

# Profitability of production and resource-use efficiency among ofada rice (*Oryza sativa japonica*) farmers in Southwest, Nigeria

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## Abstract

*Ofada* rice has recently gained prominence and it is quickly drawing international attention since it has revealed a strong consumer disposition and it has been perceived to be more nourishing due to its natural taste, a value added to this kind of rice. Nigeria has potential to produce it to self-sufficiency level but due to the inefficient use of inputs and in-availability of some inputs, this has become a mirage. Data was obtained from 180 rice farmers selected from the rice growing areas in Ogun state, with the use of well structured questionnaire. The data collected were then analyzed using both descriptive and inferential statistics. The descriptive analysis showed that 70% of the farmers were males, the average age and farm size was 45years and 2.9ha, respectively. The maximum likelihood estimates of the stochastic production frontier model results showed that a unit increase in farm size, labour, seeds and chemicals used will result in extra 64.587kg, 3.98kg, 0.54kg, and 2.258kg of the output, respectively. Marginal value product (MVP) to the unit prices for these inputs was greater than one implying that all these resources were underutilized. The gross margin analysis revealed that the profit from rice farming was ₦56, 082 (US\$373.88) per hectare per farmer. Farmers' efficiency can be enhanced by increasing the area of land cultivated, labour used, quantity of seeds and chemicals used for production.

**Keywords:** gross margin, ofada rice, *Oryza sativa japonica*

## Rentabilidade da produção e eficiência de uso de arroz ofada (*Oryza sativa japonica*) por produtores no sudoeste da Nigéria

### Resumo

O arroz *Ofada* tem ganhado destaque e está rapidamente atraindo a atenção internacional, pois tem revelado uma forte disposição de consumidores e tem sido percebido como sendo mais nutritivo devido ao seu sabor natural, um valor agregado a este tipo de arroz. A Nigéria tem potencial para produzi-lo ao nível de autossuficiência, mas devido ao uso ineficiente dos insumos e a indisponibilidade de outros, isto tem se tornado uma miragem. Os dados foram obtidos a partir de 180 produtores de arroz selecionados em áreas crescentes de produção de arroz no estado de Ogun, por meio da utilização de um questionário bem estruturado. Os dados coletados foram então analisados por estatística descritiva e inferencial. A análise descritiva mostrou que 70% dos agricultores eram do sexo masculino, a idade média e tamanho da propriedade era de 45 anos e 2.9ha, respectivamente. As estimativas de máxima verossimilhança dos resultados obtidos a partir da produção aleatória no modelo de fronteira mostraram que o aumento de uma unidade no tamanho da propriedade, trabalho, sementes e produtos químicos utilizados resultará em 64,587 kg extras, 3,98 kg, 0,54 kg e 2,258 kg de produção, respectivamente. O valor do produto marginal (MVP) com os preços unitários para esses insumos foi maior que um, implicando que todos esses recursos foram subutilizados. A análise da margem bruta revelou que o lucro do cultivo de arroz foi ₦56, 082 (EUA \$ 373,88) por hectare por agricultor. A eficiência dos agricultores pode ser melhorada através do aumento da área de terra cultivada, trabalho utilizado, a quantidade de sementes e produtos químicos utilizados para a produção.

**Palavras-chave:** margem bruta, arroz *Ofada*, *Oryza sativa japonica*

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## Introduction

*Ofada* rice (*Oryza sativa japonica*) is an indigenous variety grown under the upland production system in Nigeria. Its production has geographical spread covering Ogun, Lagos, Osun, Ekiti and Oyo states with Ogun state being the focal point. Its production occurs during specific months of the year, mostly from March to August, known to be a rainy period. Common problems associated with its production are pest attack, insufficient rain, difficulty in harvesting and weeding, among others. It is largely grown in eight Local Government Areas of Ogun State and consumed as a whole grain. *Ofada* rice has recently gained prominence and it is quickly drawing international attention (Anounye et al., 2007) since it has revealed a strong consumer disposition and it has been perceived to be more nourishing due to its natural taste, an added value to this kind of rice. According to Osaretin et al. (2007), *Ofada* rice variety contains higher protein, fiber and lower water than the commonly consumed foreign rice (*aroso*). The variation in protein content might be due to the processing, storage and transportation methods employed during and after its production as dietary fiber results in reduction of risk of bowel disorders and fights constipation. The lower water content accounts for longer shelf life.

