Original Research Article

Determinants of Agricultural Productivity Among Smallholder Oil Palm and Food Crop Farmers in Edo State, Nigeria

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Abstract

The need to increase productivity especially in the face of constraints faced by farmers that practice sole cropping of oil palm led to the farming system that advocates different enterprises on a particular piece of land. This study was designed to provide information on the variables that play significant roles in determining the level of productivity among smallholder oil palm farmers in Edo State, Nigeria. A multistage sampling technique was used to select 90 respondents. Multiple regression analysis was used to analyze the data and the result showed that the double log function was the lead equation having a coefficient of multiple determination of 88.5%, with the mean and standard deviation of 0.7046 and ± 0.03634 respectively. The result showed that maize output, maize output price and cassava output price as the variables that significantly determined the productivity among smallholder oil palm farmers involved in intercropping of their plantations with food crops. Smallholder oil palm farmers should be encouraged to intercrop their plantations in order to increase food production and enhance income generation before canopy closure. Also, policies that will ensure stable prices of these commodities should be put in place by the policy makers.

Key words: Determinant, Productivity, Intercrop, Small holder, oil palm, food crops.

Introduction

The total value of the world annual output of the oil palm industry at current prices is in the region of US$40-45 billion which underscores the economic importance of the crop. Malaysia alone in 2010 earned about US$16 billion from all its exports of various palm products (MPOB, 2011)

The oil palm, in the foreseeable future, is likely to continue its dominance in the output and export of vegetable oils because of its comparative advantages over other sources of vegetable oil for reasons which include the fact that at the present time, it is the highest yielder of vegetable oil per hectare when compared to all other vegetable oil-bearing crops, and the fact that the present

realizable yields are still very far from the theoretical maximum yield potentials (USDA, 2007) Currently, Indonesia which is now the World's leading producer of palm oil has an estimated 7.5 million hectares under the crop, and Malaysia has a planted area of 4.96 million hectares while, Nigeria, outside the natural groves, has a total area under improved plantings of about 430,440 hectares (Omoti, 2009).

From the area of about 2,100,000 under natural groves and 430,440 hectares of plantations, Nigeria produces an estimated 750,000-850,000 tonnes of palm oil, and about 150-200,000 tonnes of palm kernel oil annually. These figures would give an estimated total production of 900,000-1,050,000 tonnes of palm oil and palm kernel oil annually. Of the total palm oil and palm kernel output, production from the natural groves and small holder plantations accounted for about 81% and 89% respectively while production from the large estates accounted for about 19% and 11% respectively. Therefore in Nigeria, palm oil production is still very much dominated by the small holder producers (Omoti, 2009). However, in 2017, the country's domestic production stood at 1.03million metric tonnes (USDA, 2018).

The oil palm, a very versatile crop and nature's gift to the tropics, has from the colonial times played a significant role in the socio-economic development of Nigeria. Together with other agricultural commodities like cocoa, rubber, timber, groundnut and cotton, these commodities were the major sources of revenue for Nigeria's economic development from colonial times up to the immediate post-independence era. (Nwawe and Oviasogie, 2017).

In the former Eastern Nigeria (present south-east and parts of south-south geopolitical zones), it was estimated from the 1962/63 census that at the least, about 3,670,800 representing 70% of the 5,244,000 agricultural workers out of an adult working population of 6,596,000 in Eastern Nigeria in 1963 were involved in the production of palm products for export (Usoro, 1974)

Apart from employment generation, the export duty and oil palm products sales tax revenues formed the bulk of the internally generated revenue which constituted the major source of revenue for the economic development of Eastern Nigeria.

Although the country is now a net importer of palm oil, the total gross value of the production by the industry at current domestic prices is in the region of N120-N150 billion annually which is very significant in terms of the Agricultural Gross Domestic Product of the country (Nwawe and Oviasogie, 2017).

The oil palm has enormous potentials. Today, its cultivation has transformed in a spectacular way, the economies of countries such as Malaysia, Indonesia, Columbia, Thailand, Papua New Guinea, Cote d'Ivoire and many others. If properly harnessed, the oil palm can once again contribute significantly to Nigeria's economic development and provide the much-needed jobs for Nigeria's teaming population.

From being the leading producer and exporter of palm products from the inception of international trade in the commodity up to 1966, Nigeria is currently placed in a shaky fifth position in the

league of major world producers and worse still, Nigeria became a net importer of vegetable oil from the late seventies and has remained so ever since. The decline and stagnation of the industry over the last forty five years has been attributed to a number of reasons chief among which are the discovery of petroleum and low productivity (Nwawe and Oviasogie, 2017).

