

## DIFFERENTIALS IN ADOPTION OF PRO-VITAMIN A CASSAVA VARIETIES AMONG FARMERS IN SOUTH-EAST AND SOUTH-SOUTH ZONES OF NIGERIA

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### ABSTRACT

*This study assessed the factors influencing adoption of Pro-vitamin A cassava by farmers in south-east and south-south zones of Nigeria. The data for the study were collected from 480 farmers in the study area. An interview schedule with a well-structured questionnaire was used for the study. The data were analyzed by descriptive and inferential statistics and way(s) of presentation included percentages, mean counts and multiple regression analysis. The coefficient of years in group membership and participation in extension activities had a direct relationship with level of adoption of pro vitamin A cassava at 5% and 10% significant level respectively. The coefficient of household size, farming experience, farm size, farm income and palatability had indirect relationship with level of adoption of pro vitamin A cassava at 1%, 5% and 10% significant level respectively. The result also showed high level of adoption ( $\bar{x}=3.3$ ) of pro vitamin A cassava among the respondents which other factors such as health /nutritional benefit of the technology might have influenced the adoption level. This paper therefore call for policies aimed at creating more nutritional information about the new cassava technology to sensitize the farmers more and regular participation in extension activities and belonging to cooperative association in order to boost adoption of pro vitamin A cassava in Nigeria.*

**Keywords: Pro- vitamin A Cassava, Varieties, Farmers, Adoption, Determinants.**

### INTRODUCTION

Cassava is an essential root crop widely grown by both male and female farmers in Nigeria (Ironkwe, 2012). It is a robust crop able to withstand disease, drought and pests. It can grow on poor marginal soils and is thus cultivated and eaten where both poverty and malnutrition is widespread (Harvestplus, 2013). Whilst Nigeria is the biggest global producer of cassava, at 60 mt in 2017, just 2.8% is pro vitamin A cassava. Switching to newly released pro vitamin A cassava varieties could provide up to 40% of the vitamin A recommended daily allowance for children under five, in a country where nearly one in three children under five and one-quarter of all pregnant women are vitamin A deficient. Pro-vitamin A cassava is a genetically improved cassava variety containing  $\beta$ -carotene (a precursor of vitamin A) which has the potential for the alleviation of vitamin A deficiency in low income population (Onyeneke *et al.*, 2018). In Nigeria, the world's largest producer and consumer of cassava, Vitamin A deficiency affects 30% of children under the age of 5 (WHO estimates, 2009). resulting in reduced immunity, impaired vision, and, in some cases, even blindness and death (Njoku *et al.*, 2013) Furthermore, these health impairments cost Africa's largest economy an estimated US \$1.5 billion in lost Gross Domestic Product (GDP) every year (Egesi *et al.*, 2014). Progressively, International Institute of Tropical

Agriculture (IITA), Ibadan in partnership with National Root Crops Research Institute (NRCRI), Umudike, Nigeria, developed these pro vitamin A cassava varieties using traditional breeding methods in a Harvest-Plus-funded project. The first three pro vitamin A cassava varieties were released in 2011 by the National Variety Release Committee of Nigeria as UMUCASS 36, UMUCASS 37, and UMUCASS 38; and are recognized as IITA genotypes TMS 01/1368, TMS 01/1412, and TMS 01/1371 while the last three varieties released later were UMUCASS 44, UMUCASS 45 and UMUCASS 46 (NRCRI, 2014). The project works with national partners and the private sector to ensure that the pro-vitamin A-rich varieties reach resource-poor farmers in Nigeria (Abdoulaye *et al.*, 2015). According to Ilona (2012), it was estimated that by 2018 more than 2 million farming households would be planting vitamin A cassava and at least 17 million rural and urban consumers would be consuming vitamin A *gari* and *fufu* in their regular diets. However, the rate of adoption of pro vitamin A cassava depends on its profitability in terms of its availability, affordability, accessibility, nutritional value, health benefits, high yield, marketability and quality of the products. The broad objective of the study is on differentials in adoption of pro-vitamin A cassava varieties among farmers in south-east and south-south zones of Nigeria. The specific objectives of the study were to

describe the socio-economic characteristics of respondents; determine the levels of adoption of pro vitamin A cassava by farmers and to analyze the determinants of adoption of pro vitamin A cassava by farmers in south-east and south-south zones of Nigeria.

