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Effect of Striga Resistant Maize Varieties on Productivity and Food Security of the Farmers in Niger State, Nigeria

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Abstract

The study examined the effect of Striga resistant maize varieties on productivity and food security of the farmers in Niger State, Nigeria. Primary data were used for the study. A multi-stage sampling technique was employed in the selection of respondent for the study. The primary data were obtained using structured questionnaires administered to 266 farmers. Descriptive statistics, Total Factor Productivity (TFP) Index and Multiple regression, Food security index estimation and binary logit regression were used for the analysis of data. The result shows that majority of the striga resistant maize farmers were male as indicated by 88.7% of the respondents. About 37.25 of the striga resistant maize farmers were within 41 – 50 years and 31.1% were within 31 – 40 years with mean age of 45 years. About (32%) had no formal education, 88.7% were married with household size ranging from 6 – 10 as indicated by 45% of the striga resistant maize farmers in the study area. Furthermore, majority (74%) of the respondents were into farming as their major occupation, with inheritance (77.1%) being the major means of farmland acquisition. Also, the result shows that majority of the striga resistant maize farmers had farming experience between 1 – 5 years as indicated by about 94.7% of the maize farmers in the study area. The results also indicated that SAMMAZ 11, SAMMAZ 15 and SAMMAZ 16 striga resistant maize varieties seeds positively affected farmer's productivity at 5%, 1% and 5% levels of probability respectively. This indicated that a percentage increased in the use of these striga resistant maize varieties seeds led to an increase in the productivity of maize farmers in the study area. Also, the influence of farm size, farming experience and educational status of the farmer on productivity were positive and statistically significant at 1%, 5% and 1% levels of probability respectively. While labour cost, agrochemical and access to credit were all negatively related to the productivity of maize farmers in the study area and were statistically significant 1% level of significant. The result also shows that quantity of seed, education, and assets were positively related to the food security of maize farmers. The study concludes that the striga resistant maize boost the food security status of the farmers in the study area. It is therefore recommended that adequate policy measures should be put in place to fast track seed multiplication and distribution and on-farm trials through effective extension service delivery so as to intensify and sustain the adoption of striga resistant maize varieties. Issues relating to availability and affordability of seed need to be addressed. In this regard government should subsidize the price of seed and as well the farmers should be given short term loan government credit to promote wide adoption of striga resistant maize varieties.

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Background to the Study

Agriculture in Nigeria is increasingly recognized to be central to sustained growth and improved economic development. Agriculture plays a significant role in food security, poverty alleviation and human development (Shehu, 2014). The concept of food security has evolved, developed, multiplied and diversified since the World Food Conference of 1974, (Kumar, Bantilan, Kumar, Kumar, and Jee, 2012). Its main focus shifted from global and national to household and individual food security and from availability to food accessibility. It can be defined as the success of the local livelihood to guarantee access to sufficient food at the household level (Awotide, Abdoulaye, Alene andVictor, 2016).

Maize productivity has been hindered by low adoption of improved seeds, poor seed quality, lack of access to disease and striga resistant varieties, little or no use of fertilizers, low investment in research and poor extension services (Ebojei, Ayinde,and Akogwu, 2012). Gerald (2014) however expresses that food production can be increased by ensuring the availability of good quality seeds which improves farmers welfare and food security situation if they adopt improved production technologies. Striga resistant maize varieties are some of the technologies that can improve productivity and reduce food insecurity.

Striga causes severe yield losses; sometimes, the farmers loose 100% of their harvest (Anderson and Anderson, 2011). Therefore, it has a major economic impact for the small holders, as decreases the income significant. The weed also lowers the food supply for many households as it causes major damages on the staple food and affects families whose food consumption is dependent on the harvest, so called subsistence farmers.

Objectives of the Study

The specific objectives are to:

i. Describe the socioeconomic characteristics of maize farmers.
ii. Determine the effect of striga resistant maize varieties on productivity and the food security of farmers in the study area.

