



Adoption of Improved Cassava Varieties and Its Welfare Effect on Producing Households in Osogbo Adp Zone of Osun State

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Abstract

This study was based on the adoption of improved cassava varieties and its welfare effect on producing households in Osogbo Agricultural Development Programme zone of Osun State. A Multistage sampling procedure was used to collect information from 60 cassava farmers in the study area.

To estimate the determinants of adoption and poverty among cassava farmers, the data were analyzed using FGT poverty measure and Tobit regression model. The result showed that Poverty were higher amongst households who were non adopters of improved cassava varieties. The Tobit regression model was used to determine the factors that influence adoption and poverty. The result showed that, sex, age, access to extension agents, crop yield, marital status, labour, production input and education influenced adoption of improved cassava varieties positively. Only household size influenced the adoption level negatively. Household size, extension agent and crop yield were the major significant factors responsible for the adoption of improved cassava varieties.

The result of the determinants of household poverty revealed that, years of education, land size, credit, adoption level and extent of commercialization influenced household poverty in the negative direction implying that a unit increase in any of the variables will lead to a decrease in household poverty. Household size, age, sex and occupation on the other hand, had a direct relationship with poverty, this implied that an increase in any of these variables will lead to an increase in household poverty. Years formal education, land size, credit, adoption level, household size and extent of commercialization were found to be the major determining factors among cassava farmers in the study area. Implicitly,

this result showed that in order for poverty alleviation to be effective, human capital such as education should be emphasized. Extension services should also reach greater depth in which campaigns are staged to promote the relevance of new innovations which are labour saving and cost effective. Also, a policy targeting at household size reduction should be put in place for cassava farmers in the study area.

1.0 Introduction

Agriculture plays an important role in the economic development of Nigeria. It provides food for the growing population, employment for the population, raw materials and foreign exchange earning for the development of industrial sector (The Comet, 2000). However, the ability of Nigeria agriculture to perform its role in development has been on the decline in recent years. The overall agricultural situation deteriorated creating a wide gap between the supply and demand for food (FAO, 2000). Revenue from agricultural sector dwindled and the government was faced with mounting food import bills. At the same time, industries continued to import agricultural raw materials, thus putting considerable stress on Nigeria's foreign exchange earnings. It was against this background that Nigeria government adopted different agricultural programmes and policies aimed at raising the production and efficiency of the agricultural sector. (Ministry of Agriculture and Rural development 2003).

In the period before the 70s, agriculture was the economic mainstay for Nigeria as a nation. Then, Nigerians engaged in various kinds of agricultural practices to meet their local economic and export need (FAO, 2000). Specifically, between the late 50s and early 60s Nigeria was rated as the highest exporters of cocoa and kolanut in West Africa sub-region. This status quo was perpetual until around 1973 when the black gold (Petroleum) was discovered in the country (Nweke, et al 2004).

Investigation have shown that cassava was considered by the household as their most important food crop (Akoroda and Teri 2004) Some sizes of the households take meals from cassava daily throughout the year and during the rainy season this percentage goes up to 96% of the households. Outside the rainy season 54% of the households ate cassava at least once a day (Akoroda and Teri 2004). Cassava can be processed into several products which can easily and safely be consumed or stored. These are boiled and roasted cassava, dried chips, flour, beer etc. Other parts of the cassava plants are also of domestic significance (Akoroda and Teri, 2004). For instance the green leaves are used in preparing vegetable stews and the stem is the major means of its propagation. Cassava has become a staple food for most Nigerians (Not only among rural people but also among the urban dwellers) possibly because of the ease with which its major food product (Garri) can be prepared and used as a source of food (IITA, 2004).

As a food crop cassava has some inherent characteristics which makes it attractive, especially to the smaller holder farmers in Nigeria. First it is rich in carbohydrate especially starch and consequently has a multiplicity of end users (IITA,2006). Secondly, it is available all the year round, making it preferable to other more seasonal crops such as grains, peas and beans and other crops of food security (Akoroda and Teri 2004). As a cash crop, cassava generates cash income for the largest number of households in comparison with other staples.

For introduction of improved varieties of cassava to be increased there is need for the qualitative extension services among farmers (Oladosu, 2003). However, the level of adoption of the improved technologies is low improper application of some of the technologies are also ripe among farmers (Oni 2003). In order to address the above problems, the following specific objectives were stated. Analyze the determinants of adoption of improved cassava varieties and to analyze the determinants of poverty in the study area.