## METHODOLOGY

The study was conducted in south-east and south-south zones of Nigeria. In south-east, farming is the predominant occupation of the people, majority of who are small-holder farmers while in south-south, resident population (65%) are engaged in agricultural activities while (35%) of them are into oil activities. The population of the study consisted of cassava farmers in the study area purposively selected from Imo and Anambra States representing south east and AkwaIbom and Delta states representing south-south Nigeria. This was because pro vitamin A cassava had been massively disseminated in those areas. Multistage sampling technique was used in selecting the sample size of 120 respondents from each state giving a total of 480 respondents cumulatively chosen from the four states. The first and second stages involve purposive selection of 8 agricultural zones (they were: Owerri and Orlu agricultural zones from Imo State; Aguata and Awka agricultural zones from Anambra State; Delta North and Central agricultural zones from Delta State and Ikot-Ekpene and Uyo agricultural zones from Akwa-Ibom state and 24 blocks from the eight agricultural zones. In the third stage, 48 circles were randomly selected from the blocks. Finally, 10 pro vitamin A cassava farmers were randomly selected from the circles, giving 120 respondents from each state and a total of 480 respondents across the states. Focus Group Discussion (FGD) with well-structured questionnaire were used to elicit information from the respondents to achieve the study objectives which were in sub-sections. Objectives 1 was analyzed using descriptive statistics such as percentage, objective 2 was analyzed using mean count (level of adoption of pro vitamin A cassava was measured by mean score of farmers, this was presented on a 3- point rating scale. The points were adopt and still using = 3, adopt and stopped = 2, never adopt = 1. In using the three point rating type, a mid-point was obtained by adding 3, 2 and 1 which gave 6 and when divided by 3 gave a mean score of 2.0 which was the bench mark), while objective 3 was analyzed using Ordinary Least Square regression, thus:

$$Y = b_0 + b_1 X_1 + e_i$$

Where:

Y = adoption of pro vitamin A cassava varieties

The value of log likelihood function is given as, empirical model are presented below;

$$Y = f (X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, \dots, X_n + e_i)$$

X<sub>1</sub> = educational qualification (years of schooling)

X<sub>2</sub> = household size: (no. of persons in a household)

X<sub>3</sub> = farming experience (years)

X<sub>4</sub> = farm size (hectares)

X<sub>5</sub> = farm income: (naira)

X<sub>6</sub> = easy access to farm credit (mean)

X<sub>7</sub> = member of cooperative (years)

X<sub>8</sub> = participation in extension activities (mean)

X<sub>9</sub> = level of palatability (mean)

e<sub>i</sub> = error term.

## RESULTS AND DISCUSSION

### The selected socio-economic characteristics of the respondents

The results in Table 1 showed that moderate proportion (51.5%) of the respondents in the study area had spent 12-18 years acquiring one form of education or the other. This implied that they are literate. Certainly, education exposes farmers to new development in agriculture and empowers them to adopt desirable technologies. This finding agrees with Amadi *et al* (2018) who reported that 50%-95% of farmers studied had obtained one form of formal education or the other and that higher literacy level increases the chances of adoption of a technology. Majority (66.5%) of the respondents in the study area had household size of 5-8 persons. The size of the household is attributable to the need for cheap and dependable labour derivable for involvement in pro vitamin A cassava production. This is in line with the findings of Abdoulaye *et al*, (2015) that large households are better adopters of improved cassava varieties in Nigeria. This implies that household has a lot of bearing on their ability to adopt pro vitamin A cassava. The result also showed that majority (56.9%) of the respondents in the two zones had 4-6 years of experience in farming pro vitamin A cassava. The findings show that farmers were made up of people who were both fairly experienced and also relatively new in pro vitamin A cassava farming. The report of Harvestplus, (2014) agrees in part with these findings when it stated that technical skill and experience are determinant factor of farmers' involvement in pro vitamin A cassava farming. Majority (73.2%) of the respondents had farm size of between 0.1-0.99 hectares with a mean farm size of (0.64 hectare). These predominant small sizes at least gave credence to previous studies on pro vitamin A cassava farms which have always been reported as being characteristically small scale production. Majority (77.7%) of the respondents have extension contact. This factor proved essential in the dissemination and adoption of pro-vitamin A cassava improved farming practices. According to Bouis and Saltzman (2017), extension was provided to farmers along with promotional free stem bundle packs for (low-risk) field trials and it prove successful because farmers who found it desirable further made commercial purchases to increase the use of this yellow cassava variety and distribute to other farmers. Majority (65.9%) of the respondents have belonged to group membership for few years. This

implies that the respondents are still young in years as group members in the study area particularly in

Imo and Anambra states.

