

# Resource Use Efficiency in Urban Agriculture in Southwestern Nigeria

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Keywords: Urban Agriculture- Food Crops- Resource Efficiency- Nigeria

## Summary

*The rate of urbanization in West Africa including Nigeria is expected to lead to increased demand for food and possible associated increases in urban unemployment and food insecurity. The challenge therefore is for researchers and policy makers to put in place policies and goals to make urban agriculture a legitimate and viable economic activity capable of mitigating the problem of urban food insecurity. The paper sets out to evaluate the efficiency of resource use in urban food crop production. Structured questionnaires were applied to urban food producers in five districts of two cities. An effective sample of 120 respondents was available for evaluation. Results from the analysis of data have shown that almost all (92%) of the food producers are literate. Both men (53%) and women (47%) are participating in food production in urban areas. Majority (61%) of the food producers secured loans from the formal sector. The average revenue for urban food crops production was ₦51, 294 per hectare with a gross margin of ₦23, 688. This means that food crop production in urban areas is profitable. 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.*

## Résumé

### Efficacité de l'utilisation des ressources dans l'agriculture urbaine dans le sud-ouest du Nigeria

*Le taux de croissance urbaine en Afrique de l'Ouest incluant le Nigeria est supposé accroître la demande alimentaire et ses corollaires à savoir le sous-emploi urbain et l'insécurité alimentaire. Le défi pour les chercheurs et les décideurs consiste cependant à mettre en place des politiques et des programmes faisant de l'agriculture urbaine une activité économique légitime et viable capable d'alléger le problème d'insécurité alimentaire urbaine. L'agriculture urbaine est en voie de progrès dans la plupart des cités urbaines. Cette étude vise à évaluer l'efficacité de l'utilisation des ressources dans la production végétale urbaine. Des questionnaires bien structurés étaient administrés à des producteurs dans cinq districts de deux villes. Un échantillon de 120 producteurs était analysé. Les résultats de l'analyse montrent que presque tous les producteurs (92%) sont lettrés. Les deux sexes, hommes (53%), femmes (47%) participent à la production alimentaire en zone urbaine et la majorité (61%) des producteurs avaient contracté du crédit auprès du secteur formel. Le revenu moyen du producteur urbain était de ₦51.294.ha<sup>-1</sup> avec une marge brute de ₦23.688.ha<sup>-1</sup>. Ceci signifie que la production alimentaire en milieu urbain est profitable. Cependant, il apparaît un déséquilibre dans l'utilisation des facteurs de production. Des intrants tels que semences et produits agrochimiques sont efficacement utilisés alors que les producteurs sont inefficaces dans l'utilisation de la terre et de la main-d'œuvre. Globalement la production urbaine végétale n'a pas encore atteint l'optimum dans la combinaison des ressources.*

## Introduction

All over the world, except in sub-Sahara Africa where the opposite holds, urbanization is associated with economic growth. Paradoxically, sub-Sahara Africa has the highest rates of urbanization globally and more than half of its entire population will be living in cities during the next two decades. This situation implies that in West Africa especially Nigeria the problem of urban poverty, unemployment and urban food insecurity will become exacerbated rather than ameliorated by the phenomenon. At the same time as these problems grow, the niches for activities that alleviate them also take hold and possibly expand. One of such activities to which urban households have turned for food, employment and income is urban agriculture. It is thus not entirely surprising that urban agriculture has grown in importance and scope in the last few decades.

Urban agriculture is a term used to describe the production of agricultural products in the urban environment. Three major types of urban agriculture have been identified as urban shifting cultivators, household gardeners and urban market producers, all which play distinct roles and contribute to urban market. In urban agriculture, much of the activities described are practiced in zones around large cities and urban towns. These areas are characterised by strong urban influences and demand, easy markets, services and other

inputs.

Urban agriculture in the developing countries has been growing in importance and scope in more recent times. It is estimated that 800 million people are engaged in urban agriculture worldwide, with the majority in Asian cities and of these 200 million are considered to be market producers, employing 150 million people full time (12). According to Mougeot (6) urban agriculture is an important supply source in developing country food systems. It represents a critical food security valve for poor urban households providing cheap, simple and flexible tool for productively using open urban spaces, generating employment and income, adding value to agricultural products.

