ANALYSIS OF DETERMINANTS OF PRODUCTIVITY AND FOOD SECURITY OF EARLY MAIZE VARIETIES FARMERS IN GWAGWALADA AND KUJE AREA COUNCIL OF FCT, ABUJA.

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Abstract

The study evaluated factors influencing early maize productivity and food security of farmers in Gwagwalada and Kuje area council of FCT, Abuja, Nigeria and identify the problems faced by farmers in the study area. 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. Descriptive statistics, logit regression model, t-test, food security line were used for the analysis of data. The major drivers of production in the study area were found to be farming experience, education, marital status, membership of cooperative societies, household income and extension contact. 79% of producers with an average daily per capita household calorie consumption of 3606.30kcal were food secure while 44% of non- producers were food secured. 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 production of early maize varieties.

KEYWORDS: food security, productivity, maize varieties, early maize

INTRODUCTION

Nigeria is predominantly rural in character with about 80% of the population directly and indirectly dependent on agriculture. Land is much diversified reflecting various ecological conditions. The production of food and fibre to satisfy the ever-increasing population is critical to the socio-economic well-being of our nation. Maize is one of the staple foods, very nutritious and it is known to be eaten in various forms by both humans and livestock. As a matter of fact, maize is used as the main energy ingredient in livestock feed. Maize/Corn is also processed into a multitude of food and industrial products including starch, sweeteners, corn oil, beverages, industrial alcohol and fuel ethanol et al. Maize is the most widely distributed crops of the world. It is cultivated in tropics, sub-tropics and temperate regions unto 50^0 and from sea level to 4000 m. As regards to area and production maize ranks third in world production (380 MT from 120MH) following wheat (440 MT from 240 MH) and rice (420 MT from 140 MH). This represents 24% of the total cereal production as compared to 27 % for wheat and 25% for rice. Maize is a large contributor to the nation's economy. According to Statistic, Nigeria produced 7.2 Million metric ton of maize in 2016/2017. Imagine if we could increase Maize production in Nigeria by another 10%! This would raise our production to about 8 Million metric tons which would have a significant impact in the nation's Gross Domestic Product.

Agriculture plays a significant role in food security, poverty alleviation and human development (Amaza and Maurice, 2005: Agbonika (2016)). Food security became a catch-phrase in the mid 1990s (Okezie and Okorie, 2009). Food security concept has evolved, developed, multiplied and diversified over the years (Agbonika, 2016). Its main focus has shifted from global and national to household and individual food security and from food 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 (Devereaux and Maxwell, 2001).

Due to technological bias, stress on production rather than equitable distribution, access, affordability and utilization of improved varieties of crops, there was no solutions to food insecurity in the 1970s and 1980s. it has become obvious that food security revolves around complex issues that encompass a wide range of interrelated environmental, economic, social and political factors. A systematic approach encompassing improve varieties of seed is required in addressing food security and lack of which pose serious challenge to many regions in their ability to address food security adequately Clover, 2003: Agbonika, 2016). Individuals have sufficient access to food when they have adequate incomes or other resources to purchase or barter to obtain levels of appropriate foods needed to maintain consumption of an adequate diet/nutrition level (United States Agency for International Development (USAID), 2010). Food access depends on the ability of households to obtain food from current production, purchases, gathering, or through food transfers from relatives, members of the community, the government or donors. The distribution of food is an important determinant of food security for all household members. Food access is also influenced by the aggregate availability of food in the market, market prices, productive inputs, and credit (USAID, 2010).

Maize is a crop of great economic importance in Nigeria. Maize is a cereal crop grown for food, feed and industrial uses and it is the second most common cereal food crop after rice (Ayoola *et al,* 2012). Maize is widely cultivated throughout the world, and a greater amount of maize is produced each year than any other grain, in Nigeria it is produced largely in the northern guinea savannah. There are several domestic markets for maize all over Nigeria and maize also filters into international markets such as Niger, Chad, Mali, Benin Republic and some other countries in the West African Sub region (ASCE, 2008). Maize is widely consumed as a stable food by poor rural and urban households: providing carbohydrate, vitamins, and relatively small amount of protein to human beings and livestock as well. Maize will continue to play a large and important role in Nigeria's food production (USAID, 2010).

