Effects of Improved Vegetable Seeds on Farmers' Income and Poverty Status in Selected LGAS, Rivers State, Nigeria

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Abstract

This study examined the effects of access to improved vegetable seeds on farmers' income and poverty reduction in Rivers State, Nigeria. Primary data obtained through the use of well-structured questionnaire was collected through a multistage sampling technique in selecting 180 vegetable farmers. Data collected were analysed using both descriptive (mean, frequency and percentages) and inferential statistics such as logit and ordinary least square regression model and principal component analysis. The results of the socioeconomic characteristics of the vegetable farmers in the study area showed that majority (70%) of the vegetable farmers were 45 years and below with mean age of 37.4 years, majority (80%) of the vegetable farmers were female while 50% were married. Majority (55%) had secondary education with mean years spent in school of 14 years, 50% of the vegetable farmers had between 1-5 years experiences in vegetable farming with mean farming experience of 8years, 55.56% cultivated between 0.1-0.5 hectares of land with mean farm size of 0.55 hectares. Majority (60%) had between 1-5 contacts with the extension agents, 90% had no access to credit while 70% of the vegetable farmers were members of cooperative organization. The level of access to improved vegetable seeds in the study showed that 70% of the vegetable farmers had no access to improved vegetable seeds. The coefficient of education, access to credit, farm size, household size, income and access to improved vegetable seeds were significant and statistically influenced the poverty status of the vegetable farmers in the study area. The result of the effects of access to improved vegetable seeds on income of vegetable farmers showed that the coefficient of marketing experience, household size, education, credit amount, farm size and access to improved vegetable seeds were significant and statistically influenced the income of the vegetable farmers in the study area. The major constraints to access to certified vegetable seeds were poor seed distribution networks and rural infrastructures, lack of market information, poor access to agricultural credit, lack of resources for training and information dissemination and poor extension services. It was concluded that access to improved vegetable seeds are key drivers of increasing productivity which in turn increase farmers' income and reduced poverty and recommended that public and private agricultural advisory/extension services providers should intensify their efforts in the provision of advisory/extension services and educate vegetable farmers on improved vegetable seeds for improved productivity and reduction in poverty status of the vegetable farmers.

Keywords: *Improved, Vegetable, Seed, Access, Productivity, Poverty*

INTRODUCTION

The most important prerequisite for good crop production is the availability of good quality seeds of high-yielding varieties (Oyekale *et al*., 2014). The quality of seeds alone is known to account for an increase in productivity of at least 10–15percent. To achieve this high quality, all the factors in production that will affect viability and genetic purity should be taken into account.

A quick development in agriculture would serve as a catalyst for the improvement of the standard of living for majority of Nigerians and for agriculture to develop, access by farmers to productive resources that are crucial to increase productivity is essential. Improved seed is an important input in all crop-based farming system and is a key factor in determining the upper limit of yield and therefore the ultimate productivity of input such as pesticides, fertilizer and agricultural technology (Maredia & Howard, 1998; Cromwell, 1990).

Diversification into vegetable crops could play key role in overcoming the economic challenges of poverty and unemployment in rural areas. Vegetable production can be profitable even on small farms; it generates a regular income stream as production cycles are shorter and less seasonally-bound, and consumer demand is rising (Schreinemachers *et al*., 2018). Being more intensive and less easily mechanized, vegetable production, processing and marketing can create additional employment in rural and peri-urban areas, which could benefit women and youth (UN, 2015).

The first Sustainable Development Goal, to end poverty in all its forms and everywhere depends on raising the productivity of agriculture (von Braun, Swaminathan, & Rosegrant, 2004). However, (von Braun *et al*., 2004) argued that the research agenda for agriculture must be broadened from cereal crops and must put more emphasis on vegetables.

Objectives of the Study

i describe the socioeconomic characteristics of the vegetable farmers in the study area
i examine the level of access to improved vegetable seeds in the study area;
ii Estimate the determinants of Access to Improved Vegetable Seeds and their Effects on Income of Vegetable Farmers
iii analyze the effect of the Determinants of access to improved vegetable seeds and their Effects on income of vegetable farmers
iv identify constraints to accessing improved vegetable seeds in the study area.

