Influence of Improved Maize Variety Adoption on Livelihood of Farmers in Niger Sate, Nigeria

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ABSTRACT

The study examined the adoption of open pollinated improved maize variety in Niger State, Nigeria. To achieve the objectives of the study, 120 farmers were randomly selected from three Local Government Areas in the State. Validated interview schedule with reliability co-efficient of 0.74 was used for collecting data and data collected were analyzed using descriptive statistics, livelihood index and multiple regression analysis. Result showed that the mean age of the respondents was 34 years, while the mean farm size was 1.9 ha. Finding indicated that 82.5% of the respondents were full adopters by cultivating improved maize variety in at least 10 % of their total farm lands. The result further revealed that educational level, income, incentive and time of awareness positively and significantly influenced adoption of improved maize variety, which upshot highly livelihood status of about 70.0% of the respondents. Thus, it was recommended that incentive such as free seed of improved varieties should be given to farmers for testing by the improved varieties' promoters during awareness to facilitate adoption. It was also suggested that extension agents should synchronize awareness time with seasons of usage of the improved varieties to speed up the practical application of the improved varieties.

Keywords: Adoption, Farmers, Improved variety, Livelihood status, Maize.

INTRODUCTION

Agricultural sector is crucial to the Nigerian economy both in terms of source of food and income to a greater part of the society (Mafimisebi *et al.,* 2010). It is a significant sector of economy with several potentials for provision of employment, food security and poverty alleviation (Federal Ministry of Agriculture and Rural Development (FMARD), 2011). Thus, agricultural development is seen as the most efficient means of tackling poverty in the developing countries like Nigeria. In line with this assertion, Franklin *et al.,* (2012) posited that a one percent increment in agricultural productivity would reduce the percentage of poor people living in poverty between 0.6 and 2 percent and that no other economic activities can generate a commensurate benefit for the poor.

But, the main challenge in the agricultural sector of the developing nations is how to increase agricultural productivity to meet food security needs for the ever growing populace. As stressed by de Janvry *et al.* (2001), increase in agricultural production will have to come from growth in yields emanating from scientific advances and plant breeding activities through agricultural research. The researcher's efforts towards this quest have resulted into the

development of improved varieties of crops such as rice, cowpea, wheat, maize among others.

Maize plays a very critical role in the farming system and diets of millions of Nigerians. It is a versatile crop used for domestic consumption in addition to its industrial uses by flour mills, breweries, confectioneries and animal feed manufacturers. Consequently, increasing maize cultivation and yield can improve food security and livelihood in Nigeria (FMARD 2011). The potentials and several uses of maize has prompted plant breeding activities to improve the quality and characteristics of maize to suit the various regions and purposes (Ebojei *et al.,* 2012).

The release of the improved maize varieties by the researchers and its adoption by the farmers is aimed at increasing maize production in Nigeria. Following increase in awareness and adoption of improve maize varieties as a means of increasing food security and agricultural productivity in Nigeria, some researchers studied the concept. However, most of the past studies in Nigeria focused on the effect of improved maize adoption on yield. Other researchers focused on the effect of socio economic characteristics of farmers on adoption of maize variety (Oladele, 2005). There has been little study on the influence of adoption of open pollinated improved maize variety on the livelihood of the farmers in the study area. Information on the influence of improved maize varieties on the livelihood of the maize farmers in a prominent maize growing area like Niger State will promote adoption of improved varieties, reduce poverty and consequently improved livelihood. Hence, this study seeks to examine the influence of improved maize variety adoption on livelihood of farmers in Niger Sate, Nigeria. The specific objectives are to; describe socio-economic characteristics of the respondents, assess adoption of open pollinated improved maize variety, determine factors influencing adoption of improved maize variety and examine influence of improved maize variety on livelihood status of farmers.

METHODOLOGY

The study was conducted in Niger State which is in Guinea Savannah ecological zone of Nigeria. The State's coordinates is 10.2155^{o} N, 5.3904^{o} E. With annual growth rate of 3.4%, the State has estimated population of 5,337,149 in 2015, of which 85% of the people are farmers, while the remaining 15% engaged in other businesses. Annual rainfall ranges from 1,100mm in the Northern part to 1,600mm in the Southern part of the State. The mean

average temperature is around 32^{o}C. Major crops grown in the State include yam, cotton, maize, sorghum, millet, soybean, cowpea, rice and groundnut. Some of the major tree crops cultivated include mango, citrus, cashew, banana, pawpaw. Livestock animals reared are goat, sheep, cattle, chicken, camel and donkey. The State has three Agricultural Zones (I, II and III) (Niger State Geographic Information System, 2007).

