Journal of Agriculture, Environmental Resources and Management
ISSN2245-1800(paper) ISSN 2245-2943(online)
6(2)1-800; **FEB**.2024; pp18-28

www.saerem.com

Resource Use in Oil Palm Production in Biase Local Government Area of Cross River State, Nigeria

Ettah, Otu I. and Bullem, Francis A.

Department of Agricultural Economics, Faculty of Agriculture, University of Calabar, PMB 1115 Calabar, Nigeria. *Corresponding author e-mail: ettahotu@gmail.com,

ABSTRACT

A study on resource use efficiency of oil palm production in Biase Local Government Area, Nigeria was undertaken. Sixty oil palm farmers were randomly selected and evaluation was done with marginal and multiple regression analyses. Result of marginal analysis showed that the ratio of MVP to the MFC were greater than unity (1) for all the inputs used implying that inputs such as labour, farm size, chemicals, seeds and fertilizers were under-utilized. This meant that oil palm output was likely to increase and hence revenue if more of such inputs were fully utilized. Furthermore, the regression analysis had the highest number of significant coefficients with the correct signs and the F-test is 173.88 significant at 1%. The F-test shows that the model fits the problem because it is significant. The quantity of fresh fruit bunch (FFB) has a positive coefficient and hence a positive relationship with palm oil output produce and it is significant at 1%. The implication is that, the bunches or fresh fruit of oil palm contributes to the quantity of palm oil produced in the area. The following are recommended: necessary incentives should be provided to oil palm farmers by government to make them optimally utilize underutilized resources and the level of education of the farmers should also be boosted through adult and non-formal education so as increase effective and efficient use of resources.

Keywords: Oil palm, smallholders, efficiency, resources, marginal analysis

INTRODUCTION : Oil palm (*Elaeis guineenis*) is a monocotyledonous plant belonging to the palm family Palmae and sub family, Cocoideae. It is a Monoecious species known to produce unisexual male and female inflorescences in an alternating cycle (Adegeye and Adegeye, 2005). The tree crop is no doubt believed to have originated in the tropical rain-forest region of West Africa, (Bello, Bellow, Essien & Saidu, 2015). The adult plant possesses an impressive crown of 30 to 45 green leaves branches, each 5-9m long at the top of a trunk bearing old leaf bases arranged spirally. The stem may be 30 to 38cm in diameter, with progressive thickening towards the base. On older palms, the stem is punctuated with conspicuous and regularly arranged leaf scars and the stem terminates in a handsome growth of leaves (fronds). The palm leaf is compound and is known as the frond. The leaf is paripinnate with a prominent petiole (0.9 to 1.5m long). The petiole often broadens at the base to form a clasper round the stem. Each palm frond bears, 20 to over 150 pairs of leaflets arranged in more or less two rows along each side of the flattened rachis with the longest pinnate varying up to 120 cm (Ajalia, 2011).

According to Ukwete (2011) oil palm tree starts to bear fruit after 3 - 4 year and has a life span of over 60 years, while the economic life is about 20- 25 years. The nursery period is 11-15 months before planting and first harvest is done 32-38 months after planting depending on the specie. The fruit is plump size and reddish in colour and is comprised of exocarp, mesocarp, endosperm (shell) and (kernel).The mesocarp and endosperm contains 45- 55 edible oil (Food and Agricultural Organization (FAO) 2012). Oil palm takes 5- 10 years to reach it peak yield, the yield is about 45 - 56 percent of fresh fruit bunches and the fleshly mesocarp of the fruit is use to obtain oil. Also, the yield of oil from kernel is about 40-50% (Edem, 2010). Oil palm is affected by pests and diseases attack. The pests and diseases attack both seedlings in the nursery and mature plants on the field. Some notable pests of oil palm are snails, crickets and mammals especially rodents (rats and mice). Others include leaf-miners, weevils, caterpillars, birds and squirrels. The oil palm diseases include *Anthracnose, Freckle, Blast, Ganoderma trunk rot, Vascular wilt disease, Basal rot* and *crown* diseases. These pests and diseases pose serious problems to the production of oil palm and attack the plants at various stages of growth and development (FAO, 2012).