Theory of Individual Deficiencies

This theory of poverty asserts that the individual is responsible for their own poverty situation. Gans, (1995) and cited by Sameti *et al* (2012) believe that the individual factors that cause or fuel poverty include individual attitude, human capital, and welfare participation. Bradshaw (2006) blame the poor for creating their own problems arguing that with hard work and better choices the poor could have avoided and solved their problems. He further explained that poverty is caused by lack of genetic qualities such as intelligence that are not so easily reversed.

METHODOLOGY

Study Area

The study area for this study was selected local government areas namely (Obiakpor, Oyigbo and Ahoada West) local government areas all in Rivers State.

Research Design

This study adopted a survey research design because of its nature and the sourcing of information from the respondents. Questionnaire were utilized for data gathering in this study.

Population of the Study

The population of this study comprised of 180 vegetable farmers, systematically selected from Obiakpor, Oyigbo and Ahoada West local government areas in Rivers State.

Sampling Procedure and Sample Size

Simple random sampling of 3 communities from the 3 selected local government areas making a total of 9 communities were used for the study. The list of vegetable farmers was compiled to serve as the sampling frame for the study from which 20 vegetable farmers, systematically selected to give a total sample size of 180 vegetable farmers for the study.

Data Collection Methods and Sources

Data for this study was collected from primary source using well-structured questionnaire. Also, enumerators from ADP were engaged and trained to help in the data collection. The questionnaire was designed to cover all the specific objectives of the study.

Method of Data Analysis

Descriptive and inferential statistics were used to achieve the stated objectives. Objectives one, which was to describe the demographic and socioeconomic characteristics of the vegetable farmers in the study area was actualized using descriptive statistics. Objective two which was to estimate the income level and poverty status of the respondents in the study area was actualized using descriptive statistics. Objectives three which was to determine the effect of access to improved vegetable seed on poverty status among vegetable farmers in the study area was achieved using logit model. Objective four which analyzed the effect of access to improved vegetable seeds on income of vegetable farmers in the study area was achieved using ordinary least square regression analysis. Objective five which identified constraints to accessing improved vegetable seeds among vegetable farmers in the study area was achieved using the principal component analysis.

Model Specification
Logit Model

Logit regression model was employed to estimate the effect of access to improved vegetable seed on poverty status among vegetable farmers in Rivers State, Nigeria. The functional form of logit model is specified as follows (Gujarati, 2003):

$$Pi = E\left(Y = \frac{1}{Xi}\right) = \frac{1}{1+e^{-(\alpha + \beta Xi)}} = \frac{1}{1+e^{-(Zi)}} \quad (1)$$

For ease of exposition, the logit becomes a linear function of different explanatory variables: -

$$L_i = \ln\left(\frac{P_i}{1-P_i}\right) = Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_{2.....+} \beta_9 X_9 \quad (2)$$

Where, Y is the poverty status of the vegetable farmer,

P_i is the probability of been poor,
$1 - P_i$ is otherwise
L_i is the logit,
X_i is a vector of explanatory variables such as:
X_1 age (years)
X_2= sex (female=0, male=1),
X_3= education (years)
X_4= household size (number)
X_5= marital status (married=1, otherwise=0)
X_6= farm size (hectares)
X_7=Income (₦)
X_8= access to improved seeds (1= access, 0= subsistence)
X_9= access to credit (yes=1, otherwise =0)
β_n is a vector of parameters to be estimated.

