007). However, the average daily per capita calorie intake for food secure household was 8732.29 kcal, which is higher than the national average. The average daily per capita calorie intake of food insecure households was 880.26kcal, which is far lower than the national average and the recommended minimum requirement by FAO. The study area could therefore be regarded as food insecure given to the fact that only 46.5% of the population was able to meet the recommended calorie intake of 2250 kcal per capita per day, while 53.5% could not. The food insecurity gap/surplus index which measures the extent of deviation from food security line shows that food secure households exceeded the calorie requirement by 218%, while the food insecure households fell short of the calorie requirement by 89%. This shows a wide gap between the food secure and food insecure households in the study area. The average family size for the study area was 8 persons, while it was 9 and 7 persons for food insecure and food secure households respectively.

Table 3. Indices of farming household food security

Food Security Indices	Food Insecure Households	Food Secure Households	All
Percentage of households	53.5	46.5	100
Number of households	116	101	217
Mean of household size (adult equivalent)	8.73	7.2	8.0
Food security index (Z):			
Mean	0.39	3.88	2.01
Std	0.027	0.51	0.26
Mean households daily calorie consumption(kcal)	8532.05	67216.33	35845.95
Mean household per capita daily consumption(kcal)	880.26	8732.29	4538.89
Food insecurity gap(P)/surplus index(S)	0.89	2.18	-
Head count ratio (H)	0.54	0.47	-

Source: Field Survey, 2013

Table 4 present the maximum likelihood estimates of the logit model describe in equation 6. The result shows that in terms of predictive efficacy, the model predicted the food security status of urban food crop farming households with 69.8% accuracy. The MacFadden R-square of 0.13 implies that all the explanatory variables included in the model were able to explain 13% of the variation in food security status of the households. The log-likelihood ratio (LR) test is significant at one percent meaning that the model is adequate in explaining the probability of the effect of the explanatory variables on household food security status. The average marginal effect is 0.51, this implies that on average, the probability that urban food crop farming households will be food secure is 51%.

The empirical result revealed that the coefficient of the productivity of urban farming households was statistically significant at 1% and had a positive effect on food security status of urban food crop farming households. The marginal effect value of 0.096 implies that, if the productivity of urban food crop farming households is increased by one unit, the probability of households being food secure increases by 9.6%. This indicates that the higher the productivity of urban farming household, the higher is the probability that households would be food secure. This result agrees with the work of Liverpool-Tasie *et al.*, (2011) as the authors found out that agricultural productivity affects food security directly by increasing the available supply of food, particularly for subsistence households, and indirectly by increasing incomes.

Also, the coefficient of farm size was statistically significant at 10% and had a positive effect on food security status of urban food crop farming households. The marginal effect value of 0.11 implies that, if farm size increases by one unit, the probability that urban food crop farming households would be food secure increases by 11%. This means that, the larger the farm size, the more likely urban food crop farming households would be food secure.

The coefficient of labour used in mandays was statistically significant at 10% and had a positive effect on food security status of urban food crop farming households. The marginal effect value of 0.0034 implies that, if labour used in mandays increases by one unit, the probability of households being food secure increases by 0.34%.

Table 4. Logistic regression estimates showing effect of urban food crop farming household productivity on food security

Variables	Coefficient	Marginal Effect	Z – Value
Constant	-1.53	-	3.65***
Productivity	0.38	0.096	3.79***
Farm Size	0.46	0.11	1.80*
Labour	0.013	0.0034	1.70*
Capital	0.0071	0.0017	0.89
Log likelihood = -131.23		Average Marginal effect = 0.51	
LR test (4) = 37.31***		Number of cases predicted correctly = 151(69.9%)	
MacFadden R ² = 0.13			

Source: Field Survey, 2013; *** means significant at 1%, * means significant at 10%

4. Conclusion

This study investigated the effect of urban food crop farming household's productivity on household's food security in the study area. The result showed that 53.5% of the households were food insecure while 46.5% were food secure. Furthermore, the average daily per capita calorie intake for food secure households was 8732.29 kcal, which is higher than the national average; and 880.26

kcal for food insecure households, which is far lower than the national average and the recommended minimum requirement by FAO. Hence the study area is regarded as food insecure given to the fact that only 46.5% of the population was able to meet the recommended calorie intake of 2250 kcal per capita per day, while 53.5% could not. Also, the findings of this research revealed that, the productivity of urban farming households had a significant and positive effect on food security status of the respondents. This means that the higher the productivity of urban farming household's, the higher is the probability that households would be food secure. Since the productivity of urban food crop farmers affected the household food security. This means that to reduce food insecurity of the respondents' government must make sure that appropriate measures should be implemented to boost farmer's productivity. Measures such as: intensification of using new input technology in farming, at an affordable price to the farmers should be implemented.

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