Research has proven that Nigeria is the third largest producer of oil palm with approximately 2.3 million hectares (5.7x10 acres) under cultivation. This is because oil palm is an important source of calories and a staple food in poor communities of the world (Emokaro and Ugebekile, 2014). Oil palm seems to be part of the tradition of agriculture of Cross River State. The climatic condition and soil type of Cross River State appear favourable for the growth of the oil palm. They include availability of water supply, soil conditions in terms of fertility and topography that is suitable for the growth of oil palm. Production and development is in the hands of the small-holders farmers that depend on rainfed cultivation and a large proportion of the palm produced are on wild groves. Apart from the wild groves, three economically important varieties are grown in the study area; these are the Dura, the pisifera and the tenera. The Tenera is a cross between Dura and Pisifera (Nigerian institute for oil palm Research, (NIFOR) 2015). Oil palm requires the application of fertilizer particularly nitrogenous fertilizers such as sulphate of ammonia, muriate, of potash, etc. for growth of the young seedlings. Ettah, Igiri, Agbachom, Effiong, Iyam, Asuquo and Faithpraise (2024) (2024) classified farmers having 7.50 hectares as small - scale farmers. Olayide (2010) rather classified small scale farms as those that range from under 0.10 ha holding to 5.99 ha holdings. While Saliu *et al* (2016) posited that small - scale holders as those having 50- 100 stands of oil palm.

The multifarious use of oil palm makes it very prominent; every part of the oil palm tree is of economic value. It is a versatile tree crop with almost all parts of the tree being useful and of economic value. The principal product of oil palm is the palm fruit, which is processed to obtain three commercial products. These include palm oil, palm kernel oil and palm kernel cake. The uses of palm oil are many and varied (Ekenta and Ajala, 2018, Kuye and Ettah 2016 and Edem, 2010). Locally, it is used for cooking, soap making, metal plating and lamp oil. The palm kernel oil however, is used for soap making, as a source of glycerine for manufacturing margarine, cooking fats and for making lubricants. The residue obtained after extraction of oil is called kernel cake, which is useful in livestock feed production (Ibrahim, 2007, Saliu, *et al* 2006 and Ukwete, 2011). The midribs and rachis of oil palm are used for making brooms and roofing materials. The thicker leaf stalk is used for making the walls of village huts. The bark of the frond is peeled and woven into baskets while the trunk (main stem) can be split and used as supporting frames in buildings. A sap tapped from the male flower is drunk as palm wine, which is a source of yeast. The spent fruit bunch and fibre that remains after oil extraction can be used for mulching, as manure and as fuel. The trunk yields timber, the leaves are used for thatching the stem yields, copious supply of palm wine and the fruit yields oil. The palm tree and it products are profitable source of income and it production constitutes the primary export of some West African countries such as Nigeria and Ghana and is widely used as cooking oil (Ibitoye, Akinsorotan, Meludu and Ibitoye, 2011).

Ettah and Nweze (2016) noted that efficiency in agricultural production indicates the ability of a farmer to produce maximum output from a given bundle of resources at the lowest cost possible that is a producer's ability to obtain the highest possible output from a given quantity of inputs. Efficiency increases the ability of farmers to measure methods of increasing their production by employing fewer necessary resources (Agbachom *et. al.*, 2023 and Ettah *et. al.*, 2024). Efficiency analysis is also useful for measuring the production efficiency of different methods of oil palm production and acts as a yard stick for evaluating decisions on choices regarding the use of scarce resources. The level of managerial and technical skills, level of capital utilization, commitment of labour force and the technology in use are some of the factors influencing resource use efficiency (Ettah and Ani, 2018).

The problem necessitating this study is the lack of large acreage of land available for oil palm cultivation, owing to increasing population and urbanization. Also inadequate information on cultivation practices is a problem to most if not all farmers in the study area (Ibitoye, *et. al.*, 2011). Prominent of this information they lack is the cultivation time and post planting operations like pruning, weed control, pest control and fertilizer application. Lack of improved materials like machineries, fertilizers, pesticides, and herbicides, etc. is hampering oil palm production in the area, farmers still make use of old and traditional means of oil palm production, which is not productive and profit oriented.

