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## Efficiency of sweet orange production among small scale farmers in Osun State, Nigeria

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**ABSTRACT:** This study carried out an analysis of the technical efficiency of sweet orange production among small scale farmers in Osun State, Nigeria. A three-stage random sampling technique was used in collecting the data used for this study. The study shows that the number of stands and the size of sweet orange farms are the significant factors affecting sweet orange production in the area. About eighty-eight percent variations in the output of sweet orange production was found to be due to the technical inefficiency of the farmers. Technical efficiency of sweet orange production among the small scale farmers in the study area was found to be fairly high with a mean of 86.33%. The study recommended the need for the farmers to be assisted in setting up sweet orange plantation as a way of increasing the output in the study area.

**Keywords:** Technical efficiency, Sweet orange, Small scale farmers, Osun State.

### **Introduction**

Fruits are the natural staple food of man containing substantial quantities of essential nutrients in adequate proportion. According to (1) fruits are excellent sources of minerals, vitamins and enzymes that are easily digested and exercise cleansing effect on the blood and the digestive tract. Hence, the ailments usually caused by the consumption of unnatural foods can easily be treated by fruits. Apart from being a very good source of food, fruits are also good medicine. Sweet orange is one of the most important fruit crop grown all over the world. It belongs to citrus species which constitute the most important specie of the Rutaceae family. Sweet orange constitutes the bulk of the global citrus fruit production (2). As such it is the most popular and wide spread of the citrus fruit (1). The (3) reported that citrus fruits are rich in Vitamin C or ascorbic acid and folic acid, as well as a good source of fiber. They are fat free, sodium free and cholesterol free. In addition they contain potassium, calcium, foliate, thiamin, niacin, vitamin B6, phosphorus, magnesium and copper. They may help to reduce the risk of heart diseases and some types of cancer. They are also helpful to reduce the risk of pregnant women to have children with birth diseases. As a citrus fruit, the importance of sweet orange in nutrition and human health can therefore hardly be over emphasized. (1) noted that regular intake of orange prevents frequent attacks of common cold, influenza, bleeding as well as contributes to one's healthy living and longevity. In addition to that, the report observed that orange juice compared with all of the fruits juices is more suitable for all ages and can be given with advantages in all kinds of diseases. Apart from human consumption, the use to which sweet orange has been put include the production of feeds for livestock especially ruminant animal (4).

The main concern of any production activity has been described as that of achieving maximum possible efficiency in the transformation of inputs into outputs. In agriculture, measurement of efficiency is an important step in a process that might lead to substantial resource saving which have important implications

for both policy formulation and farm management (5). The general observation therefore is that local farmers especially in the developing countries are not technically efficient in the allocation of available resources in agricultural production (6). The main motivation of efficiency and productivity studies are the need to investigate and understand the forces that drive agricultural production growth in order to analyze and formulate any desired agricultural policy reform. Whether the future prospects of any potential agricultural policy are concerned with a sustainable or a more intensive agricultural production, the study of individual farm efficiency is essential in order to maximize the anticipated benefits of such a policy. Consequently, efficiency measures can have important implications for issues related to economic survival, the size distribution of farms, the technological adoption and innovations and the overall input use in the agricultural sector. Gains in agricultural output through the improvement of efficiency levels are becoming particularly important nowadays since the opportunities to increase farm production by bringing additional virgin land into cultivation or by increasing the utilization of the physical resources have been diminishing. In addition, eliminating existing inefficiency among farmers can prove to be more cost effective than introducing new technologies as a means of increasing agricultural output and farm household income. Furthermore, for individual farms, gains in efficiency are of great substance in periods of financial stress since efficient farms are more likely to generate higher incomes and thus, stand a better chance of surviving and prospering (7).