OLS Regression Model

The models were specified as follows:
Linear: $Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 +$ ei (3)
Exponential: $\text{In}Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 +$ ei (4)
Semi-log:
$Y_i = \beta_0 + \beta_1 \text{In}X_1 + \beta_2 \text{In}X_1 + \beta_3 \text{In}X_1 + \beta_4 \text{ln}X_1 + \beta_5 \text{In}X_1 + \beta_6 \text{In}X_1 + \beta_7 \text{In}X_1 + \beta_8 \text{In}X_1 +$ ei (5)
Double-log:
$\text{In}Y_i = \beta_0 + \beta_1 \text{In}X_1 + \beta_2 \text{In}X_1 + \beta_3 \text{In}X_1 + \beta_4 \text{In}X_1 + \beta_5 \text{In}X_1 + \beta_6 \text{ln}X_1 + \beta_7 \text{In}X_1 + \beta_8 \text{ln}X_1 +$ ei (6)
Where Y_i = Income (₦)
X_1 = marketing experience (years),
X_2 = age (years),
X_3 = household size (number of persons),
X_4 = education (years),
X_5 = marital status (1= married, 0 otherwise)
X_6 = amount of credit used (₦).
X_7 = farm size (ha)
X_8 = access to improved seeds (1= access, 0 otherwise)

Principal Component Model

To identify market, institutional and socioeconomic factors affecting access to certified vegetable seeds in the study area, Principal Component Analysis (PCA) with varimax – rotation and factor loading of ± 0.30 was used. Therefore, variables with factor loading of less than ± 0.30 and variables that loaded in more than one factor was discarded (Ashley *et al.*, 2006; Onya *et al.*, 2016).
The model is given as:
$Z_1 = a_{11}X_1 + a_{12}X_2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots a_{1n}X_n$
$Z_2 = a_{21}X_1 + a_{22}X_2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots a_{2n}X_n$
$Z_3 = a_{31}X_1 + a_{32}X_2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots a_{3n}X_n$
$Z_n = a_{n1}X_1 + a_{n2}X_2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots a_{nn}X_n$ (7)
Where
$Z_1, Z_2 \ldots Z_n$= Principal Components

$a_1 - a_n$= Factor loadings or Correlation Coefficient
$X_1, X_2 \ldots X_n$= Unobserved underlying factors constraining farmers' participation in vegetable value chain across the state.

RESULTS AND DISCUSSION

Socioeconomics characteristics of the respondents in the study area

Information about the socioeconomic characteristics of vegetable farmers in the study area are presented in Table 1

Table 4.1 Socioeconomics characteristics of the respondents in the study area

Variable	Frequency	Percentage	Mean
Age Group			
26-35	36	20.00	
36-45	90	50.00	
46-55	36	20.00	
56-65	18	10.00	
Mean Age			**37 Years**
Sex			
Male	36	20.00	
Female	144	80.00	
Marital Status			
Single	54	30.00	
Married	90	50.00	
Separated	09	5.00	
Widowed/widower	27	15.00	
Household Size			
1-3	40	22.22	
4-6	117	65.00	
7-9	23	12.78	
Mean Household Size			**6 persons**
Level of Education			
No Formal Education	09	5.00	
Primary	09	5.00	
Secondary	99	55.00	
Tertiary	63	35.00	
Mean Years Spent in School			**14 Years**
Farming Experience			
1-5	90	50.00	
6-10	45	25.00	
11-15	28	15.56	
16-20	17	9.44	

Mean Farming Experience			**8 Years**
Farm Size			
0.1-0.5	100	55.56	
0.6-1.0	45	25.00	
1.1-1.5	30	16.67	
1.6-2.0	15	8.33	
Mean Farm Size			**0.55 Hectare**
Extension Contact			
1-5	108	60.00	
6-10	72	40.00	
Mean Extension Contact		4.5 Years	
Access to Credit			
Access	18	10.00	
No Access	162	90.00	
Cooperative Membership			
Member	126	70.00	
Non-Member	54	30.00	

Source: Field Survey, 2022

Table 1 shows the socio-economic characteristics of the respondents in the study area.The distribution of the respondents based on age showed that majority (70%) of the vegetable farmers were 45 years and below. The mean age of the vegetable farmers was 37 years. Age is believed to influence the level of physical work of the vegetable farmers and their access to certified vegetable seeds. This is line with the findings of Hailua *et al.* (2015). On the other hand, Randela *et al.* (2008) stated that younger farmers are innovative and they understand the need of the day and are aware of the benefits which adoption of innovations provide.

