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RESOURCE USE AND FACTOR PRODUCTIVITY IN URBAN SMALLHOLDER VEGETABLE PRODUCTION IN UMUAHIA AGRICULTURAL ZONE OF ABIA STATE, NIGERIA

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ABSTRACT

There is strong evidence that urban poor can earn income and increase food security through vegetable production enterprises. This is majorly because, in addition to having a short gestation period, vegetable production is not capital intensive and does not involve complex production technologies at the smallholder level. But there is no doubt that urban farmers may face peculiar resource use problems that could affect the efficiency of the enterprise. The study therefore examined urban cropping systems and analyzed resource use and factor productivity in urban smallholder vegetable production, using a sample of urban farmers in Umuahia metropolis. Labour and planting materials were found to be the most significant and positively correlated input with value of output. However, neither labour nor any of the other inputs was efficiently allocated in the production. Land, planting materials and organic and inorganic fertilizers were underutilized, while labour, capital assets and credit proved to be overutilized. This situation may have arisen from the goal of production, which was largely for subsistence and hobby. An attitudinal change that can bring about positive orientation towards urban farming is needed. Goals of urban farming must go beyond mere subsistence and hobby to include income diversification and employment. Government should also enunciate an integrated programme in urban farming.
Keywords: ***Resource, Productivity, Vegetable Production, Smallholder, Urban,***

INTRODUCTION

Nigeria typifies a developing country with very high urban population growth rates. Studies by Okonjo (1974), Adepoju (1986), Onah (2001) and Okojie (2003) confirm this. Projections show that some Nigerian cities could have their populations more than triple in less than 10 years. Urbanization affects the food demand structure in a country. In African cities, consumption of traditional basic foods like cassava, maize other grains, vegetables, legumes etc. is often substituted with consumption of more processed and largely non-indigenous foods such as cereals and livestock products along with a higher consumption of pre-cooked and convenience foods (Smith *et al*, 1996).

One outcome of the adverse economic circumstances that befall African cities is a decline in real urban wages due to a contraction of the urban formal economy, growing urban unemployment, wage-freezes and rising food prices (Briggs, 1991; Maxwell, 1995). Empirical application of the life-cycle theory has shown that food consumption is the largest component of household expenditure in developing countries. A rapidly growing population has a large number of young people who tend to consume more than they produce. In the absence of a countervailing increase in the income of adults, the effect will be a high expenditure of income on consumption and reduction in household savings (Leff, 1969; Adams, 1971; Rossi, 1989; Colander, 1993).

Urban agriculture becomes inevitable if urban dwellers, especially the low - income residents, must maintain minimum food security. Smith *et al* (1996) reported that urban conditions are conducive to intensive vegetable production. Uzo (1983) reported that vegetable production is mostly undertaken in home gardens. This is in order to provide choice vegetables to augment the food budget, to provide certain crops, which are not available in certain seasons, and to ensure that vegetables are utilized as required. The report further noted that if Nigeria is to be self-sufficient in food, greater emphasis should be placed on the home gardens through a directional extension programme. Uzo (1983) defined vegetables as succulent herbaceous plants that are eaten whole or in part, raw or cooked as part of a main dish. They are rich in vitamins and characterized by high moisture content (75% or more) and 25% or less of dry matter.

Much attention has not been given to the level of resource use and factor productivity associated with urban crop production in the study area. Campbell and Dinar (1993), among others noted that choice of a production resource from among alternatives is a crucial farm decision that should involve cost, availability and quality considerations. Smith *et al* (1996) noted that most cities have sufficient usable land for farming, although other resources may be scarce. This paper therefore evaluates the production function facing urban vegetable producers and the profitability of the enterprise in Umuahia metropolis, and makes suggestions on how greater participation and productivity can be achieved on a sustainable basis.

MATERIALS AND METHODS

The Study Area: The study was conducted in Umuahia North Local Government Area of Abia State. The local government area is situated in the state capital territory. It comprises three major locations: Ibeku, Ohuhu and the metropolis. To the East, Umuahia North is bounded by Bende Local Government Area, Imo State by the North West, Isuikwuato Local Government Area by the North and Ikwuano Local Government Area by the South.

