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# RESOURCE PRODUCTIVITY UNDER FADAMAS CROPPING SYSTEM IN UMUAHIA NORTH LOCAL GOVERNMENT AREA OF ABIA STATE, NIGERIA.

## [PRODUCTIVIDAD DE SISTEMAS DE CULTIVO "FADAMAS" EN GOBIERNO DE AREA LOCAL UMUAHIA NORTE, ABIA, NIGERIA]

**J. A. Mbanasor and L. O. Obioha**
*Department of Agricultural Economics,*
*Michael Okpara University of Agriculture Umudike, Nigeria*

**SUMMARY**

This study examined the resource productivity of farmers under fadamas cropping system in Umuahia North Local Government Area (LGA) of Abia State. Farming land has become a critical problem due to increased demand for land by other users. This has given rise to the use of fadama land available in the area. Using profitability and resource use efficiency measures, it was identified that fadama farming is profitable and all the factors employed were inefficiently utilized. This suggests that higher profits and yields could be attained by efficient allocation of the employed resources which is vital to the sustainability of agriculture in Nigeria.

**Key words:** Fadamas, production costs, resource management

**RESUMEN**

El studio examinó la productividad de los agricultores en sistemas de cultivo de "Fadama" en el Gobierno de Área Local Umuahia Norte (LGA), Abia, Nigeria. La disponibilidad de terrenos para cultivo es un problema crítico debido al incremento en su demanda para usos alternos a la agricultura. Esta situación ha propiciado el uso de las áreas "fadama". Empleando medidas de rentabilidad y eficiencia de uso de recursos se identifico que los sistema "fadama" son rentables, pero que los recursos son empleados ineficientemente. Esto sugiere que pueden obtenerse producciones y rentabilidades más altas si los recursos son empleados eficientemente, factor de vital importancia para la sustentabilidad de la agricultura en Nigeria.

**Palabras Clave:** Fadama, costos de producción, manejo de recursos

## INTRODUCTION

According to FACU (1994) Fadamas are areas of low depression where water used to accumulate on the surface during the raining season. In agricultural usage however, the word fadamas refer to areas either in streams-less depression or adjacent to streams/rivers, due to its characteristic moisture retention within or very close to the rhizosphere for greater part of the year (Singh, 1997).

Fadama cropping system is a small-scale, farmer based, privatized irrigation system for crop production especially during dry season. It can be described as a small-scale irrigation developed through exploitation of shallow groundwater and surface water by individual farmers, who take responsibility for the investment and management of their farms. It is an alternative to large scale irrigation system, which failed to meet the food self-sufficiency and food security of the country (Baba, 1993).

The importance of Fadama cropping system in Nigeria cannot be over-emphasized. According to Sanda and Ayo (1994) Fadama activity afforded people some opportunities at a time they would have been idle. Besides, the surplus labour during dry seasons is utilized unlike in the rainy season when labour is a constraint.

Because of these developments, irrigation water application to agricultural crops is becoming increasingly important especially during the dry season. Considering the economic returns of Fadama land and its scarcity in relation to demand in Umuahia North Local Government Area especially during the dry season, the importance of using it most efficiently and productively becomes very imperative. It has become obvious that efforts to increase crop production through Fadama land may have to concentrate on increasing their productivity rather than on extensification of production areas *per se*.
The analysis of productivities should help to identify the possibilities for increasing output while the resources are conserved. The role of increased efficiency was examined as a viable complement to any set of policies to stimulate fadama cropping system/or to promote resource conservation.

The study would resolve the above problems through the following specific objectives namely.

(i) Identifying the crop mixtures under fadama cropping systems
(ii) Evaluating the costs and returns associated with the cropping system in the area.
(iii) Determining the productivity of various resources under fadama cropping system.
(iv) Determining the resource use efficiency of the system

## METHODOLOGY

Study Area: The study was conducted in Umuahia North Local Government Area of Abia State. The LGA lies on $7.30^{1}$ E of the Greenwich meridian and latitude $5^{0}$ $30^{1N}$ of the equator. The agroclimate is typical of the tropics and is the same in all communities in the area. Rainfall is heavy for about six months in a year (May-October) with a two weeks dry spell in August. The remaining months of November-April are dry i.e (fadama period) Umuahia fadama is cultivated during the dry season. It is along the flood plan of Mbom stream and it is cultivated by organized small scale farmers who irrigate small plots using mostly traditional water lifting devices such as calabash and buckets; only very few use pumps.

Mostly, the farm is irrigated by blocking the course of the stream by using heavy log so as to channel the stream into the fadama. The fadama is cultivated on a yearly basis for the production of vegetables crops like maize, fluted pumpkin, okoro, pepper and garden eggs.