Garrett (5) projects that by 2020 the number of people living in developing countries will grow from 4.9 billion to 6.8 billion, 90% of this expansion will be in cities and towns accounting for more than half the population of Africa and Asia. As these events unfold, West Africa will not be left out, for example Nigerian population in 2000 was 111.6 million while the urban population was 49.1 million. In 2006 Nigerian population has hit 140 million. By 2020 her population is projected to be 168.2 million while urban population will be 97.9 million. If no action is taken, rapid rate of urbanization

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Received on 19.05.08 and accepted for publication on 29.08.08.

combined with lack of economic growth in the rural areas, will exacerbate unemployment, poverty and urban food insecurity problems over the next two decades. The roles of agriculture remain significant in the Nigerian economy despite the strategic importance of the oil sector. Agriculture provides primary means of employment for Nigerians and accounts for more than one-third of total Gross Domestic Product and labour force (13).

The fact then remains that urban agriculture will compliment rural supplies and food will need to continue to be produced in and around cities where there would be more people. Boosting urban agriculture will come with the additional benefit of substantially reducing some economically wasteful and environmentally unfriendly costs associated with transportation and packing of agricultural products, as is especially the case when such goods are produced far from their consumers. The United Nations is of the belief that a dependable supply of food should be regarded as a fundamental human right (11). This is a laudable point of view which should be upheld and attained. With more people in the cities, cities must feed its people and it makes economic sense for food to be produced nearest to where it is consumed. Poor urban households have, over the years had to rely on the oars of urban agriculture for employment, income generation, hunger and poverty reduction, and generally improving livelihoods. This is how important urban agriculture is and how seriously it must be taken.

It is imperative that with the increasing rate of population growth in cities, the need to meet the food requirement with domestic production becomes very crucial. Such effort calls for production expansion strategies towards establishing a strong diversified food sector.

It is however, acknowledged that increased agricultural productivity would help in attaining the needed food security. One of the often suggested strategies for increasing this productivity is a combination of measures designed to increase the level of farm resources as well as make efficient use of resources already committed to the farm sector. The need to efficiently allocate productive resources in agriculture cannot be overemphasized. It is a success indicator and performance measure. Consequently, every factor of production would have to be efficiently and effectively mobilized to reduce the gap between actual and potential outputs.

The objective of this study is to explore the efficiency of resource use in urban food crop production. Efficiency in food crop presupposes the optimum combination of and use of resources. Any plan to achieve this optimality goal will require a through knowledge of the resource use patterns as well as an assessment of the productivities of resources. Such an understanding will assist urban policy makers and prospective investors in knowing the possibilities of increasing the level of production by giving the direction of adjustment in resource use.

## Methodology

Cross sectional data were collected using random sampling. This was done by choosing ten districts in two major cities (Ibadan and Ile-Ife). The ten districts are Aiyetoro, Ogbon-Agbara, Oke-Ola, Aseri-Ifa, Adegba, Omolade, Ibebo, Ashi, Shasha, and Alakia. One hundred and twenty urban producers were selected and interviewed with the aid of structured questionnaires.

Socio-economic data were secured on respondents' age, sex, educational level, farm size, cropping patterns and other inputs and components. The collected data were subject to descriptive and inferential statistical analysis. Different forms of production functions were fitted to the data, using Ordinary Least Squares estimating method

with estimates of marginal value productivity of selected resources derived from the best fitting production function and as well as the elasticity's of production.

The theoretical model relating output with inputs is given by:

$$Y = F(x_1, x_2, x_3, x_4, U) \text{ where}$$

$Y_1$  = value of output in Naira. The value of output was estimated in monetary terms by multiplying the physical output value by the unit price of the crop concern.

$x_1$  = Area of land cultivated in hectares.

$x_2$  = Labour input measured in man days.

$x_3$  = Value of planting seeds measured in Naira.

$x_4$  = Value of agrochemicals used in Naira.

$U_1$  = Error term.