The study is anchored on the theory of production which presupposes the explanation of the transformation process of physical inputs (e.g labour and capital) into outputs. The production technology represents the ability of the producer to transform inputs into outputs (Ettah and Ukwuaba, 2017), which is expressed into a production function as follows:

$$Y = f(x_1, x_2/x_3 \ldots\ldots\ldots\ldots xn) \qquad (i)$$

Where y = output

X_1, X_2 = variable inputs

X_3 ……………………xn = fixed inputs

The function means that output (y) is a function of variable inputs x_1 and x_2 given fixed factors (inputs) x_3 –xn. Production function can be written mathematically as:

$$Y= f(x) \qquad (ii)$$

Where Y = output

X_1 and X_2 = variable inputs

X_3 …………….X_n = fixed inputs

Furthermore, the study is based on the theory of resource use efficiency, which is best explained by the theories of cost minimization and that of output maximization (Ettah, Agbachom, Ikutal and Ubi, 2020). Farmers are assumed to either minimize cost of production, maximize farm output or both. Therefore any factor that affect cost or/and the level of the production would likely influence farmers' behavior in terms of resource use.

The study seeks to address the following specific objectives:

i. determine resources use efficiency by the small scale oil palm farmers.

ii. identify constraints militating against small scale oil palm farmers.

MATERIALS AND METHODS: Study Area: The study was conducted in Biase Local Government Area of cross River State, Nigeria. Biase local government area has an approximate land area of about one thousand three hundred and ten kilometers square (1,310 km,²) and a population of about one hundred and sixty nine thousand one hundred and eighty three inhabitants (169,183) as at 2006 census (NPC 2006). There are eleven wards in the Local Government Area namely: Umon South, Abayong, Akpet/Abini, Biakpan, Erei North, Adim,, Erei South, Ikun/Etono, Agwagwune/Okurike and Umon North. Biase Local Government is bounded in the south by Odukpani Local Government Area, West by Abia and Ebonyi States and North by Yakkur and Abi Local Government Areas respectively. Biase is located within the rain forest zone of Cross River State with annual rainfall between 2500mm-3050mm per annum. The dry season is from November to February and rainy season is from March to October with annual mean temperature of 26°c.The area is blessed with abundant fertile land which is suitable for the cultivation of wide range of arable crop such as maize, pumpkin, water leave, among others (Ajalia, 2011).The notable field crop cultivated in the area includes oil palm, kola, cocoa, rubber, coffee, among others.

Sampling Procedure and Sample size: A three-stage sampling technique was adopted for the study as follows: Stage 1. Four wards were purposively selected from the 11 wards of the study, based on the intensive cultivation of oil palm in those wards, these words are Umon south, Abayong, Akpet/Abini and Biankpan, Stage 2. In this stage, two farming communities were randomly selected from the four wards earlier selected, bringing the farming communities in the sample to eight, these were; Umon South: (Ikot Ogbondem, Umarurang.) Abayong**:** (Abrijang, Ijom), Akpet/Abini: (Ukwopeyere, Edodono) and Biankpan**.:** (Omobe, Ikun)

Stage 3. Sixty oil palm farmers were selected in this stage through 10% proportionality ratio. A list of oil palm farmers was obtained from Cross River State Agricultural Development Programme (CADEP), Biase Local Government Area Office which contained the names of all oil palm farmers in those farming communities, ten percent of the population of each community was selected to give a sample of sixty oil palm farmers used for the study

Summary of the Sampling Procedure Adopted

Table 1 Biase Local Government Area (Agriculture Development Programme)

Village and communities	Total number of oil palm farmers	Sample size (10%)
Umon south	130	13
Abayong	180	18
Akpet/Abini	200	20
Biakpan	90	9
Total	**600**	**60**

Data were obtained through validated and structured questionnaires which were designed based on the study objectives.

Analytical Method and Tool: Data collected were analyzed using marginal and regression analyses

Model Specification: Marginal analysis: The efficiency of resource use in oil palm production was obtained from the estimated equations by comparing the marginal value product (MVP) of a particular input with the marginal factor cost (MFC) of that input.