Umuahia North is located within the tropical rain forest ecological zone of Nigeria and lies within longitude 05° 29°N and latitude 07°33°E. It is 122 meters above sea level. The area is characterized by bimodal rainfall with one peak in July and the second peak in September. It has an annual rainfall of 2175mm and a relative humidity of 72%. Umuahia North Local Government Area is located in Umuahia Agricultural Zone of Abia State. The zone is noted for the production of vegetables, among other crops.

The 1991 census reported the population of Umuahia North to be 213.630; comprising 105,797 males and 107,833 females. Residents of the local government area are mainly civil servants, traders, teachers, artisans and people migrating into the metropolitan part in search of better livelihood opportunities.

Sampling Technique: A total of 70 respondents were purposively sampled in different locations in the study area. Ten (10) respondents each were interviewed in Aguiyi Ironsi

Layout, Ehimiri Housing Estate, World Bank Housing Estate, Ojike Lane, Mkporo Lane, Mission Hill Street and Umuoriehi Isingwu. The locations were purposefully chosen to include all possible socio-economic segments of the metropolis. All the respondents practised urban crop production on a smallholder scale. However, only data relating to 33 respondents involved in vegetable based crop production were used in estimating the production function. Data from the entire sample of 70 respondents were used in the preliminary evaluation as shown in the results and discussion section.

Method of Data Collection: Data used for this study were obtained from both primary and secondary sources. Primary data were obtained through the administration of structured questionnaires and personal interviews. The secondary data were obtained from relevant publications.

Method of Data Analysis: Some relevant socio-economic evaluations were done by means of descriptive statistics while the production function was estimated using the ordinary least squares (OLS) method. Four functional forms were used. They include linear, semi log, double log and exponential functions. Linear model assumes an additive relationship between the inputs and outputs, and complies with constant marginal product of factors irrespective of the scale of operation. The double-log function is very unique in empirical analysis. The exponential model is not normally used because of its complexity. The semi-log model is normally used in aggregate analysis of cost (Olayide and Heady, 1982).

Model Specification: The implicit form of the multiple regression model (production function) was specified as follows:

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6)$.....(1)

Where:

Y = Value of output in Naira

X_1-X_6 = Inputs

Explicitly, the model can be expressed as follows:

Linear

$Y = bo + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + U$..... (2)

Semi-log

$Y = Inbo + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_5 \ln X_6 + U$ ..... (3)

Double-log

$\text{Log } Y = Inbo + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_5 \ln X_6 + U$ ..... (4)

Exponential log or Log-linear

$\text{In } Y = bo + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_5X_6 + U$ .....(5)

Where:

Y	=	Value of output in Naira
X_1	=	Farm size in hectare
X_2	=	Value of labour in Naira per manday
X_3	=	Cost of planting materials in Naira
X_4	=	Depreciated value of capital assets and interest on loans in Naira
X_5	=	Farming experience in years
X_6	=	Cost of organic and inorganic fertilizers in Naira
U	=	Stochastic error term
bo	=	Intercepts
b_1-b_6	=	Coefficients

It is expected, all things being equal, that farm size, value of labour, cost of planting materials, and depreciated value of capital assets and interest on loan should be positively and significantly related to value of output. It is also expected that farming experience and cost of organic and inorganic fertilizers should also be positively and significantly related to the value of output. The allocative efficiencies of farm resources used were estimated using:

Kij = Pfi = MVP/ri

Where: MVP = Marginal Value Product of the inputs.

ri	=	Unit price or opportunity cost of inputs
P	=	Output price
fi	=	Marginal Physical Product of inputs
Kij	=	The allocative efficiency index of inputs.