Methodology

The Study Area

The study was conducted in Niger State. The state has three agricultural Zones, each Zone with a marked climate pattern and a defined agricultural system. The State is located in the Guinea Savannah Vegetation Zone of the country, with favourable climatic conditions for agricultural production. Niger State is located within Latitudes $8^{o}20^{1}$ and $11^{o}30^{1}$N of the equator and Longitudes $3^{o}30^{1}$ and $8^{o}20^{1}$E, with a population of about 3, 950, 249 (National Population Commission, 2006) which was projected to be about 5,016,816 in 2016 with an annual growth rate of 2.7%. Farming is the main occupation in the State.

Niger State experiences distinct dry and wet seasons, with annual rainfall of about 1, 400mm and rainfall duration of approximately 180 days. The average temperature is put to about 32°C. Dry season commences in October and terminates in March (Niger State Bureau of Statistics, 2012).

Sampling Technique and Sample Size

A multistage sampling technique was employed in the selection of respondents for the study who are basically maize farmers. The first stage involved purposive selection of two Local Government Areas from the Zone I where the Striga Resistant Maize Varieties demonstration plots were established (i.e. Mokwa and Lavun LGAs). The second stage involved purposive selection of all the participating farmers in the cell where demonstration plots were established. The third stage involved random sampling of maize farmers' household from the selected cells based on the sample frame. A total of two hundred and sixty-six (266) farm household were sampled using Yamane (1967).

Analytical Techniques

Descriptive statistics such as percentages and frequency distribution was employed to achieve objectives (i). Total Factor Productivity (TFP) Index, multiple regression, food security index and binary logit regression were used to achieve objective (ii) of this study

Model Specification

Total Factor Productivity (TFP) Index: Total Factor Productivity (TFP) was used to determine the productivity of the maize farmers which serves as the dependent variable for the ordinary least square regression model as used by Emenyonu, Nwosu, Lemchiand Iheke (2014). Total Factor Productivity index was determined using the formula:

$$\text{Total Factor Productivity (TFP)} = \frac{VOP}{VOI}$$

Where

Y (TFP index) = Productivity

VOP = Value of output produced (Naira)

VOI = Value of input used (Naira)

The Multiple regression analysis is implicitly specified as follows;

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12,} X_{13} X_{14,} X_{15} + e)$

Y (TFP index) = Productivity

X_1 = Quantity of SAMMAZ 11 seed (kg)

X_2 = Quantity of SAMMAZ 15 seed (kg)

X_3 = Quantity of SAMMAZ 16 seed (kg)

X_4 = Farm Size (Hectare)

X_5 = Extension contacts (Number of contacts)

X_6 = Labour (Mandays)

X_7 = Capital inputs (Depreciation in Naira)

X_8 = Agrochemicals (Litres)

X_9 = Fertilizer (kg)

X_{10} = Age (years)

X_{11} = Educational level (years)

X_{12} = Sex (1 = Male, Female = 0)

X_{13} = Marital Status (1 = Married, 0 = otherwise)

X_{14} = Farming experience (years)

X_{15} = Credit (Naira)
X_{16} = Household size (Number of persons)
e = error term
b_0 = Intercept
$b_1 - b_{16}$ = Parameters to be estimated
$X_1 - X_{16}$ = Explanatory variables

The multiple regression analysis is explicitly specified in four functional forms.

Food Security Index Estimation

Food security index estimation, using expenditure on food per capita method of Arene and Anyaeji (2010) (adopted from Omonona and Agoi, 2007) was employed to classify the respondents into food secure and food insecure households in a bid to establishing the food security status of the individual households, while Logit regression model was used to determine the effect of striga resistant maize varieties on food security.

The formula for food security index estimation is given as:

$$\frac{\textit{Per capita monthly food expenditure for the ith household}}{\frac{2}{3}\ \textit{Mean per capita monthly food expenditure of all households}}$$

Where Fi = Food security index.
When Fi ≥ 1 it implies that the ith household is food secure, but when Fi < 1, it implies that the ith household is food insecure.