The model used for estimation of efficiency ratio R, was as follows:

R = MVP/MFC (iii)

Where: R = Efficiency ratio, MVP=Marginal value product of variable inputs

MFC= marginal factor cost (price of inputs).

Base on the economic theory, a firm minimizes profits with regards to resource use when the ratio of the marginal return to the opportunity cost is one. The value are interpreted thus, R < 1 indicates excessive use, R>1 indicates underutilization and if R=1, the resources is optimally used and hence is the point of profit maximization.

Regression Analysis

Linear Model

The linear model specifies that the relationship among the variables is linear. The model is specified as:

$Yi= a_0+ a_1 X_1 + a_2 X_2 + a_3 X_3 + a_4 X_4 + a_5 X_5 + a_6 X_6 + a_7 X_7 + u_0.$ (iv)

Where:

Y_i= Total output of oil palm (Kg)

X_1= fresh fruit bunch (kg)

X_2= variety (improved = 1; local = 0)

X_3= technology adopted (dummy 1= used, 0= not used)

X_4 = processing (modern = 1; traditional = 0)

X_5 = farm size (ha)

X_6 = household size (no.)

X_7= education (no.)

X_8 = Variety of oil palm (improved = 1; local = 0)

X_8=Age of oil palm (Year)

a_0=Intercept (constant) term

a_1–a_7=Regression coefficients to be estimated

u_0=Random disturbance (error) term.

RESULTS AND DISCUSSION

Resource use efficiency of oil palm production in the area

Table 2. Resource use efficiency of the Respondents

Resources	MVP	MFC	MVP/MFC	Elasticity of Production	Efficiency Gap	Divergence
Hired labour	3, 900.8	3, 400	1.14	1.367	500.8	12.83
Family labour	3, 100.9	3, 000	1.03	0.036	100.9	3.25
Farm size	4, 800.5	3, 800	1.26	0.451	400.5	9.53*
Chemical	6,300.4	6,200	1.01	-0.296	100.4	1.59**
Stands	5,200.8	5,000	1.04	-3.910	200.8	3.86***
Fertilizer	7,800.2	7,400	1.05	0.310	400.2	5.13
Return to scale (Total)				6.37		

*, **, *** 10%, 5% 1% probability respectively

Source; estimated using field survey data, 2023

Table 2 shows a positive coefficients for cost of hired labour, this suggest that the higher the cost of hired labour, the higher the output of oil palm that will be obtained. The coefficient of the farm size was also positive and significant at 10%, this suggest that as size of the oil palm farm increases, the output also increases. This is expected because farmers who cultivate large hectares of land obtain higher output on their farm than those with small farm size. The coefficient of the chemical was negative and significant at 5%. This Suggests that inefficient use of chemical will lower the yield of oil palm production. The coefficient of stands was positive and significant at 1% level respectively, indicating that the higher the number of stands the higher the output of oil palm production. The total sum of the elasticities of production of the resources was 6.37. This implies that a 1 percent increase in the quantity of the variable inputs result in 6.37 percent increase in oil palm output. This indicates an increasing return to scale which is characteristics of stage 1 of the production function. The result agrees with the findings of Ajalia (2011) in their work on the ethnographic Study of Oil Palm Produce in Akamkpa Local Government Area of Cross River State, Nigeria. This further suggests some of the resources used are underutilized and so farmers can have more returns by increasing the quantities of these resources.

The table further showed that the ratio of MVP to the MFC were greater than unity (1) for all the inputs implying that inputs such as labour, farm size, chemicals, seeds and fertilizers were under-utilized. This means that oil palm output is likely to increase and hence revenue if more of such input are fully been utilized. The adjustments in MVPs for optimal resources use (% divergence) indicates that for optimum allocation of resources more than 12.83% increase in hired labour is required and approximately 5.13% reduction in fertilizer for optimal use in palm oil production. It should be noted that the MVPs of hired labour, family labour, farm size, seed and fertilizers were not negative indicating that palm farmers used these resources optimally. This result comforms with that of Emokaro and Ugebekile (2014) in their work: economic analysis of oil palm processing in Ovia north east and Ikpoba-Okha local government areas of Edo state, Nigeria.