The distribution of the respondents based on sex showed that majority (80%) of the vegetable farmers were female while 20% were male. This suggests that vegetable farming in Rivers State is dominated by female folks. This is in line with the findings of (Elum *et al.*, 2016) who reported that vegetable (cucumber) production is likely a gender skewed occupation as majority of the farmers were women, and agrees with Wilcox *et al*. (2015) that more women are involved in agriculture. This also imply the women participation in agriculture increase income thereby reducing poverty.

The distribution of respondents based on their marital status showed that majority (50%) of the vegetable farmers were married, 30% were single, 5% were separated while 15% were widowed. This implies that vegetable farming is dominated by married farmers in the study area. Being married may provide the vegetable farming household with enough labour to supplement the cost of hired labour and subsequently boost productivity and reduce poverty in the study area. The implication is that vegetable farming can sustain household income.

The distribution of the respondents based on their household size showed that majority (65%) of the vegetable farmers had between 4-6 persons in their household, 22.22% had between 1-3 persons in their household while 12.78% had between 7-9 persons in their household. The mean

household size of the vegetable farmers was 6 persons. This implies that the vegetable farmers in the study area had moderate household size which could help them in supplementing hired labour thereby reducing their overall cost of production.

The result on their level of education showed that majority (55%) of the vegetable farmers had secondary education, 35% had tertiary education, while 5% had primary and no formal education respectively in the study area. The mean years spent in school of the vegetable farmers was 13.6 years. Educational attainment of the vegetable farmers will go a long way to raise their productivity and enhance their ability to understand and evaluate information on new techniques and processes. This result is in line with the findings of Uwagboe *et al.* (2010) and Elum *et al.* (2016) that the farmers' level of education could enhance their farming activities, level of awareness and level of receptivity of improved technologies. In addition, an educated labour force can easily adapt to the dynamic needs of a changing economy. More so, educated farmers are more amenable to risk taking and change than non-educated ones (Nwaru *et al.*, 2006).

The result on their farming experience showed that majority (50%) of the vegetable farmers had between 1-5 years' experiences in vegetable farming, 25% had between 6-10 years' experiences in vegetable farming, 15.56% had between 11-15 years of experience in vegetable farming while 9.44% of the vegetable farmers had between 16-20 years of experience in vegetable farming. The mean farming experience of the vegetable farming was 7.8 years. Experience is expected to have a significant positive impact on the managerial ability of the respondents. Therefore, the more experienced they are, ceteris paribus, the more efficient he would be in management because the acquired experience over the years would be brought to bear on their activities. This result agrees with Busari *et al.* (2013) who noted that the years of farming experience plays vital role in influencing farmers' production. This is because the number of years a farmer has spent in the farming business is an indication of the level of practical knowledge, he may have acquired through experience on decisions taken and dealing with production, processing and marketing challenges. Increase in number of farming years would likely result in higher efficiency for the farmer by improving their level of productivity and income, thereby reducing poverty in the study area.

The result on farm size showed that majority (55.56%) of the vegetable farmers cultivated between 0.1-0.5 hectares of land, 25% cultivated between 0.6-1 hectare of land, 16.67% cultivated between 1.1-1.5 hectares of land while 8.33% cultivated between 1.6-2 hectares of land. The mean farm size was 0.55 hectares. This implies that vegetable farmers in the study area were smallholder farmers and this could have implications on the net income and poverty status

The result on extension contact showed that majority (60%) of the vegetable farmers had between 1-5 contacts with the extension agents while 40% had between 6-10 contacts with the extension agents in the study area. By implication, farmers that frequently contact extension experts are expected to adopt new technology and have better access to certified vegetable seeds (Gelaw & Bezabih, 2004; Muratbek *et al.*, 2020), which leads to high productivity and reduced poverty as concluded by Mwalupaso *et al.* (2019).