A food secured households are those whose per capita monthly food expenditure is at least two-third of the mean per capita monthly food expenditure. On the other hand, a food insecure household are those whose per capita monthly food expenditure is less than two-third of the mean monthly per capita food expenditure.

The binary logit regression analysis that was employed is implicitly specified as follows;

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10} + e)$$

The binary logit regression model is explicitly specified as:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + e$$

Where:
Y = Food Security Index (1 = Food secure, 0 = otherwise)
X_1 = Quantity of SAMMAZ 11 seed (kg)
X_2 = Quantity of SAMMAZ 15 seed (kg)
X_3 = Quantity of SAMMAZ 16 seed (kg)
X_4 = Age of household head (years)
X_5 = Sex (1 = male; 0 = otherwise)

X_6 = Educational level (years)
X_7 = Household size (Number of persons)
X_8 = Remittances (Amount received in Naira/year)
X_9 = Marital Status (1 = Married) = otherwise)
X_{10} = Assets (Naira)
X_{11} = Credit (Naira)
α = Constant
$\beta_1 - \beta_n$ = Regression Coefficient
$X_1 - X_n$ = Independent variables
e = error term

Results and Discussion
Socio-economic Characteristics of Striga Resistant Maize Farmer
The socio-economic characteristics of the respondents considered in this study includes age, level of education, marital status, farm size, farming experience main occupation, off-farm occupation among others. The results of these were presented in Table 1. The result shows that majority of the striga resistant maize farmers were male as indicated by 88.7% of the respondents. This is typical of Nigerian farmers whereby the male engages in farm work while the female focus on domestic work. About 37.25 of the striga resistant maize farmers were within 41 – 50 years and 31.1% were within 31 – 40 years with mean age of 45 years which is an indication that the striga resistant maize farmers in the study area were in their productive age of farming activities. The result of the study agrees with the findings of Challa and Tilahum (2014) who opined that the use of manual labour is prevalent in agricultural production and the quality of this labour depend on age, also among other factors, age of the farmers had significant influence on adoption and intensity of the use of improved seed technology as older farmers are more conservative and are averse to risk associated with new technologies.

Also, the results as presented in Table 1 shows that about (32%) had no formal education, 88.7% were married with household size ranging from 6 – 10 as indicated by 45% of the striga resistant maize farmers in the study area. Furthermore, majority (74%) of the respondents were into farming as their major occupation, with inheritance (77.1%) being the major means of farmland acquisition. Also, the result shows that majority of the striga resistant maize farmers had farming experience between 1 – 5 years as indicated by about 94.7% of the maize farmers in the study area. This is in line with the findings of Ayanwuyi, Kuponiyi, Ogunlade, and Oyetoro (2010) that about 72.0% of the respondents were male, 95.8% were between the ages of 31 – 51 years old, 29.4% had no formal education,70.6% have various levels of formal education while about 90% of the farmers had farming experience of about 6 years.

Furthermore, Tanko (2017) in his study on profit efficiency and constraints analysis of shea butter industry in Northern region of Ghana found that about 63.3% of the respondents were within the age range of 31 - 50 years, 71.7% were males, 66.7% of the respondents were married while 25.5% had no formal education.

Table 1: Socioeconomic Characteristics of Striga Resistant Maize Farmers

Variable	Frequency	Percentage	Mean
Sex			
Female	30	11.3	
Male	236	88.7	
Age (years)			
21 – 30	11	4.1	
31 – 40	88	33.1	
41 – 50	99	37.2	45
51 – 60	57	21.4	
> 60	11	4.1	
Educational Level			
Non formal education	85	32.0	
Adult literacy	11	4.1	
Primary education	47	17.7	
Secondary education	63	23.7	
Tertiary education	60	22.6	
Marital Status			
Married	236	88.7	
Single	9	3.4	
Widowed	20	7.5	
Divorced/separated	1	4.0	
Household Size			
1 – 5	105	39.5	
6 – 10	120	45.1	5
> 10	41	15.4	
Main occupation			
Farming	197	74.1	
Trading	15	5.6	
Paid employment	37	13.9	
Artisan	7	2.6	
Others	10	3.8	
Acquisition of farmland			
Inheritance	205	77.1	
Borrowed	38	14,3	
Rent	23	8.6	
Years of striga resistant maize varieties experience			
1-5	252	94.7	3
6-10	14	5.3	

