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Food Security and Emerging Innovations in Oil Palm Production in Osun State, Nigeria

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Abstract: Given its enormous yield per hectare and high productivity cycle, Oil palm is considered as a stabilizing crop to global food security especially in developing countries. However, in recent years, the domestic consumption of palm oil in West Africa including Nigeria has increased more rapidly than its production with the vast majority of the farmers working at near subsistence level and employing crude production and processing techniques. This study therefore appraised the impact of emerging innovations on oil palm production in Osun state, Nigeria. Specifically, the research examined the emerging innovations in oil palm production, the impact of such innovations on the level of the farmer's output and the factors affecting farmers' acceptability of innovations. A three stage random sampling technique was used to collect data from 100 oil palm farmers using a well structured questionnaire out of which 90 was found useful for the study. Descriptive statistics, T test analysis and the logistic regression model were the analytical tools employed for the study. The result of the analyses showed that there are some emerging innovations in oil palm production in the study area; however, the indigenous technologies still dominates. Farmers who employed modern technologies were found to have higher output when compared to those of indigenous technologies. Farmers' age and level of education were identified as the major factors affecting the acceptability of innovation in the study area. It is therefore recommended that the government should invest more on adult education and there should be increased awareness on the need to embrace modern technologies and innovations for the transformation of the oil palm industry in the country and consequently raise farmers' standard of living. Younger people should also be encouraged to go into oil palm production.

Key words: Food security, logistic regression, indigenous technology, innovation, oil palm

INTRODUCTION

Food insecurity remains one of the most visible dimensions of poverty and is generally the first sign of extreme destitution. Fighting poverty; ensuring food and nutrition security while protecting the environment still remains as a major challenge facing the global development practitioners. Experts have argued that significant food and nutrition problems exist in Nigeria (Adebayo, 2010; Okunneye, 2002; Famoriyo, 1998). Recent estimates put the number of hungry people in Nigeria at over 53 million, which is about 30% of the country's total population of roughly 150 million and 52% live under the poverty line (Ajayeoba, 2010). Food Security exists, at the individual, household, national, regional and global levels when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life (FAO, 2001). At the core of food security is access to healthy food and optimal nutrition for all. Food access is closely linked to food supply, so food security is dependent on a healthy and sustainable food system. The food system includes the production, processing, distribution, marketing, acquisition and consumption of food.

The oil palm (*Elaeis guineensis*) is regarded as a stabilizing crop to global food security especially in developing countries and has become an increasingly important driver of economic development and poverty reduction in the major producing countries of South-east Asia, Central and West Africa, In large part this is due to the fact that oil palm is by far the most productive of all the vegetable oil crops, yields more oil per hectare than any of the other major oilseed crops, such as rapeseed, sunflower, soya bean, peanut, or cottonseed and it is cultivated in about 43 countries, all of which are developing countries in the humid tropics (Cheng Hai Teoh, 2010). Oil palm is an important agricultural crop, which yields three important sources of food, namely

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palm oil, palm kernel oil and palm kernel cake all of which are very important both locally and internationally in the world market. An average of 3.7 tonnes of palm oil, 0.4 tonnes of palm kernel oil and 0.6 tonnes of palm kernel cake is obtainable from one hectare of land. While the first two products can be used for human consumption, such as cooking oil, margarines, shortenings, bakery fats, vanaspati, ice creams and Vitamin E, etc., palm kernel cake is used as an animal feed (Basiron, 2010). About 80% of palm oil production is destined for human consumption with the balance going to animal feed and to various industries. The fruits of the oil palm tree contain 45 to 55% oil and unlike other vegetable oils, palm oil contains high levels of beta carotene and tocotrienols, which have been found to help protect against cancer (Azizan, 2006). It has extensive domestic and industrial applications and as a source of edible oil, it contributes to food security, health and well-being of the citizens (Ikuenobe, 2010). According to analysis undertaken by Asia Plantations, the United Nations and the US Department of Agriculture, the world's growing population will require more than 230 million tonnes of edible oils by 2021, with palm oil contributing more than 100 million tonnes.

