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EFFECT OF ADOPTION OF IMPROVED CASSAVA VARIETIES ON HOUSEHOLD INCOME IN OYO STATE, NIGERIA

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Abstract
The study was carried out to analyze the effect of adoption of improved cassava varieties on household income in Oyo State, Nigeria. A Multi-stage sampling procedure was employed to select 200 respondents for the study. The study employed descriptive statistics and multinomial Logit for data analysis. The results revealed that 73.5% of the respondents were male, 66.5% were within the age range of 40-60years, 88% married, 56.0% had household size of 6-10 persons, 9% had no formal education and 40.5% sourced their fund from the cooperative societies. The estimated multinomial logit model for effects of factors influencing income from improved cassava varieties revealed that among all the variables considered in this study, educational level of the respondents, household size, and the level adoption of improved varieties were all positive and significant at 1%, while farm size was significant at 5%. The non-adopters indicated inadequate credit facility (18.8%), poor communication (18.1%), and lack of market (17.7%) as factors militating against the adoption of improved cassava varieties. Hence, considering other pertinent factors, the adoption of new and improved varieties of cassava presents farming households the opportunity to increase their income generation. There is also need for educational policies to enable the farmers access and process information on innovations that will enhance cassava productivity and hence income.
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Keywords: Adoption, Improved, Cassava, Household, Varieties and Income

Introduction

In Nigeria, studies have shown that cassava is considered by the households as their most important food crop (Akoroda and Teri, 2004). Also, households (96%) in western Nigeria consume meals from cassava daily throughout the year and during the rainy season, but within the dry season, 54% of the households eat cassava at least once a day. 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 plant are also of domestic significance (Akoroda and Teri, *ibid*). For instance, the green leaves are used in preparing vegetable stews and the stem is the major means of its propagation. Again, 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 (*Gari*) can be prepared, and used as a source of food (IITA, 2004). Cassava is the most grown crop in the southern part of Nigeria, especially by the smallholder farmers. It plays a vital role in the food security of the rural economy because of its capacity to yield under marginal soil conditions, and its tolerance to drought. Rural and urban communities use cassava mainly as food in both fresh and processed forms (IITA, *2004*).
Cassava is important, not only as a food crop, but even more, as a source of income for rural households (FAO, 2009). A large proportion is planted annually for sale. Apart from generating income for a large number of households, it provides employment opportunities. Cassava is mainly produced by small holder farmers cultivating less than two hectares of land, and plays a dominant role in the rural economy of the south agro-ecological zones, though is increasingly gaining importance in other parts of Nigeria. It is important, not just as a food crop but even more so as a major source of cash income for producing households.

The elite cassava varieties possess short growth cycle, high yields, withstands biotic and abiotic stress, early maturing, high root yields (fresh and dry), meet end-users quality characteristics, and store well in the soil for more than 18 months. Some of the recommended

varieties of cultivars in Nigeria include: TMEB 419, TMS 90257, TMS 91934, TMS 81/00110, TMS 82/00661, TMS 30001, TMS 50395, TMS 84537, NR 87184, NR 41044, NR 8082, NR 8083, NR 8212, NR 83107, TMS 30211, TMS 30555, TMS 30572, U-41044, U-7706 and U-60506-2(4). TMEB 419, TMS 30001, TMS 300017, TMS 30110, TMS 30337,TMS 4(2)1425, UMUCASS 42, UMUCASS 43 and local cultivars (Nwugo, Nwaiwa, Ekpe and Okotorowa) are popular in southeast Nigeria (Martin and Ejike,2018).