Source: Field Data Analysis, 2018

Effect of Striga Resistant Maize Varieties on the Productivity of Maize Farmers

The effect of striga resistant maize varieties on the productivity of maize farmers in the study area was analysed using the ordinary least square (OLS) multiple regression model and the result is as presented in Table 2. The Semi-log functional form was chosen as the lead equation on the basis of its R^2, F-ratio and the number of significant variables.

The coefficient of determination, R^2 was 0.4261 which implies that about 42% of the variation in the productivity of the maize farmers was explained by the independent variables included in the regression model. The F-ratio was 8.68 and was statistically significant at 1% level of significance. This shows a relative goodness of fit for the regression model and an indication that the entire model was significant owing to the fact that the explanatory variables included in the model jointly predicted the variations in the productivity of maize farmers in the study area.

The coefficient of SAMMAZ 11 seeds ($P < 0.05$), SAMMAZ 15 seeds ($P < 0.001$) and SAMMAZ 16 seeds ($P < 0.05$) had positive and statistically significant relationship with productivity of the farmers at 5%, 1% and 5% level of significant respectively. This implies that a percentage increase in these inputs holding others constant led to increase in productivity of the farmers in the study area. A unit increase in these striga resistant maize varieties seeds increased the productivity of maize farmers in the study area by 0.8282 units, 0.4272 units and 0.6422 units respectively. The coefficient of farm size ($P < 0.01$), farming experience ($P < 0.05$) and educational status ($P < 0.001$) were all positively related to the productivity of maize farmers in the study area and were statistically significant at 1%, 5% and 1% level of significant respectively. This is a direct relationship which implies that an increase in these variables led to an increase in the productivity of maize farmers in the study area and vice versa. A unit increase in farm size, farming experience and educational status increased the productivity of maize farmers in the study area by 5.1935 units, 0.2879 units and 0.2585 units respectively and vice versa. This implies that farmers with larger farm size, higher farming experience and well educated tends to be more productive than their counterpart with smaller farm size, low farming experience and less educated. This results in line with the assertion made by Obasi *et al*. (2013) in their study on the factors affecting agricultural productivity among arable crop farmers in Imo State, Nigeria, that farming experience, farm size, and education had significant relationship with productivity in the study area.

The coefficient of labour cost ($P < 0.01$), agrochemical ($P < 0.01$) and access to credit ($P < 0.01$) were all negatively related to the productivity of maize farmers in the study area and were statistically significant 1% level of significant. This shows an inverse relationship which implies that the higher the cost of labour, cost of agrochemicals and access to credit, the lower the productivity of maize farmers in the study area and vice versa. The implication is that a unit increase in the cost of labour, cost of agrochemical and credit received led to a decrease in the productivity of maize farmers by 1.9414, 5.0551 and 0.0702 units respectively. Although, the negative coefficient of access to credit is contrary to the *apriori* expectation but this may be attributed to the fact that farmers tends to divert the credit received for farming activities to other domestic and personal uses. This result supports the findings of Urgessa (2015) who studied the determinants of agricultural productivity and rural household income in Ethiopia and stated that cost of labour, fertilizer as well as other inputs were significant determinants of productivity level in the study area.