Adoption of maize production technologies has received much attention in recent years because of increase in demand for maize. Several varieties have been introduced that give high yield and resistance to diseases. Oladele (2005) opined that the efficiency of technologies generated and disseminated depend on the effective utilization by farmers. The steady growth of population has led to an increase in the demand for food and agricultural raw material (Owolabi *et al.,* 2012). According to Selener (1997) adoption of these technologies can bring about low cost of production and high returns which will improve household livelihood and its cultivation in large quantity enhance food security.

Maize continues to play a large and important role in Nigeria's food production (USAID, 2010). The total land planted to maize in Nigeria is above 2.5 million hectares with an estimated yield of about 1.4 metric tonnes per hectare (Agboola and Tijjani-Eniola, 1991). It is recorded that about 1000 metric tonnes of maize is produced in Abuja (NSEI, 2012). More than 60 percent of the Nigeria's production of maize is consumed by the industrial sector for production of flour, animal feeds, biscuits, beverages, malt drink, beer, cornflakes, starch, syrup, and dextrose (ASCE, 2008). The ban on importation of cereals by the Federal Government of Nigeria since 1986 has greatly expanded these latter uses and thus overall demand for maize. Consequently there is need to increase output per hectare through the use of modern technologies to raise the productivity of maize in the study area. Closing this gap and increasing food production will require intensive agriculture based on use of modern technologies such as improved seeds and fertilizer. It is therefore, on this note that this study attempted to determine the determinant of productivity and food security status of early maize varieties farmers in the study area and to highlight the constraint that militate against maize farming in the study area.

Materials and method

This study was conducted in two Area Councils of Federal Capital Territory, Abuja, the area councils are; Gwagwalada and Kuje. Gwagwalada Local Government Area has an area of 1,043 km² and a population of 157,770 at the 2006 census. Gwagwalada area council lies between latitude $07^0.57^{'}$N and longitude $07^0.7^{'}$E. Kuje area council comprises of 162 communities widely spread within a land mass of about 1,800 square kilometer and a population of over 420,000 at the 2006 census. Gwagwalada and Kuje area council has been known for agricultural activities over the years, informed of the areas agro-climatic conditions and rural characteristics with about 85% of the population who are mostly indigenes engaged in farming activities which includes the cultivation of cereals, tuber/root crops and legumes it make the council areas suitable for this study.

A multi-stage sampling technique was used to select the maize farming household for this study. In the first stage two Area Councils were purposively selected which are Gwagwalada area council and Kuje Area Council. In the second stage two wards from Gwagwalada Area council and three wards from Kuje Area Council were selected based on their high intensity in maize farming activities. These wards includes; Paiko, dobi, Rubochi, Gwargwada and Gudunkarya. Thirdly ten villages were selected, two from each ward based on their high level of maize production due to richness of the soil making it suitable for agricultural activities. Lastly, simple random sampling was employed in selecting 10% of the maize farming households to give a sample size of 269.

Data: Primary data was obtained through the use of questionnaire. The data on the socio-economic characteristics, farmers' food consumption and expenditure were collected. Descriptive and inferential statistics were employed in the analysis of data.

Food Security Line was used to classify farmers into either food secure or food insecure depending on which side of the line they fall. The food security line is the recommended daily per capita calorie intake of 2260 kilo calorie (FAO, 1996). A farmer whose daily per capita calorie intake is up to 2260 kilo calorie intake was regarded as food secure and those whose daily per capita calorie intake is below 2260 kilo calorie were regarded as food insecure. The food security line is given as:

$$Z = Yi / R \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where:
Z_i = food security status of ith farmers.
Y_i = daily per capita calorie intake of ith farmers
R = recommended per capita daily calorie intake (2260 kilo calorie)
Z_i = 1 for Y_i greater than or equal to R
Z_i = 0 for Y_i less than R
Additionally, the shortfall/surplus index and the headcount ratio of food security were calculated for the sampled households based on the food security line. The shortfall index (P) measures the extent to which poor households are food insecure while the headcount ratio (H) measures the percentage of the population of household that are food insecure/secure.