Most agricultural households obtain only a part of their incomes from cassava production. Earnings from non-cassava agricultural activities and off farm activities constitute a substantial part of income. The household income in this study is the income from cassava production, non-cassava agricultural activities and off farm activities of the farmers. Nigeria, like most other African countries, has realized that viability in rural development depends on sustained growth in rural income and standard of living primarily from agriculture as observed by Ajayi (2002). Agricultural production, be it crop, livestock, fishery and the like has been a dominant issue of discussion in national economic development of this country. However, despite government campaigns and slogans, farm production has not kept pace with food demand (Ani, 2006). Most food crops produced in the country come from the efforts of the small-scale resource poor farmers who depend largely on traditional farming systems for their agricultural inputs. Ani (*ibid*) noted that re-current food crises have occurred in the country partly due to high rate of population growth over food production level, and erratic amounts of food crops produced from year to year. Some of the reasons that can be adduced for this is environmental hazards from low rainfall, deforestation, continuous cropping and unhindered desert encroachment. These situations can be minimized through the use of appropriate technologies by the rural farmers. The most important factors affecting adoption behaviour of farmers are their personal and socioeconomic characteristics (Onu and Madukwe, 2002).Also, information source have been reported as important stimulus to individuals in the adoption process (Rogers, 1995). Furthermore, there is a tendency that the introduction of improved cassava technology may result in a change in households production mix. The total household income is a combination of income from cassava production and other agricultural activities. Households with comparative advantage in adopting improved cassava technologies may adopt it and re-allocate resources away from non-cassava production in order to increase production, whereas, households without comparative advantage may shift its production resources away from cassava to other crops.

However, many researchers have studied different aspects of the concept of adoption of improved cassava technologies. Some researchers focused on the effect of adoption of cassava technology on income (Ambali *et al*., 2012; Adofu *et al*., 2009). Some researchers studied the effect of innovation adoption on cassava production (Oladoja *et al*., 2008). Ayoade (2012) focused on the adoption impact of improved cassava varieties on the social life of rural farmers. There has been no concise focus to investigate the effect of adoption of improved cassava varieties on household income distribution. IITA and NRCRI have introduced various improved cassava technologies in the area in the past and hence, this study focused on the effect of the adoption of improved cassava varieties on household income distribution of the adopters and non-adopters in Oyo State, Nigeria.

Methodology

Study area

The study was carried out in Oyo State. Oyo State was created in 1976, with total area covering 27,249 km²(NARP, 1995).Agricultural sector forms the base of the overall development thrusts of the area, with farming as the main occupation of the people. Crops usually grown include: maize, yam, cassava, cocoyam, melon, cowpea, cashew and vegetables under mixed cropping practices (Adelakun *et al.,* 2020)

Method of data collection

Primary data were used for this study. The data were collected by the use of a well structured questionnaire, which contained open and close ended questions.

Sampling techniques

A Multistage sampling procedure was employed to obtain the final sample size for this study. In the first stage, two Local Government Areas (LGAs), where cassava production is most prevalent were purposively selected from each of the four Agricultural Development Programme (ADP) Zones in Oyo State. The second stage involved the random sampling of two communities from each of the selected LGAs. In the third stage, the lists of cassava farmers in the selected villages were obtained from the zonal ADP offices in each area and ten percent(10%) cassava farmers were randomly selected and interviewed from each community to arrive at a final sample size of 200 cassava farmers.

Methods of data analysis

Data analysis was achieved using descriptive statistics such as percentages, frequency tables, ranking etc. and multinomial logistic model. The empirical multinomial logit model for this study is implicitly specified as:

$$Y_i = f(X_1, X_2, \ldots, X_n) + e$$

Where,

Y_i, the dependent variable is the income of the respondents; X_{is} are the included explanatory variables. The dependent variable (Y_i) was categorized into five groups in quartiles (groups 1-5). The first group, which is the highest income group, was designated as the reference group. The explanatory variables are defined thus:

X_1 = Gender (dummy variable; 1=male, 0=female)
X_2 = Age (years)
X_3 = Marital Status (dummy variable; 1=married, 0=otherwise)
X_4 = Farmers household size (number)
X_5 = Educational level (years)
X_6 = Farming experience (years)
X_7 = Access to credit (dummy variable; 1=yes, 0=no)
X_8 = Farm size (hectares)
X_9 = Adoption of improved varieties (1= adoption; 0=non adoption)
e = Error term