Table 2: Effect of striga resistant maize varieties on productivity of the maize farmers in the study area (Semi-log production function as lead equation) (n = 266)

Explanatory Variable	Linear	Exponential	Double-Log	Semi-Log
Constant	8.5272	1.7990	6.1843 (5.93)	41.9850
	(4.72)	(7.15)		(5.27)
Quantity of SAMMAZ 11 seeds (Kg)	-.1887	-.0279	-.1260	.8282
	(-2.03)**	(-2.15)	(-1.79)	(2.30)**
Quantity of SAMMAZ 15 seeds (Kg)	.00824	.0020	.04867	.4272
	(0.22)	(0.39)	(1.25)	(2.42)***
Quantity of SAMMAZ 16 seeds (Kg)	.0338	.0073	.0966	.6422
	(0.90)	(1.39)	(2.30)	(2.92)**
Farm size (Hectare)	3.8200	.4757	.6871	5.1935
	(8.74)***	(7.82)***	(7.91)***	(7.31)***
Labour cost (Manday)	-.0001	-8.0506	-.2607	-1.9414
	(-3.96)***	(-3.58)**	(-4.57)**	(-4.05)***
Capital input (Depreciation in Naira)	.0007	.0001	-.0216	.0181
	(1.90)	(1.91)	(-0.30)	(0.04)
Fertilizer (Kg)	-.0004	-.0001	-.2741	-2.4188
	(-0.40)	(-0.85)	(-5.08)**	(-4.38)
Agrochemical (Litre)	-.71159	-.0947	-.3595	-3.0551
	(-6.41)***	(-6.12)*	(-3.56)*	(-3.54)***
Age (years)	-.0525	-.0043	.0275	.2689
	(-1.42)	(-0.85)	(0.13)	(0.18)
Education (years)	-.1373	-.0099	.0045	.2505
	(-2.91)**	(-1.51)	(0.13)	(1.15)**
Sex	.01611	.0011	-.1342	-.8731
	(0.02)	(0.01)	(-0.64)	(-0.66)
Marital status	.28203	.0757	.0088	-.3003
	(0.28)	(0.55)	(0.04)	(-0.19)
Farming experience (years)	.16458	.0119	.0190	.2879
	(2.91)**	(1.51)	(0.34)	(0.58)**
Credit (Naira)	-4.3906	-3.9607	-.0026	-.0702
	(-2.09)**	(-1.35)	(-0.30)**	(–1.18)**
Household size	.07086 (0.97)	.0097	.0401	.0291
		(0.95)	(0.58)	(0.06)
Extension contact	.22158 (0.41)	-.0323	.0377	.9910
		(-0.43)	(0.29)	(1.16)
R^2	0.3355	0.2940	0.3423	0.4261
F-Value	7.89***	6.51***	8.13***	8.68***

*10% level of significance, ** 5% level of significance and *** 1% level of significance. Figures in parentheses are the t-ratios

Source*:* Field Data Analysis 2018

Effect of Striga Resistant Maize Varieties on Food Security of Maize Farmers

The effect of striga resistant maize varieties on the food security of maize farmers in the study area was analyzed using the logit regression model and the result is as presented in Table 3. The result shows that the pseudo R-squared was 0.5057 while the chi-square result value (78.92) which is statistically significant at 1% level of probability, suggesting that the logit model has a strong explanatory power of the variables included in the model. The result also revealed that quantity of SAMMAZ 11 seed; SAMMAZ 15 seeds and SAMMAZ 16 seeds were positively related to the food security of maize farmers and statistically significant at 10%, 1% and 5% levels of significance respectively. The results also show that education and assets were positively related to the food security of maize farmers and statistically significant at 1% and 5% levels of significance respectively. This is a direct relationship which implies that an increase in quantity of seed, education and number of assets owned led to increase in the probability of the maize farmers been food secured in the study area and vice versa. This result corroborates the findings of Abdullahi *et al*., (2017) on the factors affecting household food security in rural Northern Hinterland of Pakistan, that the quantity of improved seeds, household size as well as education had significant effect on the food security status of farmers. Also, household size was negatively related to the food security status of the farmers and statistically significant at 1% probability level ($P < 0.01$). This is an inverse relationship which implies that increase in the household size of the farmers led to decrease in the probability of the farmers been food secured and vice versa. This is in line with the assertion made by Guo (2011), that the household asset has a significant relationship with food security. Also, in a study on the factors influencing household food security among smallholder farmers in the Mudzi district of Zimbabwe, Nelson *et al*., (2015) stated that age, household size and education are significant factors affecting the food security status of smallholder farmers in the study area.