$$\text{Shortfall Index (P)} = \frac{1}{M}\left(\sum_{i=j}^{M} G_i\right) = \frac{1}{M}\left(\sum_{i=j}^{M} \frac{Y_i - R}{R}\right) \quad \ldots\ldots\ldots\ldots\ldots (3)$$

$$\text{Head Count Ratio (H)} = \frac{M}{N} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where:
M = The number of food insecure households
G_i = Per capita calorie intake deficiency for ith household
N = Number of households in the sample

RESULTS AND DISCUSSION

Factors influencing early maize varieties production in the study area

The maximum likelihood estimates of the parameters of the logistic regression of factors influencing the production of early maize varieties are presented in table 1. The log-likelihood statistic of 36.0031 is significant at 1% probability level and this indicates the joint significance of the independent variables included in the model. The overall percentage of the production of early maize varieties correctly predicted seems good at 68% in comparison to the 100% prediction of a perfect model.

Major drivers of production of early maize varieties in the study area were found to be marital status of household head, farming experience, education, membership of cooperative societies, household income and extension contact. Age of household head, credit, farm size and household size were found to be insignificant in influencing production of early maize varieties in Nigeria.

Education: Education was positively related to maize farming households' production of early maize varieties and was significant at 1% probability level. The odd ratio of 1.0773 indicates that a unit increase in the educational level of the maize farming households will increase the probability of early maize varieties production by a magnitude of 1.0773. Education enables one to access information needed to make a decision to practice a new technology. This is in agreement with (Kudi *et al*., 2011; Ambali *et al*., 2012) who in their respective studies found that education is a significant factor in facilitating awareness and adoption of agricultural technologies. This is consistent with literature that education creates a favourable mental attitude for the acceptance of new practices especially of information-intensive and management-intensive practices. The implication of this is that farm households with well-educated members are more likely to

engage in agricultural production than those without.

Marital status: This was found to be positive and significant at 1% probability level with an odd ratio of 6.8544 which implies that a unit increase in marital status would increase the probability of early maize varieties production by a factor of 6.8544. This finding disagrees with Voh *et al.* (2001) who noted that marital status was not significant in influencing the production of improved cowpea varieties in the Savanna ecology of Nigeria. This result indicates that a farmer produce not only for sale but to feed his family. The implication here is that the farms would have greater attention from responsible members of the family.

Farming experience: This was positively related to maize farming households' production of early maize varieties and was significant at 10% probability level. The odd ratio of 1.0318 indicates that a unit increase in farming experience will increase the probability of the maize farming households' production of early maize varieties by a magnitude of 1.0318. This finding agrees with Ayoola (2012) who discovered a positive and significant relationship between adoption of yam minisett technology and farming experience in the Middle belt region of Nigeria. This is expected because more experienced farmers may have better skills and access to new information about improved technologies. It could also imply that knowledge gained over time from working in uncertain production environment may help in evaluating information thereby influencing their adoption decision.

Membership of Cooperative: This was found to be positive and significant at 10% probability level with an odd ratio of 1.6704 which suggests that a unit increase in years of participation in cooperative societies by the maize farming households will increase the probability of production of early maize varieties by a magnitude of 1.6704. A plausible explanation for this is that the membership of social organizations such as cooperative society enhances the interaction and exchange of ideas on agricultural technologies among farmers and thereby influencing the production decision of their members.

Household income: This was negatively related to the probability of maize farming household that adopted early maize and was significant at 10% probability level. The odd ratio of 0.9999 indicates that a unit increase in the income of the maize farming households will have the tendency of reducing their production of early maize varieties by a magnitude of 0.9999. This result is against *a priori* expectation and a plausible explanation for this is that an increase in household income could stimulate the households to invest in other business ventures other than investing in the purchase of improved maize varieties or an increase in income could be channeled towards meeting pressing household needs instead of purchasing improved maize varieties. This finding is not in consonance with Bello *et al*. (2012) who posited a positive relationship between crops based technologies and income in Jenkwe Development Area of Nasarawa State, Nigeria.