2.0 Literature review and Conceptual Framework

Tracing the origin of cassava, Kunle (2001), noted that cassava is a native of tropical America, probably Southern Mexico where it is today called Yucca. He went to reveal that there is archaeological evidence that cassava was grown in Peru four thousand years ago and it was probably among the final crops to be domesticated. The crop cannot be said to be a new extract into the staple food items composition in Nigeria and most parts of the world. It is one of the highly recognized and cultivated crops (mostly in tropics) the world over. It is widely grown root crop in most countries of Latin America, Asia and Africa (FAO 1998).

In terms of global production, cassava is grown on about 16.2 million hectares of land in 99 countries and produces about 162.7 million tons of fresh tubers per year (FAO, 2001). The five largest producers are: Nigeria, Brazil, Zaire, Indonesia and Thailand that together account for 65.5 percent of world production. FAO (2001) reported that cassava in Africa is a subsistence crop often produced on marginal lands in shifting cultivation system by small-scale farmers. They

grow cassava especially to feed their families but there is now a growing commercial market for cassava. Most of cassava products used for food are derived from the starchy roots but the leaves are also consumed as proffered green vegetables in some cassava growing communities especially central Africa. The stems are used to feed pigs and as firewood.

Cassava production in Nigeria posited was the rice until the period between 1970-1976 when many farmers migrated to the cities as a result of the oil boom. This therefore, led to great decline in the area cultivated. However, in recent years annual growth rate has reached 8.3%. presently, Nigeria produces 22million tons annually and given more incentives and access to inputs, they can produce 40million per annum (The Comet 2000). The Southern and middle belt areas of the country are the major cassava producing states in Nigeria due to crops adaptation to soils in these areas. It has ability to thrive on less fertile soil over other crops. Yields on Farm trials range between 9.9 and 17.3/ha and capable of producing up to 50tons/ha. Foreign Agricultural Service (FAS 2005) posited that the roots can be kept in the ground and harvested when needed. It is easily propagated by stem cuttings i.e. planting materials which are however not edible.

Cassava (*Manihot esculenta* 'crantz') is a very significant food crops in Nigeria and much of the tropics. It provides about 40% in Sub Saharan Africa (F.A.O 2003) and about 70% of the daily Calorie intake of over 50million Nigerians. In companion with other food crops (such as yam or maize) cassava demands less of farmers' resources. It is propagated by stems (which is not edible). It tolerates moisture stress, makes limited soil fertility demand, and has an specific planting and harvesting periods. It can be processed into a variety of food items or forms and does not require elaborate storage facilities because harvested cassava in any form deteriorated in quality after two days. Therefore, farmers leave their cassava in the field until the need arises for harvest. However, with population pressure and agricultural land use intensification, storage in the field is at a high opportunity cost since farmers require more land for cultivation.

In terms of its nutritive value, "cassava roots contain about 60% of water and are rich in carbohydrate. The roots are low in protein and lipids but reasonably rich in Calcium and vitamin C. products from cassava when consumed with some energy dense protein and nutrient rich supplementary foods such as beans and oil seeds, pulses and fishes provide energy in adequate diet" (FAO 2000). Cassava play a very active role in household food security in Nigeria, as it can be stored for long periods and is also almost available throughout the year at reasonable process.

The improved cassava variation out yielded, the local at farm level, farmers have been slow to adopt them based on factors such as: Unfamiliarity-most farmers have never had opportunity to try them and therefore do not know whether they will like them or not. Unavailability of planting materials. Their high moisture content, which leads to poor not yields. The relatively unknown processing qualities (for Garri and fufu) of the improved cassava varieties compared with the unknown qualities of the local varieties (World Bank 2000). It was noted that improved cassava varieties express their greater yield potential under both low and high inputs than the local cassava varieties.

3.0 Methodology

The study was carried out in Osogbo ADP zone of Osun State. The vegetation of the study area is purely Guinea Savannah. Farming, trading are the major occupation of the people in that zone. The 3 prominent religion beliefs in the zone are ; Christianity, Islam and have the highest follower than the traditional worshipper.

Osogbo is situated in the centre of Osun state according to osogbo local government planning authority. The geographical location of osogbo is on Latitude 15.10ON and Longitude 13.22OS. Agricultural activities in the area are production of crops such as maize, cassava, cowpea, rice and vegetable. Perennial crops such as cocoa, mango, cashew and citrus are also cultivated in the area. Lives stock production activities such as keeping of animals like cattle, sheep and goat are also practice in the area

The data that was used in this study were essentially from primary sources. Structured questionnaire were collected on the socio-economic characteristics of the respondents such as age, marital status, sex, family size, level of formal education, reasons for farming, nature of land acquisition, farming experience, farm size (in ha) and on adoption. Input-output data such as cassava output, cost of inputs, income from outputs, labour input in man days were also collected. In all ,a total of fifty three cassava adopters and seven non adopters were finally selected for the study. Two analytical techniques were adopted for the study, and are FGT (1984) poverty measurement and Tobit regression model Omonona et al (2006).