After Centuries as the leading producing and exporting region, West Africa has now become a net importer of palm oil. The exports of palm oil and palm kernel from Nigeria in recent years have dwindled significantly. 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. Today, world oil palm production amounts to 14.4 million tons, with Nigeria which is one of the largest producers in West Africa, accounting for only 7% (Olagunju, 2008). The low level of production can be linked to a number of factors which include: poor quality of oil produced, the absence of plantation development on any substantial scale and more importantly the use of inefficient methods resulting from lack of innovation among majority of players in the industry (Omoti, 2009; Hartley, 1977). Innovations in the production and processing of oil palm to increase production and ensure food security is therefore very essential.

Innovation is a key element in the sustainability of any industry. It is carried out through generation of processes and services that are nurtured by competitive production leading to high-value products. Innovation is a purposeful focused change (Drucker, 1998) and according to Lundvall (1992) is an on-going process of learning, searching and exploring, which result in new products, new techniques, new forms of organization and new markets. Innovation is not a single procedure, it is the series of activities interacting with each other. It is not just a discovery of new knowledge, not just the development of new product, procedure or services, but it is all of the above. It is process where we can find all the elements from research to service and all these have an integrated effect on the collective aim of the element" (Morton *et al*., 2006, in Szakaly, 2000).

Globally, palm oil business is a multi-billion dollar industry. The industry worldwide, has benefitted immensely from the outcomes of research and development activities and technological advances through improvements in fresh fruit bunch and oil yields per unit area, reduced inputs, leading to maximization of oil production from a smaller land area than would otherwise have been (Basiron, 2007). However this is not the case in Nigeria. The oil palm enterprise in Nigeria is widely carried out by homestead and small producers who contribute over 80.0% of national palm oil and palm kernel output employing inefficient processing techniques which result in 20-50% losses of potential palm oil production (Owolarafe *et al*., 2002; Ikuenobe, 2010). Drucker (1998) stated that Nigeria has enormous potential to increase her production of palm oil and palm kernel primarily through application of improved processing techniques. The adoption of improved processing techniques can dramatically impact on national palm oil output thereby increasing the food security situation in the country. It therefore becomes necessary to assess the actual condition of innovation actors especially end users like the farmers. Agbola (1993) opined that improved technologies that meet both growth and sustainability goals can be effectively used by oil palm processors to increase production. In the light of this, This study was carried out to achieve the following objectives:

- To identify the emerging innovations in oil palm production in the study area.
- To examine the level of implementation of the innovations.
- To determine the Impact of new innovations on the agricultural output.
- To examine the social factors affecting the acceptability of new innovation in oil palm production.

MATERIALS AND METHODS

Study area: The study was carried out in Osun State, Nigeria. The state is one of the south-western states in Nigeria, bounded in the north by Kwara state, in the east and south-east by Ekiti and Ondo states, in the south by Ogun state and in the west by Oyo state. Osun state has a total land mass of 9,251 km^2 (3,571.8 sq mi). In 2005 the population of the state was 4,137,627. More than 75% of State's inhabitants are farmers who produce food crops such as yam, maize, cassava, beans and cocoyam. The cash crops include tobacco and palm produce. oil palm is produced in almost every local government area of the state.

Sampling technique: The target population for the study was farm households involved in oil palm production in Osun State. A three stage random sampling technique was used to collect data for the study. The first stage was a random selection of four local government areas namely: Ayedire, Ifedayo Iwo and Odo-Otin Local government area in the state. The second stage was a random selection of five communities from each of the four local governments after which data was collected using structured questionnaires from one hundred oil palm farmers distributed randomly across the five local government areas in the state out of which ninety of the questionnaires were found useful.