It is cultivated under diverse ecological and production systems, i.e., the upland, rain-fed, inland shallow, deep water/flooding and lowland irrigated rice production systems (Rahji, 2005). Several varieties of rice are widely grown in Nigeria. They include ITA 150, ITA 315, FARO 8, *Ofada*.

Apart from its use for consumption, it can be used to make starch for laundry, cosmetics and textiles, beer, wine and spirits. Oil can also be obtained from the rice bran which has 14-17% oil content (Onwueme & Sinha, 1991). The oil is clear, light, odorless and can be used for soap manufacture, as anti-corrosive and rust-resistant oil. Among many uses of *Ofada* rice it can assist in employment creation, revenue generation and economic growth and development.

On the other side, Amaza (2000) reported that farmers in Nigeria are inefficient in the use of land, labour and capital which are important factors as for production. Nigeria is still faced with a major problem of feeding its population adequately. Increased production and productivity are direct consequences of efficiency of input combination given the available technology (Ogundari & Ojo, 2005).

Thus, a study was realized aiming to determine what are the factors influencing the resource-use efficiency of *Ofada* rice farmers and the profitability of *Ofada* rice production for Nigerian farmers.

## Material and Methods

A multistage random sampling technique was used to select 180 respondents, for an interview, from eight Local Government Areas known to be leading producers of *Ofada* rice in Ogun State through the information provided by Ogun State Agricultural Development Agency (OGADEP). The first stage involved the random selection of three local government areas from the eight rice growing local governments, namely: Obafemi-Owode, Yewa North and Ifo. The second stage was the random sampling of three villages from each Local Government Area while the third stage involved the selection of twenty respondents from each village through simple random sampling techniques. The descriptive statistics, budgetary techniques and stochastic production frontier model were used for the analysis of collected data.

Gross margin technique was employed to access the profitability of *Ofada* rice farmers in the study area by using Gross Margin as a proxy. The profit of an enterprise is estimated as the difference between the total revenue (TR) and the Total Cost (TC)

$$\Pi = TR - TC$$

$$\Pi = TR - (TVC + TFC)$$

in which,

TR = Total Revenue

TFC = Total Fixed Cost

TVC = Total Variable Cost

Gross margin of an enterprise is generally determined by comparing the variable costs of production with the returns from the products. A profitable enterprise has higher total revenue than the total cost of production. It is computed as the difference between the Gross Revenue or Total Revenue and the Total Variable Costs, Mathematically,

$$GM = \sum P_i Q_i - \sum C_j X_j$$

in which,

GM = Gross Margin

$P_i$  = Unit price of product  $i$ ,

$Q_i$  = Quantity produced of product  $i$ ,

$C_j$  = Unit variable cost of input  $j$ ,

$X_j$  = Quantity of input used.

## Results and Discussion

In Table 1 are presented the mean value of socio-economic characteristics of *Ofada* rice farmers in Nigeria.

**Table 1.** Mean value of socio-economic characteristics of *Ofada* rice farmers in Southwest Nigeria.

Characteristics	Mean	Standard Deviation
Age (years)	45	14.56
Household Size	10	7.37
Farm size (hectare)	2.9	2.12
Year of experience	10	7.14

The Gross margin analysis was used owing to the fact that in traditional agriculture, apart from the fact that very little fixed inputs are used, the practice of intercropping with different crops maturing at different times further complicates the estimation of the fixed costs that can be assigned to each crop harvested unlike the variable costs which are more reliable and easier to allocate. The Gross margin is therefore considered a good proxy of profitability in farms where intercropping is practiced because it uses only the total variable cost in the estimations. Although ratios are used to measure the financial position and strength of a business, it will not be used because they rely on the total cost which consists on the total fixed and variable costs in their estimations. The

Gross margin per hectare per farmer can also be used to measure and compare the efficiency of production across farms (Aihonsu, 2002).