3.1 Poverty Analysis

The analysis of poverty was based on P-alpha (Pa) measure proposed by Foster, Greer and Thorbecke (FGT) 1984. The use of FGT class of measure requires the definition of poverty line, which was calculated on the basis of disaggregated data on expenditure. The FGT measure was based on a single mathematical formulation as follows:

$$P_{\alpha} = \frac{1}{N} \sum_{i=1}^q \left[\frac{z - Y_i}{z} \right]^{\alpha}$$

Where; z = the poverty line

q = the number of individuals below poverty line.

N = the total number of individual in reference population.

Y_i = the is the per capita expenditure of households I and,

α = the degree of aversion and takes on the values 0,1,2.

3.2 Poverty Line.

This is a predetermined and well-defined standard of income or value of consumption. In the study, the poverty line was based on the expenditure of the households. A relative approach was used in which a household was defined as poor relative to others in the same society or economy. Two third of the mean per capita expenditure was used as the moderate poverty line while one third was taken as the line for extreme poverty.

The categories of poverty line was given as:

Extremely poor: Those spending <1/3 of MPCHE

Moderately poor: Those spending < 2/3 of MPCHE

Non poor: Those spending > 2/3 of MPCHE

Per capita expenditure (PCE) = Total expenditure

Household size

MPCHE = Mean per capita household expenditure.

MPCHE: Total household expenditure

Total number of respondents

FGT Measurement:

$$P_{\alpha} = \frac{1}{N} \sum_{i=1}^q \left[\frac{z - Y_i}{z} \right]^{\alpha}$$

When $\alpha = 0$, $P_0 = \frac{q}{n}$ = Poverty incidence

Where q is the number of individuals below poverty line

n is the total number of individuals in the reference population.

When $\alpha = 1$

P1 = Depth of poverty

$$P_1 = \frac{1}{N} \sum_{i=1}^q \frac{[Z - Y_i]^\alpha}{[Z]}$$

When $\alpha = 2$

$$P_1 = \frac{1}{N} \sum_{i=1}^q \frac{[Z - Y_i]^\alpha}{[Z]}$$

3.3 Determinants of Adoption

In adoption studies, the use of probability models is conceptually preferable to conventional linear regression models because parameter estimates from the former overcome most weaknesses of linear probability models namely: Providing estimates which are asymptotically consistent and efficient. The general model is a binary choice model involving estimation of the probability of adoption of a given practice (Y) as a function of a vector of explanatory variables (X).

The Tobit regression model, a hybrid of the discrete and continuous models, was used to determine the impact of the explanatory variables on the probability of adopting improved rice varieties. The model is expressed below following McDonald and Moffitt (1980).

$$Y_i = \begin{cases} y_i = \beta X_i + U_i \\ 0 = \beta X_i + U_i \end{cases}$$

Where: i = number of respondents i.e. (1,2...60)

Y_i = Dependent variable, it is discrete if farmers do not adopt and continuous if adopt.

Y_1^* = is the level of adoption defined as a/A where a is the number of the technology package that is adopted by the farming households and A is the total number of technologies available for adoption

$Y_1^* > 0$ implies that Y_1^* is observed

$Y_1^* < 0$ implies that Y_1^* is not observed.

X_1 is a vector of explanatory variables

α is a vector of unknown coefficients and

U_i is an independently distributed error term.

The independent variables specified as determinants of adoption are defined as follows:

X_1 = Marital status of household head (D=1 if married; 0, if otherwise)

X_2 = Household size.

X_3 = Sex of household head (D=1 if male; 0, if otherwise)

X4 = Education of household head (years).

X5 = Age of household head (years)

X6 = Labour (Man days)

X7 = Crop yield (tones/ha)

X8 = Extension access (D=1 if yes; 0, if otherwise)

X9 = Production input access (D=1 if yes; 0, if otherwise)

3.4 Determinants of Poverty

The analysis also utilized the Tobit regression model as stated below:

$$q_i = p_i = \beta X_i + U_i$$

$$q_i = p_0 = \beta X_i + U_i$$

Where: $i = 1, 2, 3, \dots, 60$

q_i = Dependent variable, it is discrete when household is not poor and continuous when poor.