Data analysis: Descriptive statistics such as frequency counts mean and percentages were employed to describe socio-economic characteristic of the oil palm farmers and to examine the level of implementation of innovation among the respondents. The Logistic regression analysis was used to determine the factors that influences farmers' decision to adopt innovations while, T tests analysis was used to determine if adoption of innovation has any impact on farmer's output.

Logistic regression analysis: The Logistic Regression Analysis procedure was used to model the values of categorical variable (Innovation) against number of predictors. The variable Z is a measure of the total contribution of all the independent variables used in the model and is known as the logit and β_1, β_2, β_3 and so on, are called the "regression coefficients" of x_1, x_2, x_3 respectively.

$$\ln\left(\frac{p_i}{1-p_i}\right) = Z_i = \beta_0 + \beta_i x_{1,i} + ... + \beta_k x_{k,i} + e_{ijk}$$

Where:

Z_i = Logit or log odds
p_i = Innovation = (1)
$1 - Z_i$ = Non Innovation (0)
β_0 = Constant term
x_1 = Level of education
x_2 = Age of respondents
x_3 = Source of income
x_4 = Marital status
x_5 = Source of information
X_6 = Gender

RESULTS AND DISCUSSION

Socio-economic characteristics: The socioeconomic characteristics of the oil palm farmers are given in Table 1.

Table 1: Socioeconomic characteristics of the respondents

Characteristics	Frequency	Percentage
Age in years		
≤20	4	4.4
21-30	25	27.8
31-40	22	24.4
41-50	22	24.4
51-60	16	17.8
≥60	1	11.1
Total	90	100.0
Marital status		
Single	26	28.9
Married	55	61.1
Divorced	2	2.2
Widowed	7	7.8
Total	90	100.0
Gender		
Male	25	27.8
Female	65	72.2
Total	90	100.0
Educational status		
No Formal	27	30.0
Quranic	14	15.3
Primary	13	14.4
Secondary	18	21.1
Tertiary	14	15.3
Adult	4	4.1
Total	90	100.0
Source of income		
Farming	69	76.7
Trading	17	18.9
Salary Job	2	2.2
Brick Laying	1	1.1
Carpentry	1	1.1
Total	90	100.0

From the above table, the age group 21-30 is the modal group. About 72% of the respondents are female which implies that most of the oil palm farmers in the study areas are females. Majority of the farmers are married with only about 29% being single. About 30% of the farmers have no formal education. Most of the farmers in the study area (76%) have farming as their primary source of income. Although in addition to farming, some farmers also engage in other activities such as trading (18.9%), salary job (2.2%), brick laying and carpentry (1.1%).

Methods of oil palm processing: The oil palm processing techniques used in the study area are given in Table 4.

As shown in the Table, the floating method of oil palm processing is the most commonly used oil processing technique (about 71%) in the study area. This indicates that the local method of oil palm processing is high. The digester method which is an improved method is (20%). The combined processor machine which is the most advanced and recent method account for just (8.9%). These indicate that new technologies in oil palm processing are not fully employed.

Table 2: Technology usage in oil palm production

Technology	Frequency	Percentage
Modern technologies	26	28.9
Indigenous	64	71.1
Total	90	100.0

Table 3: Sources of information on new technologies

Information source	Frequency	Percentage
Ministry of agriculture	26	28.9
Extension agents	12	13.2
Worship centers	15	16.7
Research institute	6	6.7
Siblings and relations	17	18.9
Farmers	14	15.6
Total	90	100.0

Table 4: Methods of oil palm processing

Method of oil palm processing	Frequency	Percentage
Floating method	64	71.1
Digester method	18	20.0
Combined processor	8	8.9
Total	90	100.0

Table 5: Willingness to adopt innovation

	Frequency	Percentage
Willing to adopt	81	90.0
Not willing to adopt	9	10.0
Total	90	100.0

Identification of new technology/innovation in oil palm production: The Technologies used in oil palm production in the study area are shown in Table 2.

As shown in Table 2, farmers that make use of new technologies in oil palm production in the study area are only about 28%. This is low when compared to those that make use of indigenous technologies which account for about 71%.