The result on their access to credit showed that majority (90%) of the vegetable farmers had no access to credit while 10% had access to credit facilities in the study area. Access to credit is expected to stimulate production, increase income and reduce the level of poverty among the vegetable farmers in the study area. This is in line with the work of Jatto et al., (2021) who noted that 86.67% of the farmers did not receive any credit leading high poverty level among the farmers in Oyo State.

The distribution of the respondents based on their membership of cooperative organization showed that majority (70%) of the vegetable farmers were members of one cooperative organization or the other, while 30% were non-members of cooperative organizations in the study area. Access to improved vegetable seeds by vegetable farmers is considered as a pathway for breaking poverty trap. It is expected that, access to certified vegetable seeds will increase productivity and provide additional income to vegetable farmers thereby accelerating economic growth and help millions of farmers to move out of poverty. Wossen *et al.* (2017) asserted that cooperative members are more likely to have access to improved technology than non-members.

Level of Access to Local and Certified Vegetable Seeds

The level of access to local and improved vegetable seeds in the study area is presented in Table 2

Table 2: Level of Access to Improved Vegetable Seeds in the Study Area

Access to Local Seed	Frequency	Percentage
Access	171	95.00
No Access	09	5.00
Access to Improved Seed		
Access	54	30.00
No Access	126	70.00

Source: Field Survey, 2022.

The level of access to local and improved vegetable seeds in the study showed that majority (95%) of the vegetable farmers had access to local seeds while 5% had no access, for improved seeds 70% had no access while 30% had access. The implication is that there need to create more awareness on the importance of adopting improved vegetable seeds use and to increase the availability of the seeds to farmers to enable them incorporate them in their farming. Improved seeds varieties have characteristics that can lead to greater agricultural production, on average, than traditional seeds. These seeds have higher yield potential, are more responsive to fertilizer and irrigation, have shorter maturation periods, have longer storage capabilities, are more tolerant of environmental stresses and/or have a higher nutrient content (Alessandra, *et al.,* 2018).

Determinants of Access to Improved Vegetable Seed and its Effects on Poverty Status of Vegetable Farmers

The estimate of the determinants of access to improved vegetable seed and its effects on poverty status of vegetable farmers is presented in Table 3

Table 3: Estimate of the determinants of access to improved vegetable seed and its effects on poverty status of vegetable farmers

Variable	Coefficient	Standard Error	Z-Value
Constant	-1.5249	-0.2444	6.24***
Age	-0.8334	-1.4866	0.56
Sex	2.3304	1.6129	1.44
Marital Status	1.6503	1.1156	1.48
Education	-3.3799	-1.5140	2.23**
Access to Credit	0.8513	0.4512	1.89*
Farm Size	-0.3220	-0.101	3.19***

Household size	0.0846	0.011	7.69***
Income	-2.1636	-0.3846	5.63***
Extension Contact	-3.7691	-3.9001	0.97
Cooperative Membership	0.0493	0.0418	1.17
Access to certified seed	-0.8964	-0.3873	2.31**
Log Likelihood	-176.091		
LR Chi^2	209.38		

Source: Field Survey, 2022 *Notes*: ***, **, and * indicates statistically significant at 1 percent, 5 percent and 10 percent level of significance respectively.

The result of the logit model in Table 3 indicates that explanatory variables hypothesized as factors (determinants) that influence poverty status of a vegetable farmer in the study area given the change in the z-score for a one-unit change in the predictor. The likelihood ratio chi-square of 1209.38 with a p-value of 0.0001 tells us that our model as a whole is statistically significant, that is, it fits significantly better than a model with no predictors, suggesting that the model has a strong explanatory power. In terms of consistency with *a priori* expectations on the relationship between the dependent variable and the explanatory variables, the model seems to have behaved well.

The coefficient of education was negative and significant at 5% level. This implies that the odds of a vegetable farmer being poor increased by a factor of -3.3799 with every unit decrease in education in the study area. The negative relationship implies that the higher the level of education attained, the lower the probability of the farmers being poor. This finding is consistent with a priori expectations. Education is vital for boosting the productivity of the farmers and making them more aware of the availability of certified vegetable seeds for opportunities of earning a higher income and reduction in their poverty status.