Technical efficiency is a major component of productivity used in measuring farm performance. It is used to measure the ability of a farm to obtain maximum output from a given set of inputs. A technically efficient farm therefore operates on the production frontier while a technically inefficient farm which operates below the frontier could be made efficient by increasing its output with the same input level or using fewer inputs to produce the same level output. As such, the closer a farm gets to the frontier the more technically efficient it becomes (8). World production of citrus fruit has experienced continuous growth in the last decades of the 20<sup>th</sup> century. The rise in citrus production is mainly due to the increase in cultivation areas and the change in consumer preferences towards more health and convenience food consumption and the rising incomes (2, 7). Sweet orange production in Nigeria, like many other fruit crops is carried out by small scale farmers (9). Given the changing taste and the policies of government banning importation of juice among other agricultural products, it is expected that output of sweet orange should continue to increase. More so, increasing consumption of orange fruits and products makes it imperative to increase the production in order to match its production with the demand. The drive toward increasing the national production of sweet orange therefore calls for the need to increase the efficiency with which the farmers carry out the production.

This study is therefore designed to determine the factors affecting sweet orange production and to assess the technical efficiency of sweet orange production among small scale farmers in Osun State of Nigeria. This is with a view to identifying the factors affecting the efficiency of production and making recommendation that will ensure increased local sweet orange production in Nigeria.

## **Materials and Methods**

### *Area of Study*

This study was undertaken in some Local Government of Areas of Osun State, Nigeria. Osun State created on the 27<sup>th</sup> August, 1991 covers an area of approximately 8602 sq Km. The State is bounded in the West by Oyo State, Ondo and Ekiti States in the East, Kwara State in the North and Ogun State in the South. The State runs an agrarian economy with a vast majority of the populace taking to farming (10). There are two distinct geographical seasons in Osun State. These are the rainy season starting in late March and ending in October and the dry season from November to early March. The mean annual temperature varies between 21.1oC and 31.1oC. Annual rainfall ranges between 800mm in the derived savannah agro ecological zone to 1500mm in the rain forest zone (11).

### *Sampling procedure*

The major source of data used for this study was the primary sources. This includes the use of interview schedule administered on the respondents by the trained enumerators. A three stage sampling technique

was used to collect the data for this study. The first stage includes a random selection of three Local Government Areas. The second stage involves a random selection of four villages in each of the three selected local Government Areas of the State. The third stage involved a random selection of ten orange farmers from each of the selected villages.

#### *Tools of Analysis*

The main tool used for the analysis of this study was the stochastic production frontier. A Cobb – Douglas functional form is employed to model the frontier functional form specified for this study. This is in line with (12), who observed that the Cobb- Douglas form has been used in many empirical studies, particularly those relating to developing agriculture. Although there are numerous ways of estimating a production frontier, the maximum likelihood estimation procedure has been identified as the most common one (6).

Following (13), the specification of stochastic parametric frontier recognizes component error term as major source of deviation from production frontier. By definition, stochastic frontier production function is

$$Y_i = F(X_i; \beta) \exp(V_i - U_i) \quad i = 1, 2, \dots, n$$

Where  $Y_i$  is the logarithm of output of  $i$ th firm;  $X_i$  is the logarithm of the corresponding vector of inputs;  $\beta$  is a vector of unknown parameter to be estimated;  $F(\cdot)$  denotes an appropriate functional form,  $V_i$  is the symmetric error component that accounts for random effects and exogenous shock; while  $U_i$  is a one sided error component that measures technical inefficiency.

In the explicit form, the frontier production function utilized for this study is as follows:

$$\ln Y = b_0 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + V_i - U_i$$

Where  $Y$  = out put of sweet orange in Kg

- $X_1$  = number of sweet orange stands
- $X_2$  = farm size in hectare
- $X_3$  = labour input in man-day
- $X_4$  = capital in Naira

To determine the goodness of fit  $\lambda$  estimated as  $\sigma_u/\sigma_v$  or as  $(\gamma/1-\gamma)^2$  must be greater than 1.

$$\gamma = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_v^2} \text{ measures the proportion of the variation in output of the respondent due to their inefficiency.}$$

$$\sigma^2 = \sigma_u^2 + \sigma_v^2$$

#### *Limitation to the Study*

The main limitation to this study is lack of physical record keeping. This has the effect of subjecting their responses to questions on the subject matter to memory recall. The implication of this is that the findings of this study depend largely on the accuracy of the data used for the study.