Table 3: Effect of Striga resistant maize varieties on food security of the farmers in the study area

Variables	Coefficient	Z-Value
Quantity of SAMMAZ 11 Seeds	.0398	1.47*
Quantity of SAMMAZ 15 Seeds	.0432	3.05***
Quantity of SAMMAZ 16 Seeds	.0411	3.55**
Age	-.0116	-0.44
Sex	-.4350	-0.40
Education	.0008	7.86***
Household size	-.7685	-6.90***
Remittances	.4375	0.93
Marital status	-1.079	-0.82
Credit	-7.0607	-1.00
Assets	8.1007	3.54**
Constant	7.7070	
Pseudo R-squared	0.5057	
Chi-square	78.92	
Log likelihood function	-82.575298	

*Significant at 10%level of probability, ** Significant at 5%level of probability,
*** Significant at 1%level of probability
Source: Field Data Analysis, 2018

Summary Statistics of Food Security Index

Table 4 presents the summary statistics of food security index of striga resistant maize farmers in Niger State. The result shows a mean household size of about 7 persons, with total maximum food expenditure per month at 161,400 and a total minimum at 18,400. The maximum food security index was 9.83 and minimum was 0.26 with the mean food security index at 1.50 an indication that the striga resistant maize varieties farmers were food secured.

Table 4: Summary statistics of Food Security Index

Variables	Mean	Standard Deviation	Minimum	Maximum
HH size	7.24	4.17	1.00	30.00
Total expenditure on food/month	61059.36	22960.67	18400.00	161400.00
Per capita Expenditure	11076.34	8216.48	1942.86	72604.00
Food security index	1.50	1.11	0.26	9.83

Source: Field Data Analysis 2018

Conclusion

The study concluded that the cultivation of striga resistant maize varieties can be enhanced through increased availability of the varieties. The adoption of striga resistant maize varieties has contributed to the increased productivity and food security status of farming households in the study area. This suggests that striga resistant maize varieties contribute in enhancing the productivity and food security of the maize farmers. It can also be concluded that the adopters of the striga resistant maize varieties were more food secured than non-adopters and this implies that adoption of these varieties has contributed in enhancing food security among adopters.

Recommendations

Based on the findings of this study it is therefore recommended that adequate seed policy should be put in place to fast track seed multiplication and distribution and on-farm trials through effective extension service delivery so as to intensify and sustain the adoption of striga resistant maize varieties. And to sustain the current adoption of striga resistant maize varieties issues relating to availability and affordability of seed need to be addressed. In this regard government should subsidize the price of seed and as well the farmers should be given short term loan government credit to promote wide adoption of striga resistant maize varieties.

References

Agbonika, D. A. (2015). *Analysis of the impact of the adoption of early maize technology on productivity and food security status of the farmers in Gwagwalada and Kuje Area Councils of FCT, Abuja.* Unpublished M.Sc Thesis. Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria.

Abdullah, D.Z., Tariq, S., Sajjad, A, Waqar, A., Izhar, U., & Aasir, I. (2017). Factors affecting household food security in rural northern hinterland of Pakistan. *Journal of the Saudi Society of Agricultural Sciences, 30:34 – 39.*

Andersson, J. & Andersson, J. (2011). *The economic consequences of Striga Hermonthica in Ma*ize production in Western Kenya, (669).