The coefficient of access to credit was negative and significant at 10% level. This suggests that the odds of a vegetable farmer being poor increased by a factor of -0.8513 with every unit decrease in access to credit in the study area. Meaning, households identified as receiving credit were less likely to be poor than those that did not get credit. Credit assists the farm households in the purchase of farm inputs such as fertilizer, herbicides, improved seeds and investment demand which will ultimately increase their productivity and in turn aid the households to escape from poverty. This is expected, and it is in line with the findings of Oyakhilomen and Kehinde (2016) who reported that access to credit was negatively related to the poverty status of the farm households. That, access to credit enhances the farmers' production capacity through purchase of inputs such as improved seeds and fertilizer, reduce liquidity constraints, and increase the capacity of households to start off-farm businesses.

The coefficient of farm size was negative and significant at 1% level. The negative relationship implies that the higher the farm size the lower the probability of the farmers being poor. Large farm size enables the farmer to increase the quantity of inputs that will be employed for farming with a view of obtaining larger output at the point of harvest. It is expected that higher farm size will lead to higher output and income which will reduce the poverty level of the farmers in the study area.

The coefficient of household size was positive and significant at 1% level. This implies that the odds of a vegetable farmer being poor (Y=1) increased by a factor of 0.0846 with every unit

increase in household size in the study area. This further indicates that poverty is increased by higher household size and this could be attributed to increase in the needs of the household as their household size increases. The result conforms to the study of Oyakhilomen and Kehinde (2016); Jatto *et al.*, (2021) who separately reported that an increase in size of the farming household increases the probability of a household being poor.

The coefficient of income was negative and significant at 1% level. This implies that increase in income lowers the poverty status of the vegetable farmers in the study area. The negative relationship implies that the higher the income of the farmers the lower the probability of the farmers being poor. This result is in conformity with a priori expectations and also supports the findings from (Ekanem & Augustine 2015; Osuji and Henri-Ukoha, 2017) who separately reported that an increase in net farm income lowers the probability of the farmers being poor.

The coefficient of access to improved vegetable seed was negative and significant at 5% level. This implies that access to vegetable seed has the tendency to lower the poverty level of the vegetable farmers in the study area. The negative relationship implies that the higher the access to certified vegetable seeds the lower the probability of the farmers being poor. Access to improved vegetable seeds increases farmer's productivity with a resultant increase in income which reduces their poverty levels.

Determinants of Access to Improved Vegetable Seeds and its Effects on Income of Vegetable Farmers.

The determinants of access to improved vegetable seeds and it effect on income of vegetable farmers in the study area is presented in Table 4

Table 4: Estimate of the Determinants of access to improved vegetable seeds and its Effects on income of vegetable farmers

Variable	Linear +	Exponential	Semi log	Double log
Constant	1.5191	0.9283	0.5129	1.1913
	(2.43)**	(1.92)*	(3.55)***	(1.19)
Marketing	5.3341	1.1829	0.1923	3.2321
experience	(4.13)***	(1.11)	(0.99)	(1.55)
Age	-0.8392	-3.2801	-0.3471	-4.0391
	(0.11)	(2.15)*	(2.33)**	(2.42)**
Household size	-3.4738	-4.9031	-0.3829	-3.1093
	(2.45)**	(1.91)*	(1.33)	(1.51)
Education	3.0192	0.2938	0.8371	0.0193
	(3.13)***	(1.01)	(2.13)*	(4.14)***
Marital status	-0.0076	-0.7381	-0.1027	-0.3671
	(0.01)	(0.53)	(1.01)	(0.72)
Loan amount	0.0035	0.7812	1.0938	0.5429
	(2.11)*	(1.76)*	(1.69)*	(1.43)
Farm size	1.0173	1.0167	0.1981	0.3317
	(5.61)***	(2.42)**	(0.77)	(1.90)*
Access to	1.9371	2.9017	1.9021	0.9827
certified seeds	(2.56)**	(1.99)*	(3.33)***	(2.44)**
R^2	0.921	0.894	0.863	0.854
Adjusted R^2	0.914	0.861	0.851	0.838

F-ratio	233.56	198.01	187.32	181.09

Source: Field Survey, 2022. *Notes*: ***, **, and * indicates statistically significant at 1 percent, 5 percent and 10 percent level of significance respectively.