Extension contact: This was negatively related to the probability of maize farming household production of early maize varieties. The result was significant at 10% probability level with an odd ratio of 0.9460 which indicates that a unit increase in extension contact will decrease the probability of the farming households'

production of early maize varieties. This result is against *a priori* expectation. This could be due to the fact that full time farmers are always missing out on information because of their long stay on the farm. Most of them occasionally do not attend trainings and also do not avail themselves of the opportunity to meet with extension agents through which Information about improved seeds could be obtained. The implication is that access to extension services creates the platform for acquisition of the relevant information that promotes technology adoption and therefore, access to information through extension services reduces the uncertainty about a technology's performance hence may change farmer's assessment from purely subjective to objective over time.The non-significance of age of household head and farm size in influencing the production of early maize varieties agrees with the finding of Ndjuenga *et al.* (2008) who also found out that age of household head and farm size were not significant in influencing production of modern groundnut varieties in Nigeria in a study of early adoption of modern varieties of groundnut in West Africa. Amount of credit obtained was not significant in influencing the behavior of groundnut farming households and this is in line with the findings of Saka and Lawal (2009) who also establish that there was no significant relationship between adoption of improved rice varieties and credit. Also, Alarima *et al.* (2011) established that there was no significant relationship between production of Sawah rice technology and credit. The non-significant relationship between production of early maize varieties and household size as well as farm size agrees with Akinola *et al.* (2007) who noted that household size and farm size were not significant in influencing adoption of balanced nutrient management systems technologies in the northern Guinea savanna of Nigeria.

Table1: Logit regression estimates of factors influencing the productivity of early maize varieties

Variable	Coefficient	Standard error	T-value
Constant	-1.0798	0.7445	-1.4503
Age	-0.2359E -01	0.1755E -01	-1.3440
Marital status	6.8544	0.6163	3.1232***
Farming experience	1.03180E -01	0.1777E -01	1.7671*
Education	1.0773E -01	0.2677E -01	2.7814***
Household size	-0.1466E -01	0.2882E -01	-0.5086
Farm size	-0.3132E -01	0.3491E -01	-0.8972
Credit	-0.4250E -04	0.4159E -04	-1.0218
Cooperative society	1.6704	0.2800	1.8321*
Household income	-0.9999 -06	0.5064E -06	-1.8969*
Extension contact	-0.9460E -01	0.3341E -01	-1.6616*
Log likelihood ratio test	36.0031		
Pseudo R -square	0.11		

***, **,* implies significant levels at 1%, 5% and 10% respectively

Food security level of the early maize varieties farming households

The result of the food security status of the respondents is presented in Table 2. In this study, a one month (30 days) recall method was used. The food security line of daily 2260 kcal by FAO (1996) was adopted in this study. The household's calorie intake was obtained through the household's consumption and expenditure data. From the data, the quantity of every food item consumed by the households in the 30 days period was estimated. The quantities were converted to gram and the calorie content estimated using the nutrient composition table of commonly eaten foods in Nigeria (Oguntona and Akinyele, 1995). Per capita calorie intake was calculated by dividing estimated total household calorie intake by the family size after adjusting for adult equivalent using the consumption factors for age-sex categories. To get the household's daily per capita calorie intake, the household's per capita calorie intake was divided by 30. A household whose daily per capita calorie intake is up to 2260 kcal was regarded as food secure and those below 2260 kcal were regarded as food insecure households.

Based on the recommended daily calorie intake (R) of 2260 kcal, the headcount ratio shows that 79% of the adopters with an average daily per capita household calorie consumption of 3606.30 kcal were food secure and 21% of this group with an average daily per capita calorie consumption of 1673.62 were food insecure. The headcount ratio for non-adopters indicates that 44% of the households were food secure with an average daily per capita calorie consumption of 3190.68 kcal and 56% were food insecure with an average daily per capita calorie consumption of 1599.17 kcal. Early maize producers had a surplus index of 0.60 and the least shortfall index of 0.26 indicating that food secure households of the maize varieties exceeded the calorie requirement by 60% while the food insecure households fell short of the recommended calorie intake by 26%. A shortfall index of 0.29 and a surplus index of 0.64 for non-producers indicate that food insecure households in this group fell short of the recommended calorie intake by 29% while food secure households exceeded the calorie requirement by 64%. This is similar to results obtained by Agbola *et al.* (2008) in their study on the impact of income diversification strategies on food insecurity status of farming households in Africa. They reported that based on the recommended daily calorie intake of 2260 kcal, 82% of the households were food secure and 18% were food insecure for households that combined crop production with livestock production. Based on the headcount ratio, it is expedient to infer that early maize adopters were more food secure ($P<0.10$) than non-adopters.