## **Results and Discussion**

The result of the frontier production function used to estimate the efficiency of sweet orange production among small scale farmers in the study area is presented as follows:

Table 1: Maximum Likelihood Estimate of the stochastic frontier production function

Variable	Coefficient	t-ratio
B <sub>0</sub>	2.3989*	9.0448
X <sub>1</sub>	.6661*	9.8565
X <sub>2</sub>	.1970*	2.2969
X <sub>3</sub>	.0319	.4787
X <sub>4</sub>	.0025	.0464
$\frac{\sigma^2}{\sigma}$	.0416*	4.2129
$\gamma$	.8871*	9.9303

Source: Data analysis, 2003

Log likelihood function = 74.3223 =  
 LR test of the one-sided error = 7.3423  
 \*significant parameter at 5%  
 $\lambda = 2.8030$

Estimated equation  
 $\ln Y = 2.3989 + .6661 \ln X_1 + .1970 \ln X_2 + .0319 \ln X_3 + .0025 \ln X_4$

The maximum likelihood estimate (MLE) of the stochastic frontier production parameter for sweet orange production is as shown in Table 1. The coefficients of the variables show that all the specified variables have the apriori expected positive sign. Table 1 shows that 88.71% of the variation in the output of sweet orange among the sampled farmers is due to their technical inefficiency. The values of the LR test of the one sided error and  $\gamma$  being greater than 1 shows that the model specified for the study is of good fit. In addition, Table 1 shows that the number of stands of sweet orange tree and the land size are the two significant variables affecting sweet orange production.

Table 2: Elasticities of Sweet Orange Production

Variables	Elasticity coefficients
X1	.6661
X2	.1970
X3	.319
X4	.0025

Source: Data Analysis, 2003

Table 2 shows that the variables specified in the model have inelastic effect on the output of sweet orange production. A 100% increase in the sweet orange stands will increase the output of sweet orange production in the study area by 66.61%, while a 100% increase in land size increases the output by about 20%. The summation of the partial elasticities which equals 1.19 shows that sweet orange production in the study area is carried out at an increasing returns to scale. As such a 1% increase in all the specified inputs will lead to about 1.2% increase in output.

*Technical efficiency of sweet orange production*

Descriptive statistics was used to determine the efficiency of production among small scale sweet orange farmers in the study area. The distribution of the efficiency estimates among the farmers is as presented in Table 2.

Table 2: Distribution of technical efficiency in sweet orange production in the study area

Technical efficiency%	Frequency	Percentage
Below 60	1	.84
60 - 69	6	5.04
70 -79	17	14.29
80 – 89	50	42.02
90 and above	45	37.81
Total	119	100

Source: Field data analysis, 2003

Table 2 shows that distribution of technical efficiency among sweet orange producers in the study area. It can be seen from Table 2 that about ninety five percent of the farmers given the level of technology of production are more than seventy percent technically efficient. With a mean technical efficiency of 86.34%, the study reveals that the technical efficiency of sweet orange production among the small scale farmers ranges between 58.03% and 97.10%. This shows that farmers' efficiency can be improved in order to raise the level of sweet orange production in the study area.

*Conclusion*

This study carried out an analysis of the technical efficiency of sweet orange production in the study area. Cobb-Douglas production function model was fitted to the data. The result of the analysis shows that the efficiency of sweet orange production ranges between 58.03% and 97.10%. Even though the technical efficiency of sweet orange production among the small scale farmers in the study area is fairly high, high differential in the efficiency estimates of the farmers shows that sweet orange production in the study area can be increased simply by increasing the efficiency of production.

*Recommendations*

As shown from the findings of the study, more land should be allocated to sweet orange production. This is because there is a positive relationship between the technical efficiency and the size of the sweet orange farm. Besides, considering the fact that the number of stands of sweet orange trees also affects technical efficiency in sweet orange production, farmers should be encouraged to embark on sweet orange plantation such that mono cropping system of production will be adopted. This is to ensure that the density of sweet orange plant will be increased.

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