Sources of information on new technologies: Table 3 gives a summary of the sources of information on new technologies available to the farmers.

Table 3 reveal that ministry of agriculture takes the leading role (28.9%) in information dissemination on new technologies in the study area. This however show that extension agents (13.2%) have more work to do in disseminating information on new technologies in the study area to enhance adoption by farmers.

Farmers' willingness to adopt innovation: Table 5 gives a summary of farmer's willingness to adopt innovation. As shown in Table 5, there is willingness on the part of the respondents to adopt innovation (90%), as those that are not interested are just (10%). However with adequate information the respondents might be ready to receive innovation.

Impact of innovation on the output level: Table 6 gives a summary of the impact of innovation on farmers' level of output.

Taking the p-value at 5% there is a significant difference between the two average output, this implies that farmers that make use of new innovation produce an average of 5.4 gallons per 100 kg of oil palm bunches. The minimum was 4.4 gallons per 100 kg of oil palm bunches and the maximum was 6.4 gallons per 100 kg of oil palm bunches while non-users of innovation produced an average output of 2.00 gallons per 100 kg of oil palm bunches with a minimum of 1.2 gallons per 100 kg of oil palm bunches and a maximum of 2.84 gallons per 100 kg of oil palm bunches. It can therefore be concluded that adoption of innovation contribute significantly to the level of output.

Factors affecting the acceptability of innovation in oil palm production: Table 7 gives a summary of the logistic regression analysis.

The regression analysis shows that there is a relationship between the (Y) innovation and the independents variable (x) in the acceptability of

Table 6: Innovation impact on output level

Usage of technology	Average output in (gallon) per 100 kg of bunches	t. value	Sig
Non-users of Innovation	2.0000±0.84	-5.84	0.001
Users of innovation	5.3913±0.98		

p-value 5%

Table 7: Parameter estimates for the logistic regression model

Variables	B	SE	Wald	df	Sig.	Exp(B)
Education	031**	0.192	0.025	1	0.043	0.970
Income	0.289	0.388	0.556	1	0.456	0.749
Age	-0.038*	0.041	0.856	1	0.061	0.963
Sources of information	0.362	0.192	3.550	1	0.355	1.436
Status	0.248	0.383	0.417	1	0.518	1.281
Laboursource	0.356	0.560	0.405	1	0.524	1.428
Farm size	0.069	0.036	3.815	1	0.874	1.072
Size	0.335	0.212	2.500	1	0.114	1.398
Constant	-2.028	1.487	1.860	1	0.173	0.132

Model Summary; Chi-square 34.289; Negalkerke R^2 = 0.554; *Significant at 10%; **Significant at 5%; ***Significant at 1%

innovation. The chi square statistics showed that the parameters included in the model were significantly different from Zero. The model estimates revealed that factors that significantly influenced the adoption of innovation in the study area are age and education of the farmer. Education of the farmers was significant at 5% and positively related to adoption. The implication of this finding is that, farmers with better education has the likelihood to adopt innovation compared to farmers with lower level of education. This is consistent with the *a priori* expectation. The fact that educated farmers have better access to information could contribute to this positive relationship. The age of the farmer though negatively related to adoption was found to be significant at 10%. This implies that younger farmers are more likely to adopt innovation compared to the older farmers.

Conclusion: From the result of the analyses, it is evident that there are emerging innovation and technologies in oil palm production in the study area. However the level of adoption of innovation among the oil palm farmers is quite low. This low use of modern technologies is responsible for low level of output as the few farmers that adopted innovation, had higher level of output compared to non-adopters with level of education and the farmer's age being the significant factors that affect farmers' willingness to adopt innovation.

Recommendations: In line with the result of the study, It is recommended that the government should invest more on adult education and there should be increased awareness on the need to embrace modern technologies and innovations for the transformation of the oil palm industry in the country and consequently raise farmers' standard of living. Younger people should also be encouraged to go into oil palm production given that they are more likely to adopt innovations.

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