Table 2 contains the gross margin analysis of *Ofada* rice production in the study area. The result reveals that *Ofada* rice production is quite profitable and it was also shown that labour cost accounted for 75.5 percent of the total variable costs. This shows that it is laborious. This result is consistent with that of Aromolaran (1992), who reported that labour constitutes a large percent of the total variable cost of production. It is therefore worthwhile to devise technology that is less labour intensive so as to reduce cost of production. For a hectare of land cultivated to an *Ofada* rice farmer, a gross margin of ₦56, 082 (\$373.88) was realized.

**Table 2.** Gross Margin Analysis of *Ofada* Rice based farm (per hectare per farmer).

Item/ha	Amount(₦)	% of Total Variable Cost
<b>A Total Revenue</b>	207,900	
<b>B Variable Cost</b>		
Cost of Planting	5,926.64	
Cost of fertilizer application	5,957.80	
Cost of chemical application	8,592.98	
Cost of weeding	40,100.55	
Cost of harvesting	53,995.04	
Cost of Labour	114,623	75.5
Cost of fertilizer	12,297	8.1
Cost of chemical	10,931	7.2
Cost of seed	13,967	9.2
<b>Total Variable Cost</b>	151,818	
<b>Gross Margin(TR-TVC)</b>	56,082	

Source: Field Survey, 2010; Conversion of Naira(₦)to US dollar (\$)is ₦150 to \$1.

Table 3 shows the resource use efficiency of inputs in *Ofada* rice production. The marginal physical product (MPP) for input utilization was derived from the maximum likelihood estimates of the stochastic production frontier model using the arithmetic mean value of output and input.

The MPP values as shown in the table implies that a unit increase in farm size, labour, seeds and chemicals used will result in extra 64.587kg, 3.98kg, 0.54kg, and 2.258kg of the output respectively. However, a unit increase in fertilizer will decrease output by 0.17kg.

**Table 3.** Resource use efficiency of inputs in *Ofada* rice production in Southeast Nigeria.

Variables	$P_x$	MPP	$MVP = MPP \times P_x$	$MVP/P_x$
Farmsize ( $X_1$ )	6365.43	64.587	7360.34	1.16
Labour ( $X_2$ )	432.62	3.98	453.56	1.05
Fertilizer ( $X_3$ )	106.31	-0.17	-19.373	-0.18
Seeds ( $X_4$ )	30.80	0.543	61.903	2.01
Chemical ( $X_5$ )	119.19	2.258	357.298	2.99

Source: Computed using field survey data, 2010. Note:  $P_y$  = Output price (₦113.96/kg), MPP = Marginal Physical Product, MVP = Marginal Value Product,  $P_x$  = Price of Input

The marginal value products (MVPs) for farm size, labour, seeds and chemicals used exceeded their respective factor prices. It was observed that the ratio of the marginal value product (MVP) to the unit prices for these inputs was greater than one implying that all these resources were underutilized. It therefore indicates that output can be raised efficiently by increasing the use of these inputs. This result supports the findings of Oniah et al. (2008), who reported underutilization of production resources [farm size

(ha), labour (man-days), seeds (kg) and capital [₦].

This study recommends that labour saving technologies should be introduced, adopted and subsidized for *Ofada* rice farmers in South-West, Nigeria to ensure that they actually maximize profit and improve production level. The farmers should also expand the land area cultivated to *Ofada* rice and embrace adoption of labour saving technologies, for optimal use of resources for improved income and household welfare.