Arene, C.J. & Anyaeji, M.R.C. (2010). Determinants of food security among households in Nsukka Metropolis of Enugu State, Nigeria. *Pakistan Journal of Social Sciences (PJSS)*, *30* (1), 9–16.

Awotide, B.A., Abdoulaye, T., Alene, A.D. & Victor, M. (2016). Adoption of drought tolerance maize varieties for Africa, productivity, food security and welfare in Nigeria, *An Ex-Post Impact Assessment, 1*–30.

Ayanwuyi, A., Kuponiyi, E, Ogunlade, F.A & Oyetoro, J.O. (2010). Farmers perception of impact of climate changes on food crop production in Ogbomosho Agricultural Zone of Oyo State, Nigeria. *Global Journal of Human Social Science*, *10* (7) 33 – 39.

Challa, M. & Tilahun, U. (2014). Determinants and impacts of modern agricultural technology adoption in West Wollega.The case of Gulliso District, Ethiopian Institute of Biodiversity Conservation. *Journal of Biology, Agriculture and Healthcare.* 4 (2) 20-30.

Ebojei, C. O., Ayinde, T. B. & Akogwu, G. O., (2012). Socio-economic factors influencing the adoption of hybrid maize in Giwa local government area of Kaduna state, Nigeria. *Journal of Agricultural Science, 7 (1): 23 – 32.*

Emenyonu, C. A., Nwosu, A.C., Lemchi, J. I. & Iheke, O. R. (2014). Analysis of productivity, profitability, income and return on investment in youth SMES in Niger Delta, Nigeria. *Journal of Small Business and Entrepreneurship Research, 2 (1) 20-34*.

Gerald, A. M. (2014). *Access to and adoption of improved seeds by smallholder's farmers in Tanzania: Cases of Maize and rice seeds in Mbeya and Morogoro regions*. A dissertation submitted in partial fulfilment of the Requirement for the Degree of Master of Arts in Rural Development of Sokoine University of Agriculture, Morogoro, Tanzania.

Guo, B. (2011). Household assets and food security: Evidence from the survey of program dynamics. Journal of Family and Economic Issues.32, 98–110

Kumar, A, Bantilan, M.C.S, Kumar, P., Kumar, S. & Jee, S. (2012). Food security in India: Trends, patterns and determinants. *Indian Journal of Agricultural Economics, 67 (3) 445-463.*

National Population Commission (2006). *Facts and figures of Niger State (2012 edition).*

Nelson, M., Byron, Z., Clifton, M., Kefasi, N. & Sheppard, S. (2015). Factors influencing household food security among smallholder farmers in the Mudzi district of Zimbabwe .*Journal of* Development Southern Africa. 31 (1) 35 – 78.

Niger State Bureau of Statistics, (2012). *Average monthly minimum and maximum temperature in Niger State*.

Obasi, P.C., Henri-Ukoha, A., Ukewuihe, I.S. & Chidiebere, N.M (2013). Factors Affecting agricultural productivity among arable crop farmers in Imo State, Nigeria. *American Journal of Experimental Agriculture* 3 (2) 443-454.

Omonona, B.T. & Agoi, G. A. (2007). An Analysis of Food Security Situation among Nigerian Urban Households: Evidence from Lagos State, Nigeria. *Journal of Central European Agriculture, 8* (3), 397-406.

Shehu, J. F. (2014). Productivity and technical efficiency of small-scale rice farmers in Adamawa State, Nigeria: Productivity and Technical Efficiency of Small-scale Rice Farmers in Adamawa State, Nigeria.

Tanko, M. (2017). Profit efficiency and constraints analysis of shea butter industry in Northern region of Ghana. *Korean Journal of Agricultural Sciences,* 44, 102 – 111.

Yamane, T. (1967). Statist*ics: An introductory analysis, 2nd edition*, New York: Harper and Row.

Urgessa, T. (2015). *The determinants of agricultural productivity and rural household income in Ethiopia. Unpublished M.Sc* Thesis . Addis Ababa University, Addis Ababa, Ethiopia.