According to Bayi (1981) allocative efficiency of resources refers to the ability of a firm to equate the marginal value product of a factor to its price. An input is efficiently allocated if the allocative index is equal to unity. An index less than unity shows over utilization. While an index greater than unity shows under utilization (Olayide and Heady, 1982). To determine the profitability of urban vegetable production, net farm income analysis was adopted as follows: NFI = TR – TC

Where:

NFI	=	Net farm income
TR	=	Total revenue
TC	=	Total cost

Where:

TC = TFC + TVC
TC = Total cost
TFC = Total fixed cost
TVC = Total variable cost
ATC = AFC + AVC
AFC = Average fixed cost
AVC = Average variable cost.

Net farm income is determined by subtracting the total cost of expenditures (fixed and variable costs) from the total revenue. Net farm income is the profit earned in relation to the value of the investment made. Total cost is the sum of the total fixed cost and the total variable cost. Variable costs or running costs are those costs that change with the change in the amount of output produced. Fixed cost or overhead costs are costs which do not change with the amount of output produced (McConnell and Brue, 1999).

RESULTS AND DISCUSSION

Income of Respondents: The survey showed that the highest group of urban farmers in the study area are those who earn N21,000 – N30,000 per month. This figure is very poor considering the low purchasing power of the Naira.

Table 1: Distribution of Respondents by Monthly Income Ranges

Range of income in Naira	Frequency	Percentage
1000 – 10000	8	11
11000 – 20000	10	14
21000 – 30000	16	23
31000 – 40000	12	17
41000 – 50000	12	17
51000 – 60000	4	6
61000 – 70000	8	11
Total	70	100

Source: Survey Data, 2004

Smith *et al* (1996) noted that majority of urban farmers come from the poor class. Thus urban farming is likely a survival strategy either to diversify household income or reduce food insecurity (Maxwell, 1995). Even though the sampling was purposive, the much poorer segments of the sample, that is, those within income ranges of 1000 – 10,000 and 11,000 – 20,000 would still not have been in the modal class of the urban farmers because of constraints to access to land.

Reasons for Urban Farming: Seven possible reasons were included in the questionnaire to ascertain why the respondents engaged in urban farming. Table 2 shows the distribution of the sample according to the reasons.

Table 2: Distribution of Respondents by Reasons for Urban Farming

Reasons for urban farming	**Frequency**	**Percentage**
Subsistence	35	50
Ornamentals	-	-
Income	8	11
Commercial	-	-
Gift	6	9
Hobby	21	30
Research and experiment	-	-
Others	-	-
Total	70	100

Source: Survey Data, 2004

Table 2 shows that 50% of the sample engaged in urban farming mainly for subsistence, followed by hobby, income and gift. This gives credence to Maxwell and Frakenberger (1992) who noted that the largest group of farmers in the cities does so for some "measure of food security".

Status of Involvement in Urban Farming: The survey showed that overwhelming majority of the sampled farmers engaged in urban farming on part time basis. This means that urban farming in the study area is largely a part time activity. Earlier reports have shown that urban farming does not exist in isolation. It rather takes place in conjunction with other urban economic activities (Smith *et al*, 1996; Maxwell, 1995).

Table 3: Distribution of Respondents by Extent of Involvement in Urban Farming

Extent of involvement in urban farming	Frequency	Percentage
Full time	2	3
Part time	68	97
Total	70	100

Source: Survey Data, 2004

Urban Farm Holdings: The survey showed that the predominant number of farm holdings in the study area is one. This may be attributed to lack of access to land. Maxwell (1995) noted that access to land is a major constraint to urban farming. Henderson (2002) noted that low urban income and inefficient land markets skew land distribution in favour of the rich, who often may not have immediate need for land.

Table 4: Distribution of Respondents by Number of Farm Holdings

Number of farm holdings	Frequency	Percentage
1	46	66
2	16	23
3	8	11
Total	70	100

Source: Survey Data, 2004

Table 5 shows that most smallholder urban crop farmers in Umuahia acquired farmland through renting and purchase. In several of the cases the land cultivated was located in the residential premises, hence the house rent provided access to such land. Majority of those who indicated that their holdings were purchased belong to the upper income ranges. The leased holdings were largely sourced from undeveloped plots which in many cases belong to absentee landlords.