*Sampling procedure*

The fadama farmers in Umuahia North belong to fadama cooperative groups. There are three fadama cooperative groups namely Ndakpo, Oganiru and Ubadinohia fadama cooperatives. Through Abia ADP, the list of members in each group was collected. A multi-stage stratified random sampling technique was employed in selecting 60 respondents with 20 coming from each group cooperatives.

The data for this study were collected with cost route technique, which is simply described as the collecting of data at the time the farmer is performing each operation, and the aid of detailed questionnaire administered to the selected fadama farmers in the area.

The data collected were mostly demographics and those related to input and output as well as their prices. They include size of fadama land, labour, capital, finance, water, price of labour, quantity of output, price of output, constraints etc , especially as the fadama farmers in the area are the same in their cropping pattern.

*Methods of data Analysis*

Data for the first specific objective were analysed using descriptive statistics while objective two was actualized using Gross margin and Net return analysis. The Gross margin analysis and Net profit were used as specified below.

$$Gm = \sum_{L=I}^{n} Pi\,Qi - \sum_{j=i}^{n} pi\,xj$$

Where:
Gm = gross Margin
Pi = unit price of output
Qi = Quantity of each output
Pj = Unit price of each input
Xj = Quantity of each output

Net returns = Gm – TFC

Gm as defined above
TFC = Total Fixed cost derived by depreciating fixed assets.

Returns from production were based on all the crops combination in each farm. The average was used in the computation of this analysis. Objective three and four were derived from regression analysis. The production response function model was expressed implicitly according to Oladunni (1996) thus,

$Y = f(X_i, X_2, X_3, X_4, X_5, e)$

Where,
Y = Value of output in Naira
$X_1$ = Labour in Mandays
$X_2$ = Value of fertilizer in Naira
$X_3$ = depreciated value of fixed assets in Naira (hoe, cutlass, calabash and small-scale pumps)
$X_4$ = Farm size in hectare
$X_5$ = Value of other inputs in Naira
e = Error term

The following functional forms were evaluated

(a) Linear function

$$y = b_o + b_1 x_1 + b_2 x_2 + \ldots\ldots b_5 x_5 + ei$$

here
Marginal Physical Product (MPP)

MPP = b (regression coefficients.)

Elasticity = bi x/y

(b) The Cobb Douglas (Double log) function

$\log y = \log a + b_1 \log x_1 + b_2 \log x_2 + \ldots + b_2 \log x_5 + e.\text{-subscript}$

In this,

MPP = b y/x

Elasticity = b

(c) Semi – log function

$Y = \log a + b_1 \log x_1 + b_2 \log x_2 + \ldots + b_5 \log x_5 + e.\ \text{subscript}$

In this ;

MPP = b/x

Elasticity = b/y

In all $b_1 - b_5$ are the regression coefficients.

The Cobb Douglas form provided the best fit among the rest due to high value of $R^2$. The significance of each explanatory variable was determined using t-value. The overall significance was determined by the F – test. The marginal value product (MVP) was used to determine the productivity of the resources while the ratio of MVP to the marginal factor cost (MFC) was used to determine efficiency use. MFC was either the purchased unit price of the input or the opportunity cost. Six percent interest rate was used to obtain the opportunity cost of fixed assets and other production inputs i.e for every one Naira spent on production was therefore N1.06. Labour and land were valued at their current market prices.

Marginal physical product (MPP) was calculated as b Y/X, Since Cobb Douglas function was the lead equation where b is regression coefficient of inputs y is the mean of output and x is the mean of factor inputs.

However, MPP is taken as the MVP since the dependent variable y is in monetary terms. The higher the MVP the more productive the resource, while negative MVP shows unproductive. If the ratio MVP & MFC is one, the resource is efficiently utilized, when greater than one, it is under utilized, while a ratio of less than one shows over utilization.

## RESULTS AND DISCUSSIONS

*Cropping Mixtures under fadama cropping system*

The result presented in Table 1, shows the crops combination being practiced by the fadama farmers. The result shows that the fadama farmers grow five different combinations as shown above. In all the combinations fluted pumpkin (ugu), pepper, and garden eggs were virtually in all the mixtures which shows their importance in the area.

The most outstanding mixture was fluted pumpkin/garden-egg/okoro/pepper with 50% of the farmers using the combinations. This was followed by Ugu/garden-egg/pepper with about 17% of the farmers using the mixture. It was observed that subsistence fadama farming was most common. Most farmers attempted to grow as many crops as possible in order to stabilize yield and income. All farm operations including nursery, land preparation, planting, fertilizer application, weeding, irrigation were mostly accomplished traditionally. On irrigation most of them rely on surface application of water by which they lift water from streams, open wells and tube wells; only a few use pumps.