**Table 1: Distribution of respondents based on their selected socio-economic characteristics**

Variables	Imo		Anambra		Delta		AkwaIbom		Pooled
	F	%	F	%	F	%	F	%	%
<b>Years spent in Education</b>									
0 year	8	6.7	2	1.7	0	0	0	0	21
6 – 12 years	62	51.7	38	31.7	41	34.2	20	16.7	33.6
12 -18 years	41	34.2	66	55.0	74	61.7	66	55.0	51.5
18 years and above	9	7.5	14	11.7	5	4.2	34	28.3	12.9
<b>Mean</b>		<b>13.7</b>		<b>10.4</b>		<b>11.2</b>		<b>12.8</b>	<b>12.0</b>
<b>Household size</b>									
1-4	13	10.8	43	35.8	7	5.83	29	24.2	17.9
5-8	65	54.2	72	52.5	113	94.2	78	65.0	66.5
9-12	42	35.0	5	4.1	0	0	23	19.2	14.6
<b>Mean</b>		<b>6.0</b>		<b>6.0</b>		<b>6.0</b>		<b>6.0</b>	<b>6.0</b>
<b>Farming experience</b>									
1-3	45	37.5	47	40.2	69	57.5	46	38.3	43.4
4-6	75	62.5	73	60.8	51	42.5	74	61.7	56.9
<b>Mean</b>		<b>3.7</b>		<b>3.7</b>		<b>3.4</b>		<b>3.7</b>	<b>3.6</b>
<b>Farm size</b>									
0.1-0.99	95	79.2	81	67.5	92	76.7	83	69.2	73.2
1.0-1.99	24	19.9	39	32.5	27	22.5	35	29.2	26.0
2.0 and above	1	0.8	0	0	1	0.8	2	1.7	0.8
<b>Mean</b>		<b>0.60</b>		<b>0.64</b>		<b>0.60</b>		<b>0.7</b>	<b>0.64</b>
<b>Extension contact</b>									
Yes	79	65.8	87	72.5	105	87.5	102	85	77.7
No	41	34.2	33	27.5	15	12.5	18	15	22.3
<b>Group Membership</b>									
1-10	85	70.83	93	77.5	52	42.2	50	41.7	65.9
11-20	35	29.17	27	22.5	55	43.8	58	48.3	32.0
21 and above	0	0	0	0	18	14.0	12	10.0	3.1
<b>Total</b>	<b>120</b>		<b>120</b>		<b>120</b>		<b>120</b>		<b>480</b>

Source: field survey, 2018

Note: F = Frequency; % = Percentage

#### Level of Adoption of Pro Vitamin A Cassava by Farmers

Table 2 shows that the pro vitamin A cassava varieties disseminated to the farmers in the study area were adopted in varying degrees. The mean scores of adoption of pro vitamin A cassava among farmers were Imo ( $\bar{x}$  =3.0), Anambra ( $\bar{x}$  =3.6), Delta ( $\bar{x}$  =3.0) and AkwaIbom ( $\bar{x}$  =3.8). The pooled mean score was ( $\bar{x}$  =3.4). Using the adoption indicator, the level of adoption in Anambra and AkwaIbom were very high while Imo and Delta had high adoption rate and it implies that the respondents adopted the pro vitamin A cassava disseminated to them through HarvestPlus project encompassing IITA, Ibadan,

NRCRI, Umudike and other partners in 2012 and 2014. The implication of the results of the adoption level of pro vitamin A cassava in the study implied that adopters adopted the technology because of the impact on their socio-economic status and also for curiosity to have and utilize new technology, good quality of the technology, high yield, nutritional/health benefits and marketability value. Comparatively, south-south had high level of adoption than south-east and this could be as a result of nature of the delivering agency and access to extension services. This finding is in accordance with the report of Abdoulaye *et al.* (2014) who stated that several factors could drive the adoption process. It is

also expected that high adoption would bring about improvement in the health and economic condition of this poor farmers and reduce the level of vitamin A deficiency in the study area. This agrees with the

findings of Akintola (2010) that low or non-adoption could be conditioned by institutional and structural factors, such as social networks and the market structure of seed systems.