P_i = Depth of the intensity of poverty defined as:

$$\frac{z - y}{z}$$

Where, p_i^* is the poverty depth when the poverty line (z) equals the per capita household expenditure.

X_i = is a vector of explanatory variable.
 β = is the vector of unknown coefficient.

U_i = is an independently distributed error term.

The independent variables specified as determinants of poverty are defined below:

X_1 = Household size

X_2 = Sex of respondent (D=1 if male; 0, if otherwise.)

X_3 = Education of household head (years)

X_4 = Age of respondent (years)

X_5 = Primary occupation of respondents (D=1 if farming; 0, if otherwise)

X_6 = Land size (ha)

X_7 = Credit availability (D=1 if yes; 0, if otherwise)

X_8 = Commercialization extent

X_9 = Adoption dummy

The extent of commercialization is calculated as follows:

$$X_8 = \frac{\text{Sale}}{\text{Value of total production}} \times 100$$

Poverty measure

$$P_{\infty} = \frac{1}{N} \sum_{i=1}^{\infty} \left(\frac{Z - Y_i}{Z} \right)^{\infty}$$

4.0 Results and Discussion

4.1 Determinants of Adoption of improved cassava varieties of cassava farmers in the study area

The result of determinants of adoption of improved varieties of cassava by farmers in the study area is shown in Table 1. From the maximum likelihood estimates of Tobit regression, the result showed that sigma (d) was 0.128 with a t-value of 10.115 and was significant at 1% confidence level. This implies that the model was fit to the data. This conforms to the findings of Omonona et al (2006).

The farmer's household size was significant at 1% meaning that household size was important in the adoption analysis of improved cassava varieties and was negative which implies that the larger the farmers household size, the lower the probability of adopting improved cassava varieties by farmers. The regression coefficient was -0.0215 implying that a unit increase in farmer's household size reduces the likelihood of adopting improved varieties by -0.0215. This contradicted the findings of Omonona et al (2006) which stated that household size was not a significant factor in the adoption analysis.

Crop yield of the farmer and their contact with the Extension agents were significant at 1% and were positive which reveals that the higher the crop yields of the farmers and their contact with the extension agents, the higher will the probability of adopting improved cassava varieties. This could be due to the fact that the higher crop yield was as a result of adoption of improved cassava varieties and their interaction with the extension agents. The regression coefficient was 0.0102 and 0.001 implying that a unit increase in crop yield contact with extension agents will increase the likelihood of adopting improved cassava varieties by 0.0102 and 0.001 respectively. This conform with the findings of Omonona et al (2006) which stated that crop yield and contact with the extension agents were the major factors for the adoption of improved cassava varieties.

The coefficients of marital status, sex, education, production input, labour and age of household head were not significant factors in the adoption of improved cassava varieties, but were positive which showed that they had direct relationship with the adoption of improved cassava varieties meaning that a unit increase in any of these factors will result in an increase in adoption of improved cassava varieties.

4.2 Values of Degree of Aversion of Poverty of cassava farmers in the study area.

Table 2 showed that P_0 , P_1 and P_2 which were poverty incidence, poverty gap and poverty severity of the cassava farmers in the study area. This indicated that poverty was not prevalent in the area. The majority of the farmers live above the poverty line. This was as a result of the adoption of improved cassava varieties by majority of the farmers in the study area.

4.3 Determinants of Household Poverty of cassava farmers in the study area

The result of the determinants of poverty among cassava farmers in the study area is shown in table 3. The maximum likelihood estimate of the Tobit regression results showed that sigma (d) was 0.02 with a t-value of 0.04 and was statistically significant at 1%. This conforms to the findings of Omonona et al (2006). The coefficients of sex, age and primary occupation were not significant factors in household poverty reduction.

The coefficient of the years of formal education of the farmer was significant at 1% and was positive. This shows that, the more educated a farmer, the more likely he was to be rich. This is because; education enlightens the individual and with regard to farming activities, imparts the necessary knowledge of the new package and an understanding of how to use it. The regression coefficient was -0.65 and implies that a unit increase in the year of education of a farmer will lead to an increase in the likelihood of poverty by -0.65. This conforms with the findings of Omonona et al (2006) which stated that the coefficient of the year of formal education was significant at 5% and was negative in poverty reduction analysis.