Multi-stage sampling procedure was adopted for this study, at the first stage; one Local Government Area (LGA) was randomly selected from each agricultural zone. In the second stage, three villages were randomly selected from each LGA. At the third stage, 10% of the farmers who adopted improved maize variety were randomly selected from each village. In all, a total of 120 respondents were selected as the sample size for the study.

Content validity of the instrument for data collection was ensured through experts' consultation. and literature scan. Thereafter, data collection instruction (interview schedule) was subjected to Cronbach's Alpha reliability test (0.74) and used by the researchers for data collection in September, 2019. Data were collected on socio-economic characteristics, livelihood status and adoption of improved maize variety. Socio-economic characteristics such as age and educational level and farming experience were measured in years. While house hold size was measured in numbers and farm size was measured in hectare. Income was measured in Naira and incentive and awareness time were measured as dummy variables. Adoption was measured in terms of the total land area devoted to open pollination improved maize variety production, as used by Ojiako (2007). Livelihood was determined by asking the respondents to indicate the livelihood factors (such as procurement of food items, expenditure on non-food items, procurement of household assets, procurement of farm inputs, expenditure on non-farm activities, expenditure on off-farm activities, livestock assets acquisition, livelihood expenditure, expenditure on cultural festival/ceremonies, settlement of hospital bills and sponsoring of children to school) they benefited from following the

adoption of open pollinated improved maize variety. Descriptive statistics were used to achieve objectives one and two, while objective three was achieved using multiple regression analysis. Livelihood index was used to achieve objective four. Multiple regression model is specified implicitly as: $Y=f(X_1, X_2, X_3 \ldots X_n, ei)$. The explicit forms of the regression model used for the study are expressed as:

1. Linear:

$$Y = a + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + e$$

2. Semi-log:

$$Y = a + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + \beta_8 \ln X_8 + e$$

3. Exponential:

$$\ln Y = a + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + e$$

4. Double-log:

$$\ln Y = a + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + \beta_8 \ln X_8 + e$$

Where;

Y= Level of adoption (land size allocated to improved maize variety (ha.))

b_0= intercept

X_1= Age (years)

X_2= Education (years)

X_3= Income (#)

X_4= Total Farm size (ha)

X_5= Farming experience (years)

X_6= incentive (received incentive=1, otherwise=0)

X_7= household (number)

X_8= Awareness time (pre-planting time=1, otherwise=0)

e= error term

b_1-b_8= coefficients

Livelihood Status Index (LSI)

$$LSI = \frac{Number\ of\ livelihood\ benefitted\ by\ respondent}{Total\ number\ of\ livelihood\ benefits}$$

LSI =Livelihood Status index

≤ 0.33 = Low livelihood

0.34 - 0.66 = Moderate livelihood

≥ 0.67 = High livelihood

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

Table 1 indicated that the mean age of the respondents was 33.97 year. This implies that majority of the respondents in the study area were within the youthful age group regarded as economically active, innovative and productive. This is in line with the findings of Akinbile and Odebode (2012) who reported a similar mean age of 34 years for farmers whom the authors stressed were still in their active workforce age with innovative minds for improved livelihood. Table 1 showed that 93.4% of the respondents had household size of between 1-10 individuals, while 6.6% had family size of above 10 persons. This suggests that the farmers would have access to family labour for use in farms. This result corroborates finding of Umar (2015) who reported that households in Nigeria are characterized by large family sizes. The result in Table 4.1 indicated that Majority (75.8%) of the respondents had one form of formal education or the other. This implies that most of the respondents had formal education which could enhance adoption and production. In a similar study, Umar *et al.* (2015) reported that most of the farmers acquired formal education in Niger state, Nigeria.

The result in Table 1 revealed that 78.3% of the respondents have between 1-3 hectares of farm land, while the mean farm size was 1.9 ha, which suggests that most of the farmers in the study area are small scale farmers, This result agrees with the findings of Yusuf *et al.* (2015) who stressed that majority of Nigerian farmers are small scale farmers. The result in Table 1 showed that the mean farming experience of the respondents was 14.3 years. This indicates that most of the farmers in the study area have adequate farming experience which will enhance their production. Table 1 revealed that the mean income of the respondents was #307, 712.50. This implies that majority of the respondents realized a fairly reasonable income from farming occupation.