Productivity is a ratio of a volume measure of output to a volume measure of input used (OECD, 2001). The measure of output and input is usually in a standard unit such as money value. In the case of agricultural productivity, it is the quantity (value) of agricultural output per unit quantity (value) of input(s) used in production (OECD, 2001). Measures of agricultural productivity can be classified broadly, either as single factor productivity (SFP) or total factor (multifactor) productivity (Wiebe *et al*., 2001; OECD, 2001). According to Wiebe *et al.* (2001), SFP relates a measure of output to a single measure of input while TFP relates a measure of output to a bundle of inputs. Within these two broad categories (SFP and TFP), there are many different measures; for example, at farm level, SFP measures may include yield, labour productivity and capital productivity while TFP measures may include an index of a ratio of the value of output(s) to the value of a combination of two or more factors such as land and labour or labour and capital, or the value of all factors of production utilized in the production process (Wiebe *et al.,* 2001).

Agriculture remains crucial to the Nigerian economy, being a major source of raw materials, food and foreign exchange, employing over 70% of the Nigerian labour force, contributing 21.6% to Nigeria's Gross Domestic Product and serving as a vehicle for diversifying the economy of Nigeria (NEPAD, 2003). Oil Palm is the major oil producing crop that was one of the major sources of foreign exchange earnings for Nigeria. Between 1961 and 1965 world oil palm production was 1.5 million tons, with Nigeria accounting for 43%. However, since then, oil palm production in Nigeria has virtually been stagnated. But today, world palm oil production amounts to 66.855 million tons, with Nigeria accounting for only 1% (USDA, 2018).

Malaysia's success is built on plantation management together with processing in large modern mills. The plantation mode of production is characterized by large-scale monoculture under unified management. In Nigeria by contrast, 80% of production comes from dispersed smallholders who harvest semi-wild plants and use manual processing techniques. Several million smallholders are spread over an estimated area of 1.65 million hectares in the southern part of Nigeria.

Increasing agricultural productivity under normal circumstances is a problem today, with global issues such as soaring food and fuel prices, climate change, increased poverty and growing populations with an increasing trend towards urbanization. In the past, increasing agricultural production with little or no consideration for long-term environmental sustainability led to negative consequences such as degraded land and a reduction of ecosystem, goods and services. Increasing agricultural productivity can happen through improved use and management of agricultural biodiversity resources (such as seeds, pollination, beneficial fauna, etc), to achieve higher yields while promoting the sustainability of the farming systems and progressing from subsistence farming to market-oriented agriculture.

Statement of the Problem

The oil palm industry in Nigeria is faced with myriads of challenges which can be surmounted in the short, medium and long terms with deliberate effort. The most serious challenge of the industry is how to bridge the gap between supply and demand which stands at over 500,000 tonnes of palm oil per annum (Nwawe and Oviasogie, 2017).

Objective of the Study

The objective of this study was to determine and analyze the factors that affect the productivity of oil palm farmers in the study area

Justification of the Study

There are important predictors of productivity regardless of the measures in use. Consequently, as with efficiency, productivity is increased by access to credit, educational attainment, contact with extension agents, farming experience, membership of cooperative societies, and so on. It becomes expedient therefore, to isolate these factors with a view to ensuring a redirection in agricultural policy towards improving productivity.

Methodology

Area and Scope of the Study

The study was conducted in Edo State, an inland State in southern Nigeria with its capital in Benin City. The State is known for oil palm production because of the weather condition that favours the growth of the crop, and its large, scattered production by smallholder farmers. Edo State has a land mass of 17,802km^2 (6,873 square miles) and a population of 3,497,502 (NPC, 2006). It is made up of eighteen (18) Local Government Areas (LGAs). It lies roughly between longitude 06.04E and 06.43E and latitude 05.44N and 07.34N.

The State has boundaries with Delta State to the South, Ondo State to the West, Kogi State to the North and Anambra State on the East. Benin City has a land mass of 249km^2 and a population of 374,671 (NPC, 2006).On the basis of Edo State Agricultural Development Programme (EADP, 2003) delineation. Edo State is divided into three agro-ecological zones namely, Edo South, Edo Central and Edo North. Edo central is divided into five blocks as follows: Esan Central, Esan West, Esan North-East, Esan South-East and Igueben Local Government Areas (LGAs). Edo North Comprises 6 blocks, namely: Owan West, Akoko-Edo, Etsako West, Etsako East, Owan East and Etsako Central LGAs. Edo South consists of seven (7) blocks namely, Oredo, Ovia South West, Ovia North East, Ikpoba-Okha, Egor, Uhunmwode and Orhionwon LGAs.