The coefficient of land size of farmer's farm, commercialization extent and level of adoption were significant at 1% and were negative. This shows that the more the size of the farmer's farmland, commercialization extent and adoption level, the more is likely to be poverty reduction among the farming household. The regression coefficients were -0.11, -0.53 and -0.62 respectively for farm land commercialization extent and adoption level. This implies that a unit increase in the size of these factors will result in a decrease in the probability of poverty. This contradicts the findings of Omonona et al (2006), which stated that the coefficient of farm size, commercialization extent and adoption level were not a significant factor in household poverty reduction. Credit was negatively significant at five percent level with a regression coefficient of -0.37 which implies that a unit increase in credit will lead to a reduction in the poverty level by -0.37. And lastly, household size was positively significant at one percent level with a coefficient of 0.11 which implies that a unit increase in the size of the household will increase the poverty level by 0.01.

5.0 Conclusion and Recommendation

This study had successfully shown the various factors influencing the adoption of improved cassava varieties and the welfare status of rural farmers. It is clear that crucial factors like credit availability, access to extension services and the extent of commercialization were necessary for poverty reduction. Farmers need to take full advantage of new technologies such as those studied to improve their standard of living. Policy makers should target resources to the poor. Based on the findings of this study the following recommendations are suggested in order to improve the welfare of the farming households in the study area.

Farmers need to take full advantage of the benefits of cultivating improved cassava varieties which usually translates into increased income. This will only be possible with an effective network of extension agents who deliver their services to these farmers more frequently. Learning centres should be set up in strategic locations like the ADPs (Agricultural Development Projects). These centers should be equipped with very recent technologies so that farmers can be aware, understand the technologies and apply them appropriate to their needs. In addition, the education of the farmers and their household members should be taken seriously as education has been shown to influence adoption and welfare.

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Table 1; Tobit Regression of the Determinants of Adoption of Improved cassava Varieties in the study area

Variables	Parameter value	t-ratio
Marital status	0.0609	0.924
Household size	-0.0215	-3.452*
Sex	0.0547	0.800
Education	0.0001	0.048
Age	0.0020	1.108
Crop Yield	0.0102	2.724*
Extension agent	0.001	0.02*
Production Input	0.056	1.342
Labour	2.154	1.613
Intercept	0.1226	0.986
Sigma	0.1280*	10.115

Source: Field survey,

2007

* = Significant at 1%.

Table 2: Values of Degree of Aversion of Poverty

P_{α}	Values
P_0	0.20
P_1	0.003
P_2	0.004

Source: Field Survey, 2007

Table 3 : Tobit Regression of the Determinants of Household poverty of cassava farmers in the study area.

Variable	Parameter Value	t-ratio
Household Size	0.01	0.02*
Sex	0.12	20.35
Education	-0.65	-5.14*
Age	1.14	21.37
Occupation	0.59	5.28
Land Size	-0.11	-3.55*
Credit	-0.37	3.40**
Commercialization Extent	- 0.53	-2.64*
Adoption	-0.62	-2.96*
Sigma (d)	0.02	0.04*

Field survey, 2007

* Significant at 1% and ** Significant at 5%

Reviewer's Comments

1. Comment by Shyam Yadav

IUCN SSC Crop Wild Relative Specialist Group (CWRSRG)

General comments about the paper:

1. The paper tries to examine the factors, which determine the adoption of improved technology in cassava cultivation and its effects on the reduction in the poverty.
2. The paper used right tools and techniques, which are widely used in the literature
3. The paper came out with some policy interventions for wider adoption of improved technology in Cassava and to

reduce poverty

However the following aspects needs to be incorporated before final acceptance of the paper for publication:

1. There should be clear linkages between two regressions run (one for technology adoption and other for poverty reduction). i.e, paper should clearly spell out the "technological adoption reduced poverty in the study area" and if possible quantify in % terms.
2. If possible you may include another regression equation, which will quantify impact of technology adoption on increase in "net returns from cultivation"
3. Needs sequence of arguments for better understanding how technology effects yields, reduce risk, improves food security and how all these effects poverty level.
4. The paper is poorly written, needs improvements in editing grammar/structure

2. Comment by Larry Daley
Professor Emeritus, Corvallis, Oregon, USA

Re: J.O. Amao and T.T. Awoyemi (submitted 2008) Adoption of Improved Cassava Varieties and Its Welfare Effect on Producing Households in Osogbo Adp Zone of Osun State

The results seem logical and useful, the techniques employed are both satisfactory. The problems this paper address are significant.

There are a few grammatical errors which should be addressed:

e.g. page 7. "Their high moisture content, which leads to poor not (sic) yields."

and thus this paper could benefit from some editing However, the value of the manuscript is such that this should not be barrier to publication.

Although cassava is usually characterized by low protein content this is not so for all varieties, and it might be useful to mention this point.

In all the paper is satisfactory and thus should be published, if possible with the recommended changes.