Table 1: Distribution of fadama farmers according to crop mixtures

| Crops mixtures | No of Respondents | Percentage |
|---|---|---|
| Ugu/Maize/garden-egg/pepper/okoro | 9 | 15 |
| Ugu/garden-egg/okoro/pepper | 30 | 50 |
| Ugu/okoro/pepper | 6 | 10 |
| Ugu/pepper/maize | 5 | 8.3 |
| Ugu/garden-egg/pepper | 10 | 16.7 |
| Total | 60 | 100 |

*Cost of production*

The result presented in table 2 shows the cost and revenue structure of fadama farmers. Labour contributed more than 80% of the total cost of production under fadama cropping system. This may be attributed to the increase in man-days due to the number of hours used in irrigating the farms.

The total variable costs of the fadama cropping system was N61,003.4, which included labour costs, seeds, fertilizer and other variable inputs. The value of depreciated assets was N1649.60. The result showed that the average cost of producing one hectare of fadama farms in the area was N62653.

Table 2: Enterprise Budget of fadama cropping system per hectare in local Currency (Naira).

| Item | Qty | Price unit | Value |
|---|---|---|---|
| Revenue | | | |
| Yield | 16.63mt | N5/kg | N83124 |
| Variable costs labour | 187 man-days | N300/man-day | 56100 |
| Seeds | 5kg | N270/kg. | 1393.70 |
| Fertilizer (50kg bags) | 4 bags | N485/bag | 1940 |
| Other inputs | - | - | 1569.7 |
| Fixed costs | | | |
| Depreciated Assets | - | - | 1649.60 |
| Total cost | - | - | 62653 |
| Net returns/ha | | | N20472 |

Note : One Dollar = One Hundred Naira

*Returns from production.*

The result presented showed that the average total revenue per hectare was N20472 per production period of about two months. The net return is substantial considering the duration of the period under which the amount was realized. The result suggests that fadama farmers could improve their income by increasing their farm size to the extent other resources are efficiently utilized. The crucial issue highlighted by this study is that labour is the most significant cost item in the fadama cropping system and the reduction in the man-days could turn the fortune of the enterprise-especially the man-hours used in irrigating the farms. The assistance of the farmers with small-scale pumps might be the key issue, especially as most of them still rely on the use of calabash and buckets in irrigating the farms.

*Marginal Productivities and Resource Use Efficiency*

The results presented in Table 3 show that among the three functional form for estimating MPP the Cobb-Douglas function was the best having explained 59% of the total variations in the value of output of fadama farmers. All the estimated functions are significant ($P<0.05$). This implies that they are adequate in explaining the variations in the dependent variables. However, the Cobb-Douglas form was chosen as the lead equation based on econometric and statistical reasons such as the number of regression coefficients that are significant, the value of $R^2$ and the significant level of the F-ratio.

Table 3: Marginal physical product of fadama farmers as estimated with three regression models.

| Variables | Linear | Cobb-Douglas | Semi-log |
|---|---|---|---|
| Constant | 16524.54 | 10.95*** | 341175.07 |
| | (117851.55) | (1.04) | (697587.70) |
| Labour (x1) | 280.32 | 0.19* | 114334.11 |
| | (467.62) | (0.13) | (84906.56) |
| Value of fertilizer (x2) | 2.02 E.03 | 4.38-02 | 15598.41** |
| | (0.018) | (0.05) | (32450.01) |
| Value of Fixed Assets (x3) | - 5.32*** | - 4.16 E –02*** | - 245637.53** |
| | (18.16) | (0.07) | (99217.01) |
| Farm size (x4) | 215961.76* | 1.07 | 88298.07 |
| | (59851.08) | (0.15) | (42205.56) |
| Value of other inputs(x5) | - 26.84 | - 0.25 *** | - 20539.74 |
| | (15.23) | (06) | (44559.38) |
| $R^2$ | 0.25** | 0.59*** | 0.22** |
| F-ratio | 4.9*** | 21.31*** | 4.24*** |

*** Sign. at 1%
** Sign. at 5%
* Sign. at 10%
Figures in parenthesis are standard error

The lead equation (Cobb-Douglas) shows that labour, farm size and value of other inputs were significant while value of fixed assets and value of fertilizer used were not. Among the significant variables, labour and farm size had a positive relationship with the value of outputs. This implies that as their quantities used

increase, the revenue accruing to the fadama farmers would increase.