From the food security profile of the adopters and non-adopters of early maize varieties, it can be deduced that the producers had a lower food insecurity level than the non-producers and this implies that adoption of early maize varieties has contributed in enhancing food security among producers of the varieties. Therefore, production of early maize varieties can be a panacea for food insecurity among maize farming households and hence, the fight against the menace of food insecurity among rural farming households who are into maize production can be fostered by encouraging production of early maize varieties among the households. This result is consistent with other related studies on the impact of agricultural technologies on food security (Mendola, 2007; Mignouna *et al*., 2011; Omilola, 2009).

Table 2: Distribution of the respondents by their food security level

Statistical estimates	Producers		Non-producers	
	Food secure	Food insecure	Food secure	Food insecure
Frequency	168	44	32	25
Average daily calorie intake (kcal)	3606.30	1673.62	3190.68	1599.17
Maximum daily calorie intake (kcal)	19231.90	2248.63	7248.80	2245.83
Minimum daily calorie intake (kcal)	2261.31	926.14	2279.24	726.50
Shortfall/surplus Index (P)	0.60	-0.26	0.64	-0.29
Head count ratio (H)	0.70	0.21	0.56	0.44
Standard deviation	1544.47	391.01	1310.37	382.23

Table 3 shows the result comparing the means of the food security status of producers and non-producers. The result showed a significant difference between the food security status of producers and non-producers of the early maize varieties. Since the average calorie intake of adopters is greater than the average calorie intake of non-producers with a significant t-value (P<0.10), the null hypothesis which states that production of early maize variety has no significant impact on food security level of the maize farming households is therefore rejected. This implies that there is a significant difference in the food security level of producers and non-producers of early maize varieties. Therefore, the production of early maize varieties has contributed in enhancing food security status of farming households in the study area.

Table 3:

Category	Mean income	N	Standard Deviation	t-value	t-critical
Adopters	2778.010	212	1530.228	1.628*	1.962
Non-adopters	2484.903	57	1375.723		

*P<0.10

Constraints faced by farmers in maize production

Table 4 shows the distribution of farmers based on constraints faced in maize production and are discussed according to their ranking. These problems were affecting the profits they could realize.

High Cost of Inputs

The farmers ranked high cost of inputs such as fertilizers, agrochemicals and improved seeds as their 1st constraint. About 94% of the respondents identified this as a problem. This is because the subsidized agricultural inputs especially fertilizer are enjoyed by government officials and those who patronize the party in power. Most of the farmers are forced to buy their fertilizer from the open market. Most times when new yields like early maize varieties are released into the market, farmers rarely get them because some people hoard them to resell at expensive rates, thereby forcing farmers to rely on the old varieties they are familiar with because the cost per hectare will be too exorbitant for them. High cost of agrochemicals also cannot be unconnected to the fact that farmers are made to buy these chemicals from open markets as against government provision. This increases their cost of production and subsequently reduces their profit.

Inadequate finance

The sampled maize farmers identified inadequate finance as a constraint; hence, it was ranked the 2nd constraint by the maize farmers (91%). Only a few farmers had access to the banks through cooperative societies with strict conditions to borrow. The farmers did not have the necessary collaterals required by banks and therefore depend on personal savings.

High cost of labour

Ranked 3rd constraint by the farmers was problem of High cost of labour. It was highlighted by about 82% of the respondents. The farmers said they experienced problems (high cost of labour) as it becomes very expensive during the peak period of operations.

Poor market price

About 70% of the maize farmers reported Poor/low maize price at harvest. It was ranked 4th among the constraints. This was because most of the maize farmers sold their products at harvest time when there is over supply or glut in the market. This cannot be unconnected to the unorganized nature of our rural markets. Market information flow as regards good prices is a major challenge in this aspect. Markets are located in far areas which induce the farmers to sell at giveaway prices. This makes farmers not to have steady pricing trend which they can predict at any time. The inconsistent trend of prices forces farmers to sell their produce as soon as they notice a rise in price.

Low extension contact

Some of the maize farmers stated that Low of extension services (57%) in terms of accessibility to information on improved farm technologies is hindering their maximum productivity. It ranked least (5th) among the identified constraints.