**Table 2: Mean score responses of the farmers based on their level of adoption of pro vitamin A cassava**

Pro vitamin A cassava varieties	Imo (n=120)		Anambra (n=120)		Delta(n=120)		AkwaIbom (n=120)		Pooled (n=480)	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
UMUCASS36,TMS011368										
UMUCASS37,TMS1011412										
UMUCASS38TMS1011371										
UMUCASS44TMS070220	3.00	.2.933	3.66	1.159	3.00	2.942	3.76	1.065	3.39	.8760
UMUCASS45TMS1070593										
UMUCASS46TMS1070539										
<b>Grand mean</b>	<b>3.0</b>		<b>3.6</b>		<b>3.0</b>		<b>3.7</b>		<b>3.3</b>	

Source: field survey, 2018

#### Determinants of Adoption of pro vitamin A cassava among the farmers

The estimates of the regression analysis of the determinants of pro vitamin A cassava adoption by farmers in South- East and South- South Nigeria were summarized and presented in Table 3. The R<sup>2</sup> value was 0.432 for the pooled data for South- East and South- South indicating that 43% of the variation in the adoption of pro vitamin A cassava was accounted for by the explanatory variables expressed in the model. The R<sup>2</sup> value for Imo, Anambra, Delta and AkwaIbom were 0.841, 0.406, 0.459 and 0.612 indicating 84%, 40%, 45% and 61% with Imo state chosen as the lead equation state for the four functional forms based on the value of R<sup>2</sup>. The F-value was significant at 1% probability level respectively, indicating the goodness of fit of the model used in the analysis.

The result shows that coefficient of household size was highly significant at 1% and negatively related to adoption of pro vitamin A cassava in South-East and South-South Nigeria. This implies that any increase in household size will lead to a corresponding decrease in the probability of adoption of pro vitamin A cassava among farmers in the study area. This is an indication that smaller household size is a more expensive way of providing farm labour, increasing labour or farming on a farm land and this influences adoption. This finding is not in line with *a priori* expectation and is in line with the findings of Ironkwe (2012) that small household sizes also provided enough required labour that met the demand of some of the cassava technologies in south-east.

Therefore, household size is not necessarily a requirement to adopt pro vitamin A cassava in the study area, even though it plays a role in increasing farm size and reduction of labour cost. The coefficient of farming experience was negative and was significantly related to adoption of pro vitamin A cassava at 10% level of probability in the study area. This implies that the propensity to adopt decreases as experience in farming, measured by the number of years put into farming activities, increases. This could be due to the fact that farmers become more adapted to certain ways of doing things, and the process of adopting a new innovation is always difficult. The farmers that farm on a rented land also tend to have a higher probability of adopting a yellow cassava variety. This could be attributed to the desire to achieve a higher output per hectare in the study area. This finding is not in line with *a priori* expectation and findings of Anyanwu *et al*, (2016) who reported that increase in years of experience would enable farmers to efficiently produce effectively and maximize agricultural output for improved income. The coefficient of farm income was revealed to be negative and significantly related to adoption at 10% level in the study area. It can be adduced that an increase in farm income decreases the probability of adoption of pro vitamin A cassava by farmers in the study area. Increase in farm income is expected to boost adoption of agricultural technologies because a poor farmer may not readily adopt an innovation that is too expensive. This is not in line with *a priori* expectation and findings of Nwakor, *et al*; (2016) who says that a unit increase in income will cause increase in adoption of the technologies. The coefficient of years in group membership was positively related to adoption of pro vitamin A cassava and statistically significant at 5%