The value of output was estimated as specified in equations 1, 2, and 3 as a linear, semi-log and double log.

$$Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + U_1 \dots\dots\dots \text{eq1}$$

$$Y = b_0 + b_1 \ln x_1 + b_2 \ln x_2 + b_3 \ln x_3 + b_4 \ln x_4 + U_1 \dots\dots\dots \text{eq2}$$

$$\ln Y = b_0 + b_1 \ln x_1 + b_2 \ln x_2 + b_3 \ln x_3 + b_4 \ln x_4 + U_1 \dots\dots\dots \text{eq3}$$

The best fitting equation would be chosen according to the following econometric and statistical criteria:

- 1) The magnitude of the coefficient of multiple determination ( $R^2$ ),
- 2) The significance of the individual explanatory variables as expressed by their t-values,
- 3) The significance of the overall production function as judged by the F-value,
- 4) The appropriateness of the signs of the regression coefficients based on *a priori* expectations. All the explanatory variables are expected to be positively related to the value of output.

The marginal value product (MVP) of resource provides a framework for policy decision on resource adjustment. When the MVP value is positive, it is an indication that output could be increased by using more of the given factor input. However, the magnitude of the MVP has to be compared with acquisition price which is the marginal factor cost (MFC) of the input in order to determine how useful it is to increase the level of the factor used. The divergence between the acquisition price of the input and its MVP indicates the scope of resource adjustment necessary to attain economic optimum. A given resource is optimally allocated when there is no divergence between its MVP and the MFC of the resource input. That is:

$$MV Px_1 = Px_1$$

Where  $MVPx_1$  = Marginal Value Product of input  $x_1$

$Px_1$  = Price of input  $x_1$  = MFC

A t-statistic is used to determine if there is divergence between MVP and MFC.

The acquisition price or MFC for all resources used is the average market price prevailing in the area. However, where resources are measured in value terms, efficiency in the use of resources must be evaluated by equating their MVP to one Naira plus some interest rate.

The elasticity of production indicates the changes in output relative to a unit change in input of other levels that are held constant. Mathematically, the elasticity of production is expressed:

$$Ep = \frac{\partial y}{\partial x} \frac{x}{y}$$

Where  $Ep$  = elasticity of production

$y$  = aggregate value of output

$x$  = resource input

And  $\frac{\partial y}{\partial x}$  = derivative of  $y$  with respect to  $x$

According to theory, when the ratio is greater than one, this means that the increase in output outpaces the increase in input and production is elastic. When it is less than one, this indicates that the percentage increase in output is less than the percentage increase in input and the production is said to be inelastic. When the ratio is equal to one, then output increases by the same rate as input and elasticity is said to be unitary.

## Results and discussion

The results of the socio-economics characteristics are presented in table 1. The data have shown that urban farming is practiced by both men and women. Despite the fact that women perform many functions at home they still have the time and energy to be involved in urban farming. The women labour individually for the specific return of maintaining their obligations to feed their families either through growing food for consumption or food for sale to purchase the means to meet household obligation. The age distribution of the producers has shown that 25% were below 40 years while 62% were between 41 and 59 years and 13% of the producers were above 60 years. This is an indication that farming in urban areas is practised by all categories of young and elderly people living in the cities. The data on education are interesting, as only 9% of the producers did not have any formal education. This is in contrast to rural areas where over 20% were illiterate (1, 7). About 64% of the farmers have gone through primary and secondary education while 27% have had their higher diploma and degree. The educational status of the urban producers would enable them to acquire knowledge and skill and thus increase their power of understanding. When the major occupation of the producers was analyzed, the data have revealed that about 51% of the producers' main occupation was farming. The rest were traders, teachers and artisans. These categories of urban producers used hired labour during some cultural practices like weeding and

harvesting. The study explored the migration status of the respondents. We observed that most of the producers (47%) migrated to the cities while 34% were born in the areas of study and almost (19%) were indigenes of the areas.