Results and Discussion

Socio-Economic Characteristics of the Sampled Households

Socio-economic characteristics of the sampled households with their frequency and percentages are presented in Table 1. The gender distribution of respondents indicates a higher percentage of male farmers (73.5%) than females (26.5%), indicating male dominated households within the study area. The table also shows that, majority of the respondents (88.0%) are married, 5.5% single, and widows and divorced 6.0% and 1.0% respectively. The distribution of the respondents according to their religious belief indicates that the Muslims constitute the majority of the respondents (52.5%), followed by Christians (39.5%) and Traditional worshipers (8%). This revealed that the farmers were Muslim dominated. About 25.5% of the respondents were between the ages of 21 and 40 years, while 66.5% were between 41 and 60 years. This incidentally represents the active group otherwise called working class. However, the older category above 60 years constitutes 8% of the respondents. This is an indication that cassava farming requires lots of energy which most old people are deficient in. The table further revealed that only 9% of the respondents had no formal education. This shows that most of the respondents can read and write. This level of literacy will make the respondents to understand any introduced improved cassava varieties and ultimately have the will power on how income will be distributed. Table 1 also reveals the proportion of the respondents that had farming as their primary occupation as 66.0%. The field survey revealed that the sampled respondents have large household sizes. The percentage household sizes obtained were 42.5, 56.0 and 1.50 for ranges of 1-5, 6-10 and 11-15 household members respectively. Inherited land constitutes the majority (65.03%) of the land owned in the study area, while 28.96% of the respondents obtained their land through rentals.

Table 1: Description of Socio-economic characteristics of Cassava farmers

Variables	Frequency (n =200)	Percentage
Sex		
Male	147	73.5
Female	53	26.5
Marital Status		
Married	176	88.0
Single	11	5.5
Divorced	1	0.5
Widow	12	6.0
Religion		
Christianity	79	39.5
Islam	105	52.5
Traditional	16	8.0
Age		
21-40	51	25.5
41-60	133	66.5
>60	16	8.0
Educational Status		
No formal education	18	9.0
Primary education	45	22.5
Secondary education	99	49.5
Tertiary education	38	19.0
Major Occupation		
Trading	54	27.0
Fishing	3	1.50
Carpentry	3	1.50
Bricklaying	8	4.0
Farming	132	66.0
Household size		
1-5	85	42.5
6-10	112	56.0
11-15	3	1.50
Land Acquisition		
Inherited	125	62.5
Purchased	3	1.50
Rent/Lease	55	27.5
Community Land	5	2.50
Borrowed	10	5.0
Gift	2	1.0
Access to Credit		
Access	122	61.0
No Access	78	39.0

Source: Survey Data, 2015

Improved Cassava Varieties in the Study Area

Table 2 shows that there are six identified improved varieties in the study area. Many of the adopters (50%) used TMS 30572, which ranked 1st. This finding is in line with Ayoade (2013), who revealed that all the respondents adopted TMS 30572 in her study. TME 419 ranked 2nd (33%), Vitamin A variety ranked 3rd (32%), TMS 30555 and TMS 1632 ranked 4th each (26%), while NR 8083 ranked least(13%). As stated earlier, these improved varieties have inherent characteristics like high yield, early maturity and high resistance to pests and diseases.