In relation to the efficiency of resource use which is the ratio of useful output to the total input that gives a maximum value of output from any given total of inputs, most studies on resource-use efficiency in agriculture focused on the knowledge of marginal productivity. According to Khurso (1964) and Olukosi & Ogungbile (1989), the emphasis of resource use is on marginal productivity because it is the most economical and optimal way to maximize net output in farming and it is obtained by relating the marginal value product to the input price, also called the marginal factor Cost (MFC). The marginal value product (MVP) is the expected returns from an additional unit or units of factor input concerned while other inputs are held constantly.

Upton (1973) stated that for a multi-product firm to have allocated its resource optimally among its feasible production enterprises, it must do it in such a way that the MVP of every input used is equal to the input prices in all the enterprises in which it was used. A ratio of one indicates efficiency in resource use, a ratio greater than one shows underutilization, while a ratio less than one implies that the resource has been overutilized (Iheanacho et al., 2000).

### Conclusions

It is concluded from this study that *Ofada* rice production is profitable for the farmers to the tune of US\$373.88 profit per hectare, despite the high labour requirement and costs. Also, the resource-use efficiency results empirically showed that the resources were actually under-utilized based on the ratio of the marginal value product to the unit prices of input which is greater than one.

### References

- Aihonsu, J.O.Y. 2002. *Comparative economic analysis of upland and swamp rice production systems in Ogun State, Nigeria*. 75f. (Ph.D Thesis) - University of Ife, Ile-Ife, Nigeria.
- Amaza, P. 2000. *Resourceuse efficiency of food crop Farmers in Gombe State, Nigeria*. 75f. (Ph.D Thesis) - University of Ibadan, Ibadan, Nigeria.
- Anounye, J.C., Danbaba, N., Gana, A.S., Abo, M.E., Gregorio, G., Oladimeji, O.A., Athanson, B., Ajayi, O., Nwilene, F.E. 2007. *Definition of ofada rice qualities through varietal identification and testing*. NRCI & WARDA, Maitama, Nigeria. 49 p. (Monograph Series # 26).
- Aromolaran, A.B. 1992. *Multiple objectives and resources allocation behavior of small farmers in Ifedapo area of Oyo State, Nigeria*. 229f. (Ph.D. Thesis) - University of Ibadan, Ibadan, Nigeria.
- Iheanacho, A.C., Olukosi, J.O., Ogungbile, A.O. 2000. Economic Efficiency of Resource-use in Millet-Based Cropping System in Borno State of Nigeria. *Nigerian Journal of Tropical Agriculture* 2:

15-20.

- Khurso, A.M. 1964. Returns to scale in Indian agriculture. *Indian Journal of Agricultural Sciences* 17(3): 17-28.
- Ogundari, K., Ojo, S.O. 2005. The determinants of technical efficiency in mixed – crop food production in Nigeria: a stochastic parametric approach. *Applied Tropical Agriculture* 10: 3-9.
- Olukosi, J.O., Ogungbile, A.O. 1989. *Introduction to agricultural production economics: principles and applications*. Agitab, Zaria, Nigeria. 111 p.
- Oniah, M.O., Kuye, O.O., Idiong, I.C. 2008. Efficiency of resource use in small scale swamp rice production in Obubra local government area of cross River State, Nigeria. *Middle-East Journal of Scientific Research* 3 (3): 145-148.
- Onwueme C., Sinha, T.D. 1991. *Field crop production in tropical Africa*. Principles and practice. CTA, Wageningen, Netherlands. 480 p.
- Osaretin, A., Ebuehi, T., Oyewole, A.C. 2007. Effect of cooking and soaking on physical characteristics, nutrient composition and sensory evaluation of indigenous and foreign rice varieties in Nigeria. *African Journal of Biotechnology* 6(8): 1016-1020.
- Rahji, M.A.Y. 2005. Determinants of efficiency differentials in lowland rice production systems in niger state, Nigeria. *Ibadan Journal of Agricultural Research* 1(1): 7-17.
- Upton, M. 1973. *Farm management in Africa: the principles of production and planning*. Oxford University Press, London, UK. 341 p.