To estimate the determinants of access to improved vegetable seeds and its effect on income of vegetable farmers in the study area, multiple regression analysis was used. The result of the findings is presented in Table 3. The result showed that linear functional form was chosen as the lead equation based on the number of explanatory variables as well as the value of the coefficient of multiple determinations (R^2). The coefficient of multiple determinations was 0.914 implying that 91.4% of total variations in income was explained by the independent variables included in the model while the remaining 8.6% was due to error of estimation and other factors outside the scope of the study. It also implies that the model gives the good fit. The F-value was statistically significant at 1% level which implies that the data attested to the overall significant of the regression equation.

Result shows that marketing experience, household size, education, credit amount, farm size and access to certified vegetable seeds showed significant relationship towards income of vegetable farmers in the study area.

The coefficient of marketing experience was positive and significant at 1% level. This implies that increase in marketing experience increase the income of the vegetable farmers in the study area. Experience farmers are likely to accept innovations in order to improve their productivity and income thereby reducing the poverty level of the farmers.

The coefficient of household size was negative and significant at 5% level. This implies that the larger the household size the less access to improved vegetable seed and the lower the income of the vegetable farmers in the study area. Increase in household size is expected to increase the availability of family labour of the household which in turn is expected to increase the farmer's productivity and income but, in this case, household size had a negative relationship with income which is contrary to the findings of Ojo and Ogunyemi (2014), who showed that household size among other variables, was a significant factor in the adoption of improved cassava production technologies

The coefficient of education was positive and significant at 1% level. This suggests that the education level of the farmers had the tendency to increase the income of the vegetable farmers in the study area. This agrees with the findings of Apata *et al.* (2008) and Adetunji *et al.,* (2020) where educational level had a significant effect on income as a result of the adoption of improved variety. Education has been widely cited as an important determinant of adoption of improved agricultural technologies in Africa with the main reason behind its importance being that educated farmers have better access to information and are able to understand the importance and benefits of growing certified varieties (Abdulai, 2016; Alene & Manyong, 2007; Foster & Rosenzweig, 2010; Manda, Gardebroek, Kuntashula, & Alene, 2018). Information plays a very important role in the adoption of improved agricultural technologies as it is expected that farmers will only adopt a certified variety if they have enough information about the benefits of a particular technology (Adegbola & Gardebroek, 2007).

The coefficient of loan amount was positive and significant at 10% level. This is in line with apriori expectation, that higher credit amount can lead to higher income for the vegetable farmers in the study area. In other words, farmers with low credit amount have lower chance of access improved vegetable seeds relative to farmers with higher credit amount.

The coefficient of farm size was positive and significant at 1% level. This implies that increase in farm size increases access to improved seed and the income of the vegetable farmers in the study area. In other words, increase in hectarage of land area available for the cultivation of improved vegetable seeds by the farming households, the higher their productivity as well as higher the income.

The coefficient of access to certified vegetable seeds was positive and significant at 5% level. This implies that access to improved vegetable seeds has the tendency to increase the output and the income of the vegetable farmers in the study area. Access to improved vegetable seeds potentially improves the quality and yield of vegetables thereby increasing its market value and hence, a commensurate increase in the household income. This in line with the findings of Adetunji *et al.*, (2020) who found a positive relationship between adoption of improved cassava variety and household income.