Sampling Technique

A multistage sampling technique was used. The first stage involved a purposive sampling of two zones because of the high population of small scale oil palm farmers in the areas. Stage two was

also a purposive selection of two (2) LGAs each from the selected zones, making a total of six (6) LGAs. Fifteen (15) respondents each from the six (6) LGAs were randomly selected out of the list of registered small-scale oil palm farmers to make the total number of ninety (90) respondents for the analysis.

Data Sources

Primary data used for this study were collected from the respondents through the use of a structured questionnaire. Secondary data used were from relevant sources to support the discussion

Analytical Procedure

Aggregate agricultural productivity for this study was measured by the index of the ratio of the total value of farm output (measured in naira values), to the value of total inputs (expressed in naira) used in farm production. In its implicit form, the function estimated in this study is specified as:

$Q_H = f(X_1, X_2, \ldots, X_{12}, e)$…….. eqn. (1)

$Q = \sum Yp / \sum Xr$ = Aggregate Agricultural productivity …… eqn. (2)

$\sum Yp$ = total value of output

$\sum Xr$ = total value of input

Where,

Y = Agricultural productivity (ratio of total value of farm output to total value of farm input),

X_1 = farm size (ha)

X_2 = Expenditure on planting materials (₦)

X_3 = intercropping (No.)

X_4 = Age (yrs)

X_5 = level of education (yrs)

X_6 = House hold size (No.)

X_7 = farming experience (yrs)

X_8 = capital inputs (depreciation) (₦)

X_9 = Distance to the nearest market (km)

X_{10} = maize output price (₦)

X_{11}= maize output (₦)

X_{12} = cassava output price (₦)

e = error term

Results and Discussion

Table 1 shows the regression result of the three functional forms, the linear, semi-log and the double log, the double log which formed the lead equations. The R^2 value of 0.885 shows that 88.5% of the variations in productivity was accounted for by the variations in the three forms put together. The adjusted R^2 also supported the claim with a value of 0.871 or 87.1%. This implies that the independent variables explained the behavior of the dependent variable at 87% level of confidence. The calculated F-statistic of 60.884 which is greater than any value in the F- table implies that there was a significant impact between the dependent variable and the independent variables. The Durbin-Watson (DW) statistics as shown in the regression result was 2.092. This implies the absence of multicollinearity. The mean of the dependent variable as shown by the regression result was 0.7046 while the standard deviation (SD) 0.03634 which was less than one (<1). This further justifies the acceptance of the regression result.

Table 1: Functional forms of the determinants of Oil Palm productivity among smallholder farmers

Variables	Linear	Semi-log	Double log
Constant	5.114(0.120)	0.710(0.011)	1.222(0.257)
Age	-0.001(0.002)	0.00(0.000)	-0.017(0.017)
Level of Education	0.001(0.005)	5.625E-005(0.000)	-0.001(0.006)
Household Size	-0.001(0.005)	0.00(0.000)	0.003(0.008)
Farming Experience	0.001(0.002)	3.554E-005(0.000)	0.005(0.004)
Farm Size	-2.753(1.429)	-0.343(0.130)	0.00(0.000)
Distance to Market	0.002(0.003)	0.000(0.000)	0.001(0.004)
Maize output	0.899(0.278)	0.098(0.025)	0.378(0.066)
Maize output price	-3.957E-006(0.000)	-5.993E-007(0.000)	0.167(0.028)
Cassava output price	1.779E-005(0.000)	1.875E-006(0.000)	0.739(0.038)
Depreciation	-6.655E-005(0.000)	-8.987E-006(0.000)	0.026(0.085)
Plant material	0.000(0.000)	2.572E-006(0.000)	1.305(0.128)
R^2	0.769	0.808	0.885
Adj R^2	0.737	0.781	0.871
Durbin-watson	2.015	2.048	2.092
Mean	5.08	0.7046	0.7046
Std D	0.36463	0.03634	0.03634
F-value	23.646	29.784	60.884

Source: Field Survey, 2013.