Table 5: Percentage Distribution of Respondents by Sources of Farm Holdings

Sources of farm holdings	Frequency	Percentage
Communal	-	-
Lease	18	19
Rent	38	39
Purchase	30	31
Gift	8	8
Open spaces	2	3
Others	-	-
Total	96	100

Source: Survey Data, 2004

Systems of Vegetable Farming in Umuahia North: Distance of farm-holding from farmer's residency is usually treated as an important index of agricultural intensification. Farms located close to the farmer's residence stand the advantage of greater manuring and better husbandry than farms located far away (Uzo, 1983). However, homestead farms in the urban areas are expected to dominate the farming system since majority of urban crop farmers only engage in farming on part-time basis.

Table 6: Distribution of Respondents by Location of Farm Holdings

Range of farm location (Km)	Frequency	Percentage
0.00 – 0.10	56	65
0.11 – 0.20	18	18
0.21 – 0.30	4	4
0.31 – 0.40	-	-
0.41 – 0.50	2	3
0.51 – 0.60	4	4
0.61 – 0.70	-	-
0.71 – 0.80	-	-
0.81 – 0.90	2	3
0.91 – 1.00	2	3
Total	88	100

Source: Survey Data, 2004

The survey showed that majority of urban farms are located within the home or at a maximum distance of 0.1km from the home. Vegetables grown in the area were mainly fluted pumpkin (*Telferia occidentalis*); okra (*Abelmoscus exculentus*); egg plant (*Solanium spp*); tomato (*Lycopersicon esculentus*); bitterleaf (*Venonia amydalina*) and *Amaranthus spp*. Ellis and Sumberg (1998) observed that in densely populated cities, most urban farms are located in small plots within or very close to the home.

Majority of urban farmers in the sample were of the view that farm holdings within the home offers the advantages of getting access to food crops like vegetables and fruits as frequently as possible at any time of the day. This result shows that home garden is the dominant system of farming in the metropolis.

Five base crops, namely, yam, cassava, vegetables, cocoyam, pineapple and plantain were identified during the survey. Respondents obtained the distribution presented in Table 7 through direct observation and confirmation.

Table 7; Distribution of Respondents by Base Crops in Farm Holdings

Base Crops	Frequency	Percentage
Yam	2	3
Cassava	32	46
Vegetables	33	47
Cocoyam	1	1
Pineapple	1	1
Plantain	1	1
Total	70	100

Source: Survey Data, 2004

The result presented in Table 7 shows that vegetable and cassava are the major base crops in the study area. FAO (1995) reported that root and tuber crops, mainly cassava are the most important staple food of rural and urban households in Southeastern Nigeria. Majority of the respondents who had yam as their base crop indicated that they cultivated it just as a hobby.

Majority of urban farmers who had cassava and vegetables as their base crops indicated that they cultivated these crops because they know how best to cultivate them. They also indicated that vegetables are frequently needed in the home, and hence growing them increased their food security. In addition, vegetable and cassava do not require very expensive inputs and complex practices to grow. Majority of urban farmers who had cocoyam as their base crop indicated that this crop grows in their plot even when it is not cultivated, especially when other crops must have been harvested. Majority of urban farmers who had pineapple and plantain as their base crops indicated that they cultivate these crops for consumption anytime they are needed.

IITA (1990) defined intercropping to be the growing of two or more species of crops in the same field in the same year. Sole cropping is the growing of one crop variety in the same field in the same year. While crop rotation is the growing of different crops on the same piece of land in different years.

The distribution of the sample according to system of crop production is presented in Table 8.

Table 8: Distribution of Respondents by Cropping Systems

Cropping Systems	Frequency	Percentage
Intercropping	68	97
Sole cropping	2	3
Crop rotation	-	-
Other cropping systems	-	-
Total	70	100

Source: Survey Data, 2004

The survey showed that 97% urban farmers in the study area practice intercropping and 3% practice sole cropping. Crop rotation and other cropping systems were not observed among the sample. This overwhelming dominance of intercropping in the study area confirms the report of IITA (1990) that intercropping is the dominant cropping system in most parts of the humid tropics, especially under rain-fed condition.