It shows that the revenue of Fadama farmers would depend on the extent they increase their farm size especially considering the constraint imposed by irrigation facilities. It also indicates that the other inputs used had negative influence on the value of output, implying the more they were used, the less the revenue that would accrue to the farmers.

The non-significant use of fertilizer and depreciated value of fixed assets maybe attributed to the level of use. Only very few farmers use pumps and there maybe shift in the use of fertilizer to manure due to cost and unavailability at the right time. It is believed that fadama soils around Umuahia are naturally fertile with nutrient recycling ability.

*Marginal productivities of inputs*

The result of the estimated production function were further used to compute the marginal productivities of the inputs in Table 4. The computed marginal value products in this case are the Marginal Physical Products (MPPS) since the output was measured in monetary terms.

Table 4: Marginal value products and unit acquisition costs of inputs.

| Input | Marginal value products | MVP/MFC | Unit Acquisition cost |
|---|---|---|---|
| Labour in man-days (x1) | 0.28 | .001 | 300 |
| Value of fertilizer (x2) | 0.17 | .160 | 1.06 |
| Value of depreciated assets (x3) | -0.20 | -.189 | 1,06 |
| Farm size (ha) | 44.47 | .022 | 2000 |
| Value of other inputs | -7.01 | -6.613 | 1.06 |

This implies that a one unit increase in any of the inputs, holding others constant, will change the monetary returns by a value corresponding to the marginal value product of that input. It is also evident from the result that the marginal value products (MVP) of all the inputs were lower than their unit costs. The result further confirms that farm size and labour use were more productive than other resources.

The relative allocative efficiency of the fadama farmers was based on the non-classical requirement that each factor be paid equal to its marginal value product. Based on this, the ratio of marginal value product (MVP) to marginal factor cost (unit acquisition cost) was computed and the values were 0.001, 0.160 –0.189 0.022 and –6.613 for labour, fertilizer, depreciated assets, farm size and other inputs respectively. Previous studies show that maximum or absolute allocative efficiency for a particular resource is confirmed if efficiency ratio is equal to one. But if efficiency ratio is greater than one, it means that less than the profit maximizing level of the input is in used. Also, if efficiency ratio is less than one, it means more than the profit maximizing level of that particular resource is in used (Onyenweaku and Fabiyi 1991). But from the result of this study, it is evident that the efficiency ratio was less than one indicating that more than the profit maximizing level of all the resources were employed by the fadama farmers. This suggests that all the resources were inefficiently allocated and were over utilized above their economic optimum levels. The result shows the need for the fadama farmers to reduce the use of all the resources employed in order to improve efficiency.

*Elasticity of production*

The elasticity of production shows the change in output relative to a unit change in input. For the Cobb-Douglas function which was our lead equation, the coefficients of the estimated model were direct elasticity of production. From the result in Table 3, the production elasticity for each of the resources is less than unity except that of the farm size with 1.07, indicating that the relationship between these resources and output is inelastic except that of the farm size which is at the maximum technical efficiency i.e elasticity greater than unity. Also the coefficient of returns to scale is 1.013 indicating increasing returns. This implies that the farmers were operating at the region of maximum technical efficiency, an irrational region of production. This finding is in conformity with the assertion of Olayide and Heady (1982) that actual cases of increasing returns occur at relatively low levels of output that are characteristic of small scale farming.
The significance of these results is that higher outputs are possible with an increase in the level of aggregate input at the current level of technology.

## CONCLUSIONS AND RECOMMENDATIONS

The findings that emerged from this study have vital policy implications for enhancing, revitalizing and

improving the fadama cropping system in Nigeria at large.

The results have shown that the sizes of fadama land holdings in the area were small with the average farmer cultivating less than one hectare. This could be attributed to the small size of fadama land area relative to the total cultivable land which has imposed constraint of owing large plots by groups. The small size of holdings probably influenced the over utilization of all the resources employed by the fadama farmers.

The encouragement of the groups to replace most of the manually-operated traditional water-lifting devices with modern types (such as pumps) might enable farmers to increase their size of holding as more non-fadama plots can be reached with water. This would also reduce the cost of labour which was highly outstanding in the cost structure of the farms, thereby enhancing the net farm income. Studies elsewhere in Nigeria (Baba, 1993; Adebibu 1994) and in Niger Republic (Baba and Alassane, 1997) showed improved net income by the introduction of modern water lifting devices.

The study further revealed that all the resources were used aboved their economic optimum level. The farmers could be organized through their cooperatives, and be trained in the use of improved resources to avoid over utilization.

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