The double log function form was chosen as the lead equation because it has a very low standard error of 0.2618, a considerable adjusted R^2 which is 0.910. R^2 the dependent variable (Quantity of palm oil in liters) was explained by the independent variable (Quantity of fresh fruit bunch, variety of fresh fruit bunch, technology used, processing period, farm size, household size and level of education). Aside from the above reasons, it has the highest number of significant coefficients with the correct signs, the F-test is 173.88 and significant at 1%. The F-test shows that the model fits the problem because it is significant. The quantity of fresh fruit bunch (FFB) has a positive coefficient and hence a positive relationship with palm oil output produce and it is significant at 1%. The implication is that, the bunches or fresh fruit of oil palm contributes to the quantity of palm oil produce in the area. The quantity of fresh fruit bunches is an important factor in oil palm production. A unit increase of this variable will bring about increase in the output of palm oil produced as well. Also variety of palm fruit has positive coefficient and a positive relationship with the dependent variable. The type of oil palm fruit used in the production is an important variable that determine the quantity and quantity of palm oil produced in the study area, the coefficient of improved technology is positive and significant at 5% level. High tecnology means that oil extraction is more efficient unlike the manual production. Processing period is significant at 5% and has negative coefficient and hence negative relationship with quantity of palm oil produced in the study area. The result of the regression also shows a negative relationship of household size with the dependent variable and not significant at any level.

Level of education of the farmers is significant at 5% level, which also has a positive coefficient and hence a positive relationship with the quantity of oil palm produced. This may be due to the fact that educated farmers possess the ability to embrace innovation that will boost their production. Education also contributes to effective oil palm processing. The findings of this study agree with that of Ibrahim, (2007) in his study on the economics of oil palm production in Ogun state, Nigeria. It is also confirmed by Bello, *et al., (2015)* in their study on the assessment of the economics, potentials of oil palm production in Enugu state Nigeria.

CONCLUSION: Oil palm production has been an age old trade in Cross River State and has been a source of employment to many despite been a rural based enterprise. However, much improvement has not been recorded in terms of production technology and output. There is generally inelastic respond of output to input application and the consequent profit therefrom is low. The regression analysis showed that fresh fruit bunches, type of variety, processing method, technology, education and household size are the significant factors that influence oil palm production in the study area. Efficiency of resource use indicates that labour, farm size, chemicals, seeds and fertilizers were under-utilized. The following are recommended: necessary incentives should be provided to oil palm farmers by government to make them optimally utilize underutilized resources and the level of education of the farmers should also be boosted through adult and non-formal education so as increase effective and efficient use of resources.

Constraints to Oil Palm Production

Table 3: constraints to oil palm

Functional form	Constant	Ffb	Type of variety	Technology	Processing	Farm size	HHSIZ	Education	S.E	R^2	ADJ. R^2	F-value
Linear form	16.370 (4.567)	0.285 (1.484)***	9.577 (0.7830)*	11.379 (1.805)*	-0.734 (-2.805)*	-.259 (-0.619)	-0.466 (1.549)**	0.466 (0.994)**	4.1080	0.844	0.834	86.450***
Semi log	47.158 (17.903)	2.926 (3.993)***	5.5523 (0.709)*	8.783 (1.933)*	-1.127 (1.689)*	-.268 (0363)	-..719 (1.456)	0.208 (0.633)*	1.5608	0.9065	0.900	153.536***
Double log	3.869 (87.550)	0.480 (3.885)***	0.960 (1.187)*	0.165 (1.689)*	-0.190 (1.702)**	-.006 (-.445)	-0.12 (1.390)	0.004 (0.668)**	0.2618	0.916	0.910	173.838***

Source; field survey, 2023

t values are in parenthesis, *** significant at 1%, ** significant at 5%, * significant at 10%

Adj R^2 = 0.910

f-value=173.88 173.838

REFERENCES

Adegeye, A.J. and A.O. Adegeye (2000). Technical and Economic Information in Agriculture (The Oil Palm Elaeis guineensis) in *Nigerian Agricultural Development Studies* 1(2): 140-155.