Problem of Transportation

Harvested farm produce are transported with great difficulties from the farms to market or points of processing. The farm products are mostly transported to the market for sale. Therefore, both categories of farmers ranked high cost of transportation 6th constraint among the constraints encountered by them. About 47% of had this challenge. This cannot be unconnected to the bad roads in the area which makes some roads inaccessible by vehicles rather they use motorcycle, hence, charges are

high. Erratic fuel prices and its scarcity is also a factor in this case. The difficulty in getting transport to market their produce leads to these farmers being exploited by hawkers and people with their own private transport, thereby causing a decline in returns.

Table 5: Distribution of farmers based on constraints faced in maize farming

Constraints	Frequency	Percentage	Rank
High cost of Inputs	252	94	1
Lack of finance	246	91	2
High cost of labour	222	82	3
Poor/low maize price at harvest	188	70	4
Low extension contact	152	57	5
Problem of Transportation	126	47	6

*Total frequency is more than 269 due to multiple responses

Conclusion

The findings of this study indicate that a larger proportion of farming households who produced the early maize varieties preferred DMR-ESR Y CIF2 and this variety is largely attributed to its higher grain yield, long ear and low nitrogen tolerance as indicated by the farmers, this implies that the cultivation of early maize varieties can be enhanced through increased availability of the varieties. The production of early maize varieties has contributed to the increased food security status of farming households in the study area. Research institutes, Universities of Agriculture and colleges of Agriculture should be well funded and equipped to carry out research and send out the findings by making seed available and therefore, adoption and production of these varieties as some farmers are very much interested in cultivating these varieties but do not have access to the varieties. 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 production of early maize varieties. Arising from the significant influence of farmers association on the production of early maize varieties, farmers should be encouraged to join co-operative societies so as to foster their interaction and exchange of ideas on early maize varieties and also, accessibility to these varieties.

REFERENCES

Agbonika .D.A (2013). Information on Maize Technology among Rural Youth: A Solution for Sustainable Agriculture in Nigeria. *Proceedings of the Nigerian Society of Engineers Internationl Engineering Conference, Exhibition and Annual General Meeting held at Interanational Conference Centre, Abuja, Nigeria. 9th-13th December,2013.*

Agbonika .D.A. and Aiyedun E.A. (2012). Sustainable Food Security: The Nigerian Experience. *Proceedings of the 26th annual conference of the farm management association of Nigeria (FAMAN) held at Michael Okpara University of agriculture, umudike, Nigeria.15th-19th October, 2012.Pp 101-105.*

Agboola A. A and H. A. Tijani-Eniola (1991). *Sustainability of Maize Production through Approprite Farming Systems and Practices*. International Institute of Tropical Agriculture, Ibadan, Nigeria.

Alarima, C. I., Kolawole, A., Sodiya, C.I., Oladele, O.I., Masunaga, T. and Wakatsuki, T. (2011). Factors affecting the adoption of sawah technology system of rice production in Nigeria. *Journal of Food, Agriculture and Environment*, 9 (3&4): 177-182.

Amaza, P.S. and Maurice, D.C. (2005). Identification of Factors that Influence Technical Efficiency in Rice-based Production Systems in Nigeria. Paper presented at the workshop on policies and strategies for promoting rice production and food security in sub-Saharan Africa. 7 – 9 Nov., 2005, Cotonou, Benin.

Ambali, O. I., Ologbon, O.A.C. and Akerele, E.O. (2012).Effect of agricultural technology on income of cassava and maize Farmers in Egba division of Ogun state, Nigeria. *Journal of Agriculture and Veterinary Sciences,* 4: 23 – 33.

Ayoola, J.B. (2012). Socio-economic Determinants of the Adoption of Yam Minisett Technology in the Middle Belt Region of Nigeria. *Journal of Agricultural Science*, 4(6): 215 – 222.

Bello, M., Daudu. S., Galadima, O. E., Anzaku, T. K. A. and Abubakar, A. A. (2012). Factors Influencing Adoption of Crop-Based Technologies in Jenkwe Development Area of Nasarawa State, Nigeria. *Global Advanced Research Journal of Agricultural Science*, 1(8): 250-256.

Devereux, S and Maxwell, S. (2001). *Food Security in Sub-saharan Africa*. London, UK: intermediate Technology Development Group publishing.