Table 2: Improved cassava varieties in the study area

*Improved Varieties	Frequency	Rank
TMS 30572	50	1st
TME 419	33	2nd
Vitamin A	32	3rd
TMS 30555	26	4th
TMS 1632	26	4th
NR 8083	13	5th

***Multiple responses recorded**
Source: Survey Data, 2015

Determinants of Income from adoption of Improved CassavaVarieties

In an attempt to investigate multiple effects of factors influencing the household income of cassava farmers, a multinomial logistic regression was conducted. The household income is categorized into five groups in quartile. The inference from the estimated coefficients for each category is made with reference to group 1, which is made up of highest income respondents. A likelihood ratio (χ^2) value for 245.23648 which was significant at 1% level of probability was obtained. This ascertained that all the slope coefficients are significantly different from zero. The pseudo R^2 value of 0.2381 also confirmed that all the slope coefficients are not equal to zero. Therefore, the explanatory variables are adequate in explaining the household income groups of the farmers in quartile. The results of the estimated model are discussed in terms of the significance and signs on the parameters. Evidence from the model (Table 3) revealed that the set of significant explanatory variables varied across the groups in terms of their levels of significance and signs. However, educational level, household size, farm size and adoption of improved varieties are positive and significantly associated with the classification of the income groups to the reference group. The positive sign implies that the probability of respondents to fall into highest income group is seen to increase with household size (Group 3, at 1% sig. level), educational level (Group 4 and 5 at 1% level), farm size(Group 2and 4, at 5% significance level) and adoption(Group 3, 4 and 5 at 1% level of significance).

Relative to the reference group, increase in household size might increase the financial strength of the respondent's family, thereby influencing the adoption of the new varieties of cassava, which in turn increases the household income from cassava production. This is consistent with the findings of Ojo and Ogunyemi (2014), who revealed that household size among other variables, was a significant factor in the adoption of improved cassava production technologies .Likewise, higher educational qualification by a farmer may likely influence his/her choice of improved cassava variety, which translates to higher income from eventual proceeds. This agrees with the findings of Apata *et al.* (2008), where educational level had a significant effect on income as a result of the adoption process. Again, increase in hectarage of land area available for the cultivation of new varieties of cassava by the farming households, the higher their probability of earning higher income. Lastly, the adoption of improved cassava varieties potentially improves the quality and yield of cassava production thereby increasing its market value and hence, a commensurate increase in the household income.

Some of the variables were significant but negative. For age, estimates of group 2 and 3 were negative despite both being significant at 10%, implying that as farmers grow older, they are unlikely to adopt new cassava varieties due to the old methods they are conversant with, hence, reducing their probability of being in the highest income group. This agrees with the findings of Ojo (2012), that a farmer tends to reject innovations different from their traditional methods as his/her age increases. The tables also showed that access to credit was negative and significant. This implies that the farmers that have no access to credit have lower probability of being in the high income group relative to farmers that have access to credit.

Table 3: Estimated multinomial logit model for effects of factors influencing income from improved cassava varieties

Variables	(Reference Group) 1	Group 2	Group 3	Group 4	Group 5
Gender	3.1580	-1.4057	-1.1600	0.1154	-0.7076
		(-2.18)*	(-1.71)*	(0.14)	(-0.99)
Age	0.2524	0.0044	-0.1090	-0.1067	-0.0412
		(0.10)	(-2.50)**	(-2.21)**	(-0.88)
Marital Status	-0.0683	-0.3311	0.4084	0.1382	-0.1472
		(-0.93)	(1.23)	(0.33)	(-0.35)
Household size	-4.0174	0.7276	1.8045	0.8550	0.6302
		(1.21)	(2.99)***	(1.40)	(1.07)
Education (years)	-0.6833	-0.0797	0.1243	0.3077	0.3309
		(-0.96)	(1.49)	(3.73)***	(4.09)***
Farming Experience (years)	-0.0069	-0.1119	-0.0006	0.0570	0.0623
		(-2.28)*	(-0.01)	(1.17)	(1.37)
Access to Credit	6.4854	-1.7275	-1.6241	-1.6895	-1.4437
		(-2.51)**	(-2.35)**	(-2.38)**	(-2.05)**
Farm size (ha)	-2.0339	0.5674	0.5092	0.5552	0.4031
		(2.15)**	(1.99)	(2.16)**	(1.54)
Adoption	-6.3541	0.7412	1.8949	2.116	2.735
		(0.11)	(3.10)***	(3.71)***	(3.75)***
Constant	2.2006	5.1822	0.5982	-2.0708	3.9102
		(1.62)	(0.31)	(-1.00)	(-1.90)*
No of Observation	200	200	200	200	200
Log likelihood - -245.2560					
LR chi^2-square- 153.26					
Pro> Chi-square – 0.0000					
Psendo R^2= 0.2381					