### Cropping practices of the producers

We observed that urban shifting producers farm whenever they could find empty spaces in the cities. They grow leafy vegetables, tomatoes, pepper, okra and some food crops mainly for the informal market in order to meet their more basic needs, also for better-off households. Traditional leafy vegetables which grow fast and absorb few inputs are one of their important products, because they contribute to the inexpensive vegetable supply of the urban lower classes. In addition we noticed household gardeners that reside in towns and farm around their homes or elsewhere in or near the city. They raise small livestock and grow various vegetables. Women are more prominent among this group. They grow for the market and to supplement household food supply.

There are also the urban market producers who produce vegetables and crops like yams, cassava and maize. Crop-livestock interactions and integration occur in various mixes. Production of swine and poultry as well as micro-livestock like rabbits and snails at commercial rather than subsistence levels characterized the system because they lend themselves well to the urban environment marked by land scarcity and can be raised in confinement. However, for ease of data collection this study concentrates on producers of vegetables, yams, maize, cocoyam and cassava.

Investment in production inputs is usually high and often requires institutional credit and access to land which respondents enumerated as their critical needs. In order to explore these critical areas of needs, respondents were asked to indicate their farm size and how they acquire their lands and credit. The responses provided by the producers are shown in table 2. Almost 56% of the farmers secured their lands through inheritance. About 19% got their land as gifts from relatives, friends and colleagues in the same location while 13% purchased their lands and almost 12% rented the lands. Those who purchased their lands, their land rights are more secured and their investments seem accordingly higher and of longer-term in nature whereas those who rented their lands, their rights to use the land for other purposes other than what they are meant for are very limited. Those who purchased their lands have erected residential buildings on part of the plots. The sizes of the lands have shown that about 71% of the producers' possessed 0.01 to 0.60 hectare of farm while

**Table 1**  
**Socio- economic characteristics of the producers**

Characteristics	Numbers of producers	Percentage of producers
1. Age (in years)		
21-30	10	8.3
31-40	21	17.5
41-50	44	36.7
51-60	30	25.0
Over 60	15	12.5
2. Sex		
Male	64	53.4
Female	56	46.6
3. Educational Status		
No Education	11	9.2
Primary	29	24.2
Secondary	48	40.0
Technical (Diploma)	17	14.1
Higher (Degree)	15	12.5
4. Major Occupation		
Farming	61	50.8
Trading	18	15.0
Artisan	20	16.7
Teaching	17	14.2
Others	4	3.3
5. Migration Status		
Indigenous	23	19.2
Born in the area	41	34.2
Migrant	56	46.6

Source: Field survey 2007.

**Table 2**  
**Access to land, credit and farm size**

	Number	Percentage
1. Access to land	23	19.2
Gift	14	11.7
Rented	16	13.3
Purchased	69	55.8
Inheritance		
2. Access to credit		
Relatives and friends	36	30
Community banks	21	17.5
Cooperatives	52	43.3
Money lenders	11	9.2
3. Farm size (ha)		
0.01–0.02	12	10.0
0.21–0.40	43	35.8
0.41–0.60	31	25.8
0.61–0.80	19	15.9
0.81–1.00	10	8.3
Over 1.00	5	4.2

Source: Field survey 2007.

**Table 3**  
**Result of the regression analysis**

Variable	Linear	Semi log	Double log
Constant	1161.43 (-4.75) <sup>xx</sup>	3.42 (2.99) <sup>xx</sup>	11.96 (4.60) <sup>xx</sup>
X1	3.12 (4.01) <sup>xx</sup>	1.93 (0.69)	2.82 (6.74) <sup>xx</sup>
X2	1.43 (1.64) <sup>x</sup>	0.78 (0.61)	1.25 (1.73) <sup>x</sup>
X3	0.49 (0.03)	0.09 (1.90) <sup>x</sup>	0.88 (.37)
X4	2.71 (2.01) <sup>xx</sup>	0.18 (1.04)	0.33 (1.18) <sup>x</sup>
R2	0.87	0.64	0.89
F	171	29	163

<sup>x</sup> Significant at 0.05    <sup>xx</sup> Significant at 0.01

**Table 4**  
**Ratios of the marginal value production to marginal factor cost and calculated t-values**

Resources	MVP (N)	MVP/MFC Ratio	Calculated t-values
Land (X <sub>1</sub> )	3.86	0.94	-2.16 <sup>x</sup>
Labour (X <sub>2</sub> )	1.54	0.09	-1.48 <sup>x</sup>
Seeds (X <sub>3</sub> )	1.95	1.35	0.88
Agrochemicals (X <sub>4</sub> )	1.77	1.12	0.53