Food Agriculture Organization (FAO, 2008). Issue and Opportunities for Agricultural Development in the Second Millennium and Beyond. The food and agriculture organization of the United Nations (FAO.) Rome, Italy.

Food and Agricultural Organization(2010). Crop and food supply assessment mission to Ethiopia. FAO Global Information and Early Warning System on Food and Agriculture, World Food Programme, Rome, Italy. Pp3-7

Food and Agriculture Organization(FAO), (2011).FAOSTAT database. http://faostat.fao.org. Accessed 1st July 2012

Hall, B: ***Understanding food security data and methodology*** Hunger Issue Brief, Food security Institute, Center on Hunger and Poverty.(2004),. Available on http:// www.centeron hunger.org/FSI/research.html

Idrisa, Y.L., Gwary, M.M. and Ibrahim, A. (2006): Determinants of Adoption of Cassava Farming Technologies in Mubi north Local Government Area of Adamawa State Nigeria. *Journal of Production Agriculture and Technology, 2(2)*: *26-36.*

Iken JE, Amusa NA, Obatolu VO (2002). Nutrient composition and weight evaluation of some newly developed maize varieties in Nigeria. J. Food Tech. Africa (Kenya) 7:25-28.

Iken, J.E., & Amusa,N.A (2004). Maize Research and Production in Nigeria. *African Journal of Biotechnology* 3(6):302-307.

Kamara, A.Y., Kureh, I., Menkir, A., Kartung, p., Tarfa, B. and P. Amaza. 2006. Participatory on-farm evaluation of the performance of the Drought-tolerant maize varieties in the Guinea Savannas of Nigeria. *Journal of food, Agriculture and Environment, Vol*. 4 (1): Pp 192 – 196.

Kavoi, M.M., Hoag, D.L. and Pritchet, J.(2010). Measurement of economic efficiency for smallholder dairy cattle in the marginal zones of Kenya. *Journal of Development and Agricultural Economics*, 2(4): 122 – 137.

Kudi, T. M. Bolaji, M. Akinola M. O. and Nasa'I D. H. (2011). Analysis of adoption of improved maize varieties among farmers in Kwara State, Nigeria. *International Journal of Peace and Development Studies,* 1(3): 8-12.

Lance Gibson and Garren Benson (2002): *Origin, History and uses of Corn* (Zea mays); Iowa State University, Department of Agronomy.

Lawal BO, Saka JO, Oyegbani A, Akintayo JO (2004). Adoption and Performance Assessment of Improved Maize Varieties Among Smallholder Farmers in Southwest Nigeria. *J. Agric. Food Inf.*, 6(1): 35–47.

Maxwell, S. (1996). "Food Security: A Post-modern Perspective" *Food Policy*, 41(2):385-99

Maxwell, S.and M. Smith (1992).Household Food Security: A Conceptual Review". In S. Maxwell and T. R Frankenberger, eds., Household Food Security: Concepts, Indicators, Measurements. A Technical Review. Jointly sponsored by UNICEF and IFAD.

Mendola M. (2007). Agricultural technology adoption and poverty reduction: A propensity–score matching analysis for rural Bangladesh. *Food policy* 32 (2007): 372-393.

Mignouna, D.B., Mutabazi, K.D.S., Senkondo, E.M. and Manyong. V.M. (2011)Contributions of agricultural improved technologies to rural poverty alleviation in developing countries: case of imazapyr-resistant maize in western Kenya, 55TH Annual AAERS National Conference. pp : 1 -19.

Mignouna, D.B., Manyong, V.M.,Mutabazi, K.D.S., Senkondo, E.M. and Oleke, J.M.(2012).Assessing the technical efficiency of maize producers with Imazapyr-resistant maize for Striga control in Western Kenya. *Journal of Development and Agricultural Economics*, 4(8): 245 – 251.

Muhammad L., K. Njoroge, C. Bett, W. Mwangi, H. Verkuil and H. De Groote. 2002. The Seed Industry for Dryland Crops in Eastern Kenya. Mexico, D.F.: CIMMYT and Kenya Agricultural Research Institute (KARI).