Source: Survey Data for analysis, 2015

*****, **, and * is significant at 1%, 5%, and 10% level of probability respectively**

Table 4 shows the values of the estimated marginal effects and the quasi-elasticities calculated for the significant variables. This is done for the variables that are significant in the multinomial analysis. However, there are some variables that are significant in a group but not significant in another group. Such variables that are not significant are designated as not applicable (NA) in the table. Apart from the partial elasticities of farming experience that is inelastic, all other factors like age, household size, adoption and education are elastic. For the variable that is inelastic, the probability of classifying the farmers into any particular group is not greatly affected by marginal changes in the variable as a one percent change in the variable leads to a less than proportionate change in the probability of classification into the four other groups relative to the reference group. For the variables that are elastic, one percent change in these explanatory variables leads to a more than proportionate change in the probability of classification into the four other groups relative to the reference category.

Table 4: Marginal effect and quasi-elasticity estimates

Variables	Group 1 (Reference Group)	Group2	Group 3	Group 4	Group 5
Gender	0.1086	-0.1026	NA	0.1519	NA
	(0.5178)	(-0.5411)		(0.6137)	
Age(years)	NA	0.0093	-0.0105	NA	NA
		(2.5825)	(-2.9162)		
Education (years)	-0.1999	-0.0251	NA	0.0199	0.0265
	(-1.2933)	(-2.6999)		(1.0540)	(1.4137)
Farming Experience (years)	NA	-0.0171	NA	NA	NA
		(-2.6999)			
Adoption	-0.1954	-0.1634	NA	0.1255	0.1258
	(0.7148)	(-05969)		0.3361	(0.3446)
Household size	-0.1138	NA	0.1852	NA	NA
	(-1.2110)		(1.6748)		

*** = Marginal effects are above while partial elasticities are in parentheses**

NA=Not Applicable

Constraints militating against the Adoption of Improved Cassava Varieties in the study area

Investigating constraints limiting the non-adoption of improved cassava varieties in the study area revealed that almost all (91%) the non-adopters indicated inadequate credit facility. About 88% of the non-adopters indicated poor communication, while 86% indicated the lack of market. Twenty-three percent of the respondents indicated lack of extension advice. This result is in agreement with the findings of Umunakwe *et al*., (2015), where inadequate credit facility, lack of good communication and extension service all posed as major constraints to the adoption of improved cassava varieties.

Table 5: Constraints militating against the adoption of improved cassava variety

*Constraints	Frequency	Percentage
Technology is Inadequate	42	8.66
Lack of extension services	23	4.74
Poor communication system	88	18.1
Technology too complex to understand	32	6.6
Lack of market	86	17.7
Low price of cassava	45	9.28
Inadequate credit	91	18.8
Improved cassava variety is inaccessible	66	13.61
Scarcity of labour	12	2.474

***Multiple responses recorded**

Conclusion

The study revealed that among other factors (level of education, household size and farm size), adoption of improved cassava varieties have a significant impact on the income of the farming household. This to large extent is a means of self sustenance and poverty alleviation, especially among small to medium holder cassava farmers. Of course, there are militating factors to the adoption of improved cassava varieties as stated in the study. However with ease of access to improved cassava varieties, improved extension services to farmers, availability of government subsidy on agricultural inputs, enabling and conducive cassava market structure, availability of affordable labour for cassava production and standardized pricing for cassava products, all these challenges can be well mitigated, thereby ensuring the household income is enhanced. Also, adult schooling is recommended for uneducated farmers to help them make informed decision concerning adoption.

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