alpha level. This indicated that the more in group membership the more the adoption of pro vitamin A cassava in the two zones. This also is in accordance with *a priori* expectations. Farmers who belong to group associations are likely to be aware of pro vitamin A cassava varieties and most institution both extension and research interact more with farmer based organizations with the aim of reaching out to many farmers within the shortest time frame with improved varieties and innovations. This result is consistent with the findings of Natson *et al.* (2018) that cooperative societies ensure collective production, marketing, enables farmers to access loans, training, ensuring pooling of resources together and reduction of information asymmetry thus reducing transaction costs and ensuring economies of scale. The coefficient of farmers' participation in extension activities was positive and significant at 10% level of probability in the two zones. This is in line with *a priori* expectation as

extension provides farmers with information on availability and technical skills for using pro vitamin A cassava. Access to extension has been widely reported to positively influence adoption and continued use of agricultural technologies (Knowler and Bradshaw, 2007). This is also in line with the report of Onyeneke, *et al;* (2018) who reported that access to extension services proved essential in the dissemination and acceptance of the new technology of pro-vitamin A bio fortified cassava varieties in Akwalbom. The coefficient of farmers' level of palatability was negative and significant at 10% level of probability in the study area. This implies that any increase in the level of palatability of the farmers will lead to a corresponding decrease in the probability of adoption of pro vitamin A cassava products among farmers in the study area. Comparatively, the levels of adoption of pro vitamin A cassava were more influenced more by farmers in South-East than in South-South Nigeria.

**Table 3: Ordinary least square regression analysis result of the determinants of adoption of pro vitamin A cassava among the respondents (n=480).**

Variables	Imo Semi-log	Anambra Linear	Delta Linear	Akwalbom Linear	Pooled Linear
Constant	.977 (.884)	-5.248 (2.221)***	1.119 (6.84)***	.986 (3.814)***	.400 (3.840)***
Educational Qualification	.060 (1.289)	.310 (3.459)***	-.495 (-5.39)***	.158 (1.40)	.011 (.229)
Household size	.037 (0.647)	-.086 (-.989)	-.038 (-.465)	-.069 (-.975)	-.153 (-2.86)***
Farming Experience	.680 (8.114)***	.166 (1.857)*	.029 (.304)	.114 (1.340)	-.120 (-2.248)*
Farm Size	-.063 (-.874)	-.272 (-2.956)**	-.265 (-2.729)**	-.005 (-.065)	.132 (-2.762)***
Farm Income	-.018 (-.337)*	.196 (2.490)**	.028 (.335)	-.071 (-1.110)	-.130 (-2.011)*
Easy Access to Farm Credit	-.073 (-1.687)*	.313 (3.286)***	.262 (3.194)**	-.043 (-.582)	-.015 (-.234)
Years in Group Membership	-.040 (-.968)	.162 (2.127)*	-.412 (5.042)***	-.672 (-6.952)***	.109 (2.115)**
Participation in Extension activities	.105 (2.072)**	-.115 (-1.244)	.150 (1.984)*	-.089 (-1.112)	.092 (1.724)*
Level of Palatability	-.202 (-2.269)**	.139 (1.776)*	.066 (.901)	.016 (.217)	-.100 (-2.144)**
<b>F. stat</b>	<b>64.663***</b>	<b>8.363***</b>	<b>9.578***</b>	<b>19.247***</b>	<b>6.915***</b>
<b>R<sup>2</sup></b>	.841	.406	.439	.612	.432
<b>R- adjusted</b>	.828	.358	.393	.580	.412

Source: Field Survey data, 2018

Key: Significant at 1%\*\*\*, Significant at 5% \*\* Significant at 10%\* level of probability

## CONCLUSION

The study has shown that pro vitamin A cassava varieties have been adopted by farmers in south-east and south-south zones of Nigeria. The study also concluded that explanatory variables such as household size, farming experience, farm income, group membership, participation in extension activities and level of palatability determined farmers' adoption of pro vitamin A cassava varieties and have a lot of bearing on their ability to adopt pro vitamin A cassava. This paper therefore call for policies aimed at encouraging extension workers and the technology developers by providing them with all it takes to carry out nutritional information campaigns with regards to pro vitamin A cassava to boost the degree of adoption and consumption in order to boost the immune system of adopters in the study area.

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