Resource Use and Factor Productivity: Model Estimation: The estimation was done with data from the 33 respondents who had vegetable based crop holding. The result of the estimation is presented in Table 9.

Table 9: Regression Estimates of Urban Vegetable Based Crop Production in Umuahia North

Variable	Linear	Exponential	Double-Log	Semi-Log
Constant	699.143*	6.506***	3.690***	-18559.98***
	(1.474)	(36.704)	(4.415)	(4..963)
X_1	2518.030	7.279***	3.106E-02	-1650.951***
	(0.601)	(4.649)	(0.265)	(3.148)
X_2	0.853**	-1.673E-04	0.243	1692.836**
	(2.356)	(1.327)	(1.353)	(2.110)
X_3	2.677**	8.747E-04**	0.359*	1173.74
	(2.647)	(2.315)	(1.585)	(1.158)
X_4	-0.276	1.005E-03	0.183	437.727
	(-0.160)	(1.557)*	(0.811)	(0.433)
X_5	-21.561*	9.489E-03*	-0.338*	-1636.104*
	(-1.527)	(1.800)	(-1.474)	(-1.593)
X_6	6.231E-02	3.877E-04	0.111	488.923
	(0.28)	(0.459)	(0.708)	(0.699)
R^2	0.965	0.913	0.907	0.917
R^{-2}	0.957	0.895	0.872	0.886
F-ratio	128.134***	49.140***	25.955***	29.539***
N	33	33	33	33

*** Significant at 1%
** Significant at 5%
- Significant at 10%

Source: Computed from Survey Data, 2004

From Table 9, the linear model had the highest F-ratio, coefficient of multiple determination (R^2), and number of significant variables. On these bases, it was chosen as the lead equation. The adjusted coefficient of multiple determination (R^{-2}) of 0.957 showed that 96 percent of the variation in the dependent variable (Value of vegetables produced) is adequately accounted for by the independent variables X_1-X_6. The remaining 4 percent or thereabout accounted for by factors which are not included in the model.

The explicit form of the equation is stated as follows:

$$Y = 699.143 + 2518.030X_1 + 0.853X_2** + 2.677X_3** + (-0.276)X_4$$
$$(1.474) \quad (0.601) \quad (2.356) \quad (2.647) \quad (-0.160)$$

$$+ (-21.561)X_5* + 6.231E\text{-}02X_6$$
$$(-1.527) \quad (0.28)$$

($R^2 = 0.965$, $R\text{-}^2 = 0.957$, F-ratio = 128.134***, n = 33).

The insignificant relationships between farm size and value of output does not quite agree with *a priori* expectation, speaking in general terms. But the observed size of cropholdings shows that the variation in farm size was not pronounced. The positive sign gives an indication that the relationship would have conformed with *a priori* expectation if obvious variations existed in farm size, other things being equal. That depreciated value of capital assets and interest on loans was negative and non-significant in the production function does not really mean that the variable impacted negatively on production. The fact is that majority of the vegetable farmers do not have several farming assets apart from hoe, shovel and cutlass, and the observed slight variations could go in any direction in the function. The few with appreciable assets may not have cultivated so much at the time of survey, since production is largely for subsistence and hobby. The scale of operation may equally not have warranted much need for loan from the formal sector, which must necessarily attract interest. In the same vein, there was no marked difference observed in the quantity of purchased fertilizers used by the vegetable farmers. Greater proportion of their soil fertility improving materials was got from kitchen refuse. Some used poultry droppings obtained from poultry farms in the town and environs, while very few used inorganic fertilizers in very negligible quantities.