Agbachom, Emmanuel E., B. Onabe Maria , Abayan Victor , Anoh Regina, Ajigo Ikutal2 , Otu I. Ettah, Godwin M. Ubi (2023). Influence of Poverty Gap and Severity Index on Production among Cassava based Farmers in Southern Nigeria. *Bhartiya Krishi Anusandhan Patrika* BKAP-595, Agricultural Research Communication Centre (ARCC); 37 (5) 1-6.

Ajalia, J.E (2011). Ethnographic Study of Oil Palm Produce in Akamkpa Local Government Area of Cross River State, Nigeria. International *Journal of Research in Arts and Social Sciences* 3(42)

Bello, R, S, Bellow, M. B, Essien, B. A & Saidu, M. S. (2015). Economic potential of oil palm production and machinery use in UDI, Enugu State, Nigeria. Science Journal of Business Management, 3(5): 16-20.

Central Bank of Nigeria (2007). Statistical bulletin. CBN: Abuja.

Ettah, O. I. and Nweze, N. J. (2016). Analysis and determinants of technical efficiency among cassava farmers in Cross River State, Nigeria. *International journal of innovative research & development*. September, 2016. 1 (2).

Ettah, O. I and Ukwuaba, I. C. (2017). Agricultural technology: type, effect and constraints on food production: a case of Nigeria Agriculture. *International journal of science and technology*; 5 (5). 23-29.

Ettah Otu I. and Ani Stella O.(2018). Allocative and Technical Efficiencies Among Small Holder Cocoyam Farmers in Cross River State Central Agricultural Zone, Nigeria. *Journal of Agriculture and Crops*: 4 (6), 68-72,

Ettah, O. I.**,** Emmanuel, E. A., Ikutal, A., & Ubi, G. M. (2020) Analysis of Marketing Margins and Efficiency of Cassava-based Product in Cross River Central Agricultural Zone, Nigeria. *Annual Research & Review in Biology*, *34*(5), 1-7.

Ettah O.1, Igiri J.A., Agbachom E., Effiong J. B., Iyam, M. A., Asuquo I. A. and F. O. Faithpraise (2024). Stochastic frontier technical efficiency analysis of watermelon (citrullus lenatus) production in Nigeria; *The African Journal of Food, Agriculture, Nutrition and Development (AJFAND)* 24(1): 25126-25144

Edem, (2010). Palm oil biochemical, physiological nutritional, hematological and toxicological Aspect. Plants Foods for Human Nutrition. 319-341.

Emokaro, C.O & Ugebekile, P. C (2014). Economic analysis of oil palm processing in Ovia north east and Ikpoba-Okha local government areas of Edo state, Nigeria. *Nigerian Journal of Agricultural, Food and Environment.* 10(2): 70-78.

FAO (2012). Agricultural Development in Nigeria: Small Scales Oil Palm Production in Africa FAO *agriculture service bulletin 148 ISSN 1010-1365 Rome, Italy.*

Ibrahim B.O (2007) *Economics Analysis of Palm Oil Production in Ogun State, Nigeria. The open Journal System*

Ibitoye, O. O, Akinsorotan, A.O, Meludu, N.T. & Ibitoye, B.O. (2011). Factors affecting Oil Palm Production in Ondo State of Nigeria. *Journal of Agriculture and social Research (JASR),* 11(1): 97-105.

Kuye, O.O. and Ettah, O. I. (2016). Contribution of urban mixed cropping in household food security in Nigeria and around the globe. *International Journal of Environment,* *Agriculture and Biotechnology*. July – August 2016 1 (2).

Nigerian Institute for Oil Palm Research (NIFOR) (2012) A Manual on Oil Palm Production Nifor City 45p.

Saliu, O.J: S. O, Ukwuteno and D. O Ekpa (2006). Constraints in the Adoption of Improved Oil Palm Technology Among Small-Scale Farmers in Dekina Local Government Area of Kogi State in *Journal of Scientific and Industrial Studies*. 4(3):29-32.

Ukwete, S.O (2011) Economics of Small Scales Oil Palm *Production in Kogi State, Nigeria. Unpublished Ph.D Thesis. University of Nigeria, Nsuka*.