The model is $Y= 1.22 - 0.017(0.017)X_1 - 0.001(0.006)X_2 + 0.003(0.008)X_3 + 0.005(0.004)X_4 + 0X_5 + 0.001(0.004)X_6 + 0.378(0.066)^{***}X_7 + 0.167(0.028)^{***}X_8 + 0.739(0.038)X_9 + 0.026(0.085)^{***}X_{10} + 0.378(0.066)X_{11} + 1.305(0.128)X_{12}$

Figures in parenthesis are the t-values. *** significant levels at 1%

The above model tested the effect of three variables namely maize output, maize output prize and cassava output prize on productivity of smallholder oil palm farmers. The regression result indicated positive and significant effect of maize output on productivity with a coefficient of 0.885. Hence from the values of the t-statistic, the coefficients of the three explanatory variables were all significant and the probability of rejecting any of them was less than 1%. The standard errors for the three explanatory variables were also low. Hence, all the coefficients of the explanatory variables were all significant.

The positive effect on farming experience implies that years of experience played a major role in determining productivity of crops when intercropped, and this is in accordance with the findings of Ehirim (2006) who observed that changes are expected over time due to increasing farming experience acquired by farmers.

The result on household size supports the argument made by Udry (1996) that a larger household size relaxes the labour constraint, which is one of the key resources in production and hence facilitates yield. Since household size and quantity of family labour used are positively related (Udry, 1996) it is most likely that farmers with larger families relied more on family labour, hence minimizing the production costs and increasing gross profit. The positive result of maize output indicates that a unit increase in maize yield led to an increase in the proportion of maize output sold.

The positive effects of maize output prize and cassava output prize indicate that an increase in output prize was an important indicator in the decision of cassava and maize producers on the proportion of output to sell, further indicating that a unit increase in price of maize and cassava output would lead to an increase in maize and cassava sold, supported by Komarek (2010). MAAIF (2000) opined that an increase in the price of agricultural crops acts as an incentive to increase commercialization of small holder production while low prices acts as a deterrent to market oriented farming.

Conclusion and Recommendations

The study showed that maize output, maize output price and cassava output prices significantly affected the productivity of oil palm at 1% level respectively in the study area. This shows that farmers should make effort to increase food crop intercropping with oil palm to increase their revenue base in other to cover for lean period when the oil palm starts fruiting so as to maximize their profit and encourage commercialization. Also, government should assist farmers with incentives to boost production, and with policies that will ensure stable prices of these commodities.

References

EADP (2013). *ADP Annual Repor, 2013.* Edo State Agricultural Development Programme (EADP), Benin City.

Ehirim, N.C, Odurukwe, S.N, Ajaero, J. and Emenyonu, C.A (2006). Socio-economic analysis of farming risk in cassava production in Owerri, Nigeria.Federal University of Technology Owerri. *International Journal of Natural and Applied Sciences* 2(2): 89-95.

Komarek, A. (2010). The determinants of banana market commercialization in Western Uganda. *African Journal of Agricultural Research* 5(9): 775-784.

MAAIF and MFPED (2000). Plan for Modernization of Agriculture: Eradicating Poverty in Uganda. Government Strategy and Operational Framework. Kampala, Uganda.

NPC (2006): *Census Report.* National Population Commission, Abuja, Nigeria.

NEPAD (2003). Comprehensive Africa Agriculture Development Programme (CAADP). Available at: http://www.nepad.org/system/files/caadp.pdf [accessed 17 July 2009].

Nwawe, C.N. and Oviasogie, P.O. (2017). Oilpalm industry, past performance and current challenges: Invited Paper presented at the Seminar on *Sustainable Financing of Smallholder Farmers in the Oil palm Value Chain under the Anchor Borrowers Programme*. November 10th 2017.

OECD, 2001.Measuring Productivity: Measurement of Aggregate and Industry-Level. *OECD Manual*. Available at: www.SourceOECD.org, [accessed 20 June 2009].

MPOB (2011): Overview of the Malaysian Oil Palm Industry. Available at http://www.palmoilworld.org. [Accessed on the 26th of October, 2018].

Omoti, U. (2009). Oil Palm Sector Analysis in Nigeria. *Volume 2: States' Report.* United Nations Industrial Development Organization (UNIDO).

Udry, C. (1996). Gender, Agricultural Production, and the Theory of the Household, *Journal of Political Economy* 104(5): 1010-1046.

USDA (2007). Foreign Agricultural Service Commodity: Intelligence Report. United States Department of Agriculture, Washington D.C.

USDA (2018). Palm oil Production. Available at http://www.indexmundi.com. [Accessed on the 26th of October, 2018]

Usoro, E.J. (1974). *The Nigerian Oil Palm Industry*, Ibadan University Press, Ibadan, Nigeria, p153

Wiebe, K.D., Soule, M.J. and Schimmelpfennig, D. (2001): Agricultural Productivity for Sustainable Food Security in Sub-Saharan Africa. In Zepeda L (ed.), *Agricultural Investment and Productivity in Developing Countries*. FAO, Rome.