Efficiency of Resource Use Urban Vegetable Based Crop Production: The allocative efficiency of the five basic production inputs, excluding farming experience, was estimated as indicated in the methods section. The results are presented in Table 10. As can be seen in the Table, all the five inputs were inefficiently allocated in the production. Their high values indicate that vegetable based crop production in Umuahia North is characterized by inefficiency in the utilization of resources. Farm size, cost of labour, cost of planting materials and cost of organic and inorganic fertilizers have positive allocative efficiency values. Positive allocative efficiency suggests that the marginal productivity values of farm size are on the increase therefore suggesting equally that the production is going on in the first stage; therefore the input is being underutilized.

Table 10: Allocative Efficiency of Resource use in urban vegetable based crop production

Variable	Acquisition cost per unit (Px)	Coefficient b1	Mvp=biy/ x	Allocative Efficiency ratio E = MVP/PX	Deviation from optimality (1-E)x 100
Farm size X_1	N100	2518.030	231.67	2.316	1.316
Labour X_2	N400	8.853	2.587	0.0064	99.36
Cost of planting materials	N180	2.677	1805.06	10.028	-9.028
Depreciated value of capital assets and interest on loans X_4	N25	-0.276	-58.04	-2.322	3.322
Cost of organic and inorganic fertilizer X_6	N10	0.06231	12.221	1.222	0.222

Source: Computed from Regression Coefficients and Input Prices

The negative efficiency of depreciated value of assets and interest on loan indicates that the marginal productivity values are on the decrease, hence suggesting that such resources are utilized in the third stage of production. The implication of this is that an increase in value of assets and interest on loan will result in lower productivity.

Costs and Returns Analysis: The net farm income analysis was used to determine the profitability of urban vegetable based crop production in the study area. The net farm income was computed as Net Farm Income = Total Revenue – Total Cost. The result is presented in Table 11.

Table 11 shows that despite the inefficient allocation of production inputs in urban vegetable production, the enterprise is quite profitable in Umuahia North. With a total revenue of N1907.1 and a total cost of N1449.8 the enterprise has a reasonable rate of returns on investment per hectare. If the resources can be efficiently utilized, then the enterprise has good prospects to raise household income and also reduce food insecurity among urban households in the city.

Table 11: Cost and Returns of Urban Vegetable Based Crop Production

Item	Value (N)
(A) Average Revenue	1907.1
Total Revenue	1907.1
(B) **Cost items**	
1. Variable cost items	
(i) Labour	860.7
(ii) Planting materials	391.75
(iii) Organic and inorganic fertilizer	99.15
Total Variable cost	1331.6
2. Fixed cost items	
(i) Depreciated value of capital assets and interest on loans	118.2
Total fixed cost	118.2

Note: Total Cost = Total fixed cost + Total variable cost
= N1331.6 + N118.2 = N1449.8
Net farm income = Total revenue – Total cost
= N1907.1 – N1449.8 = N457.9
Source: Computed from Cost and Returns Data

CONCLUSION AND SUGGESTIONS

Urban farming in Umuahia metropolis conforms to the characteristic low resource use productivity of smallholder farm enterprises in Nigeria. In particular, vegetable production in the city is largely associated with very smallholdings and insufficient external inputs that scarcely guarantee high output levels in an intensive cropping system. The goal of most vegetable farmers in the area may have set a limit to their expectations. Since the enterprise has good prospects of contributing to urban household income and food security, it would be worthwhile to encourage its growth and sustenance.

The first challenge lies in bringing about the requisite attitudinal change in urban residents. Goals of production must shift from mere subsistence and hobby to encompass income diversification and employment. It is only when the farmers target to make income that scale and efficiency considerations will become paramount.

While people can go on using undeveloped spaces available to them, it is being strongly advocated here that government should include urban farming in its urban settlement plans. It is clear that urban farming cannot attain impressive commercial status under the present inefficient urban land market. It is therefore suggested that government should map out urban farm estates in which allocations are given to urban dwellers under temporal use rights for vegetable production, and perhaps production of other arable crops with short maturity periods. Such estates should have all the basic physical facilities that will enhance

productivity. Arrangements for extension and credit, as well as marketing, using farmer participation approach in planning and implementation, will also be very useful in ensuring sustainability.

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