Constraints to Accessing Improved Vegetable Seeds Among Vegetable Farmers

The constraints to accessing improved vegetable seeds among vegetable farmers in the study area is presented in Table 5

Table 5 constraints to accessing improved vegetable seeds among vegetable farmers

Constraint	Economic Factor	Institutional Factor	Technological Factor
Poor availability of quality seed	-0.0773	-0.0819	-0.1250
Pest and diseases attack	-0.1842	-0.1092	-0.0432
Lack of insurance policy	0.6741	0.1106	0.5501
Lack of market information	0.2196	**0.4187**	0.1347
High price of vegetable seed	0.1023	0.1019	0.0772
Market uncertainty	0.0123	0.5672	0.4321
Unavailability of certified seeds	**0.3501**	0.1032	0.2107
Unavailability of land	0.4432	0.8571	0.3501
Poor extension services	0.1553	0.0165	**0.6543**
Poor Agricultural Pricing and Low Fertilizer Use	0.3701	-0.3901	-0.0937
poor Access to Agricultural Credit	0.2103	**0.4492**	0.1822
Land Tenure	0.1398	0.2441	0.0917
Low and Unstable Investment in Agricultural Research	0.2891	0.1089	**0.5018**
Poor Market Access and Marketing Efficiency	0.1244	0.3101	0.0219

Post-harvest losses of fruits and vegetables in Nigeria	**0.3374**	0.2105	0.1029
Low production of breeder seeds	-0.1101	-0.2110	-0.3144
Poor seed certification and quality control arrangements	-0.1320	-0.2803	-0.1293
Poor seed distribution arrangement	**0.5087**	0.1920	0.0102
Poor seed distribution networks and rural infrastructures	**0.4519**	-0.1381	0.2739
Lack of resources for training and information dissemination	-0.2103	0.1102	**-0.4167**

Note: factor loading of $\pm$0.30 is used at 10% overlapping variance.
Variables with factor loading of less than 0.30 were not used.
*** Variables that load in more than one factor were discarded.

Table 4 showed the major constraints to accessing improved vegetable seeds by vegetable farmers categorized into three components. The components are economic factor, institutional factor and technological factors.

Based on the factor loading, the economic components that were extracted are post-harvest losses of fruits and vegetables in Nigeria (0.3374), Poor seed distribution networks and rural infrastructures (0.4519), unavailability of improved seeds (0.3501). Most rural areas are inaccessible due largely to the poor nature of the roads. This hindered the movement and performance of staff whose activities are required in the rural communities. Supply of improved seed varieties in such rural areas is also affected. Hence, farmers in such communities are deprived of the benefits of improved technology. One of the consequences of poor rural roads is the high cost of input delivery. The few dealers who find their ways into such rural areas often exploit the farmers through charging high prices for their stock. Poor seed distribution arrangement (0.5087). The development of rural infrastructure plays an essential role in improving rural livelihoods and enhancing sustainable and environmentally friendly agricultural production.

Based on the factor loading, the institutional factors that were extracted are lack of market information (0.4187) and poor access to agricultural credit (0.4492). A lack of perfect information can also lead to market failure. When buyers and sellers don't have all the correct information they may buy or sell a product at a higher or lower price than what would be reflective of its true benefit or cost and Poor access to credit is seen as a key barrier to adoption of these technologies.

Based on the factor loading, the technological factors that were extracted are lack of resources for training and information dissemination (-0.4167) and poor extension services (0.6543). Agricultural extension programmes have been one of the main conduits of addressing rural poverty and food insecurity. This is because, it has the means to transfer technology, support rural adult learning, assist farmers in problem-solving and getting farmers actively involved in the agricultural knowledge and information system (Christoplos, 2000).

Conclusion and Recommendation

The study concluded that access to improved vegetable seeds are key drivers of increasing productivity which in turn increase farmers' income and reduced poverty.

Recommendation

Increase the vegetable farmers access to credit by reducing the bottlenecks involved in securing credit from commercial banks, including agricultural banks, cooperatives, semiformal credit agencies and informal lending networks.

Public and private agricultural advisory/extension services providers should intensify their efforts in the provision of advisory/extension services and educate vegetable farmers on access to certified vegetable seeds for improved productivity and reduction in poverty status of the vegetable farmers. They should make improved vegetable seeds accessible and available to the farmers.

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