<sup>x</sup> Significant at 0.1

25% of the producers controlled 0.61 to 1.00 hectare of land and only 4% had access to over 1.00 hectare of land. Concerning credit access, majority of the producers (61%) secured credit or loans from the formal sector (community banks and cooperatives). This is unlike in rural areas where producers secure most of their loans from informal sector (1, 8). We discovered that farmers in towns are in good relationship with the formal financial institutions and they combine savings with credit. All these go to help the urban market producers. About 30% of the producers enjoyed credit from relatives and friends who in most cases charge little or no interest on such credit.

The average revenue for food crops production in the study area was N51,294 per hectare with a gross margin of N23,688. This indicates food crop production in urban areas to be profitable. We discovered a kind of inter-household transfers of food and money in the study area. The exchanges were predominantly between households living in close proximity in urban cities and many transfers were from husbands who live in separate residences from their wives. Respondents indicated that without the money transferred they would not have secured all their household needs.

### Resource use efficiency

The results of the regression are shown in table 3. Based on the previously explained criteria, the double log production function was chosen as the lead equation. This equation shows that the land area cultivated, cost of seeds and agrochemicals are highly significant at 1% level. However, labour input used, relevant explanatory variable is significant at 0.05. The coefficient of determination (R<sup>2</sup>) indicates that 89% of the variation in revenue from food crops is explained by variation in the level of use of each of the specified inputs. The F-value attested to the joint significance of the explanatory variables on revenue from food crops.

The marginal value product is used to judge the efficiency of resource used at a given level of technology and prices

of both input and output. The estimates of the MVP, ratios of the MVP to MFC and the calculated t-values are given in table 4.

The significant difference between MVP and MFC of land and labour as depicted by the calculated t-value reveal that land and labour are not used efficiently. In the same table, the calculated t-values of planting seeds and agrochemicals costs show there is no significant difference between the MVP and MFC. This indicates that the two inputs are used efficiently.

The production elasticities for the resources are calculated, which show land, labour, seeds and agrochemicals to be 0.97, 0.89, 0.31 and 0.21 respectively. The sum of the elasticity of production of the resources indicates an increasing return to scale in the urban areas (2.43). This means that urban producers are yet to attain an optimum size of the combination of the resources. Consequently, urban producers can have more returns by increasing all the quantities of the inputs used.

### Conclusions

This study has revealed some conclusions that can be drawn as regards urban food production. The average size of plot of urban producers was 0.55 hectare. Majority of the producers secured their loans from the formal sector. This enabled the producers to purchase planting seeds and agrochemicals at the appropriate time. The timely release of fund enhanced the returns that accrued to the producers. There has been an interhousehold transfer of food and money in the area of study, which have increased the food security of most families and helped their non food expenditures.

Food producers in the urban areas are yet to attain an optimum level of combination of the resources as the elasticity of production of the resources indicate an increasing return to scale. The need arises for adjustment in the level of resource use most especially with regards to expanding the size of plots used for production. In view of the accessibility of producers to funds, output can be envisaged by increasing the inputs used.

It is apparent from this study that urban agriculture enjoys the advantages of providing fresh food for home consumption, income for the family and employment for the poor. Past research efforts for example (3) on food production in rural Nigeria have emphasized poor infrastructure such as bad road network and lack of storage as obstacles to the delivery of basic and perishable goods into urban cities. It is strongly recommended that urban agriculture (not far from the cities) should be promoted in Nigeria.

The current research discovered that the crop-livestock interaction and integration occur in various mixes in urban areas. In order to understand its complexity, future research will have to examine the crop-livestock production system and resource allocation. The other point of interest is to compare urban agriculture in cities from different ecological zones in order to understand and learn from their differences and

### Acknowledgements

The authors gratefully acknowledge the funding provided by the Alexander Von Humboldt foundation.

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