Ndjeunga, J., Ntare, B.R., Waliyar, F., Echekwu, C.A., Kodio, O., Kapran, I., Diallo, A.T., Amadou, A., Bissala, H.Y. and Da Sylva, A. (2008). Early adoption of modern groundnut varieties in West Africa. Working Paper Series no. 24. Sahelian Center, BP 12404 Niamey, Niger: International Crops

Research Institute for the Semi-Arid Tropics. 62 pp.

Odoemenem, I.U. and Obinne, C.P.O.(2010). Assessing the Factors Influencing the, Utilization of Improved Cereal Crop Production Technologies by Small Scale Farmers in Nigeria. *Indian Journal of Science and Technology* 3(1): 180 – 183.

Oguntona, E. B. and Akinyele, I. O. (1995). Nutrient Composition of Commonly Eaten Foods in Nigeria-Raw, Processed and Prepared. Food Basket Publication Series, Ibadan, Nigeria. P131.

Okezie, C.A. and Okorie N. U. (2009). Climate Variality and Change: Implication for Household Food Security. 43rd Annual Conference of Agricultural Society of Nigeria 20th-23rd oct., 2009 Pp 409-412

Oladele,O.I. (2005). The Importance of Farmers' Adoption of New Agricultural Technologies. *Journal of central European agriculture.* 6(3):250-256

Omilola, B. (2009).Estimating the Impact of Agricultural Technology on Poverty Reduction in Rural Nigeria. IFPRI Discussion Paper 00901.pp. 1 -30.

Owolabi, J.O., Wamba,J., Issa, F.O. and Oyewole, S.O (2012). Factors Associated with the Adoption of Improved Cowpea Production Technologies in Lafia Local Government of Nasarawa State. Proceedings of the 26th annual conference of the farm management association of Nigeria (FAMAN) held at Michael Okpara University of agriculture, Umudike, nigeria.15th-19th October, 2012.Pp 101-105.

Petros, T. (2011). Adoption of conservation tillage technologies in Metemaworeda, North Gondar zone, Ethiopia. M.Sc thesis Department of Rural Development and Agricultural Extension, Haramaya University.

Saka, J.O. Okoruwa, V.O. Lawal B.O. and Ajijola, S. (2005): Adoption of Improved Rice Varieties Among Small-Holder Farmers in South-Western Nigeria. *World Journal of Agricultural Sciences* 1 (1): 42-49, ISSN 1817-3047 © IDOSI Publications, 2005

Saka, J.O. and Lawal, B.O. (2009). Determinants of adoption and productivity of improved rice varieties in southwestern Nigeria. *African Journal of Biotechnology*, 8(19):4923 – 4932.

Sanusi, R. A., Badejo, C. A. and Yusuf, B. O. (2006). Measuring Household Food Insecurity in Selected Local Government Areas of Lagos State and Ibadan, Nigeria. *Pakistan Journal of Nutrition.* (5): 62-67.

Selener, D. (1997). *Participatory Action Research Network*. Cornell university ithoea, New York, USA.

Shi ZS, Zhang SH, Li FH, Wang ZP, Zhang XH, Zhang Yl, Zhu M (2008). Comparison and analysis on maize yield performance of mid-maturing, mid-late maturing and late maturing varieties in Liaoning areas. *Journal of Maize Science,* 16(6): 6-10.

Staton WR (1954). Progress report on a maize survey of West Africa. Reports of West African Maize Research Unit.

United States Agency for International Development. (2010). Policy Determination.: Definition of Food Security. Washingtin DC. United States Agency for International Development.

Van Eijnathen LM (1965). Towards the improvement of maize in Nigeria. Ph.D. Thesis. Wageningen, The Netherlands.

Voh, J.P., Ahmed, B., Olufolaji, S., Dike, M. and Ishaku, F. (2001). Adoption of Improved Cowpea Technologies in the Savanna Ecology of Nigeria. A Report of Survey Conducted on Pedune/Pronaf Project in Nigeria. Institute For Agricultural Research Ahmadu Bello University, Samaru - Zaria, Nigeria.

Vogel C. and J. Smith (2002). The Politics of Scarcity: Conceptualizing the current Food Security Crisis in Southern Africa. *South Africa journal of science*. 98:315-317.

Wang X, Chang J, Qin G, Zhang S, Cheng X and Li C (2011). Analysis on yield components of elite maize variety Xundan 20 with super high yield potential. *African Journal Agricultural Research*, 6(24): 5490-5495.