Table 1: Socio-economic characteristics of the respondents

Variable	Frequency	Percentage	Mean
Age			
21-30	23	19.2	
31-40	82	68.3	
41-50	5	4.2	
51-60	7	5.8	
Above 6	3	2.5	
Total	120	100.0	33.97
Educational level			
Non-formal	29	24.2	

education			
Primary	36	30.0	
Secondary	34	28.3	
Tertiary	21	17.5	
Total	120	100.0	
Farm size (ha)			
1-3	94	78.3	
4-6	26	21.7	1.9
House hold size			
1-5	41	34.2	6.5
6-10	71	59.2	
11-15	8	6.6	
Total	120	100.0	
Farming experience			
1-10	22	18.3	
11-20	83	61.2	
Above 20	15	12.5	
Total	120	100.0	14.3
Income			
10,000-50,000	19	15.8	
51,000-100,000	8	6.7	
101,000-150,000	14	11.7	
150,000 Above	79	65.8	
Total	120	100.0	307,712.5

Source: Field survey, 2019

Adoption of Open Pollination Improved Maize Variety

Result in Table 2 indicated that a combined total of 99 respondents which constituted 82.5% of the respondents cultivated open pollinated improved maize variety in at least 10 % and above of their total farm land. Hence, they were considered as full adopters of this improved maize variety in the study area having devoted up to 10% of their total farm lands to improved maize variety cultivation. On the other hand, 21 respondents which constituted 17.5% of the total respondents devoted less down 10% of their total farm lands to the cultivation of improved maize variety, and thus they were categorized as partial adopters of the improved maize variety in the study area. In a similar study, Ojiako *et al.* (2007) posited that a farmer that devoted at least 10% of his or her total farm land to improved variety production is considered as an adopter for that particular technology. This result shows the

level of acceptance for improved maize variety in the study area by the farmers as a means of improving livelihood.

Table 2: Adoption of open pollinated improved maize variety

Percentage of land devoted to improved variety	Frequency	Percentage
Less than 10%	21	17.5
10.0-29.9%	30	25.0
30.0-49.9%	49	40.8
50.0-69.9%	13	10.8
70.0-89.9%	4	3.3
90.0% and above	3	2.6
Total	120	100.0

Source: Field survey, 2019

Factors Influencing Adoption of Improved Maize Variety

Four functional forms of multiple regression models were run and the exponential equation gave the best fit. From Table 3, the diagnostic statistics of the exponential such as the F- ratio was highly significant at ($P<0.001$), indicating the goodness of fit of the model. Moreso, the R^2 value of 0.582 indicated that 58% of the variation in the adoption level was attributed to the factors captured in the model.

The coefficient of education was positive as expected and statistically significant at 1% probability level. The positive coefficient implies that an increase in the level of education would increase the probability of adoption of improved maize variety. Education is believed to increase one's acumen for innovative decisions thereby increasing the probability of adopting an innovation. This agrees the findings of Dereje (2006) which stressed that education enable the farmers to cope with complexities associated with the adoption of new technology. Income was positive and significantly related to adoption of improved maize variety by farmers. A unit increase in the income of farmers could increase the probability of adoption of improved maize variety by farmers. Previously, Rahmeto (2006) found that higher income increases farmer's financial ability to invest in technologies' adoption.

Farm size was negatively signed and significant at 1% level of probability. The result points to the fact that a unit increase in farm size will reduce the probability of adoption of improved maize variety by farmers. This is unexpected because increase in farm size increases the need for technological inputs like fertilizer, agrochemicals, capital and information, which are limited in supply. Hence, it is assumed that the scarcity of these inputs required to fully adopt improved maize variety might discourage the farmers from allocating more land for the cultivation of improved maize variety. This finding strengthens the report of Idrisa, Ogunbameru and Madukwe (2012) who also found significant negative relationship between farm size and adoption of improved seed.

Similarly, the influence of incentive on adoption of improved maize variety was positive and highly significant at 1% level of probability, which is an indication that the influence of this factor (incentive) on adoption of improved maize variety could not have occurred by chance. These points to the usefulness of offering incentives in terms of giving the farmers free seed of improved varieties to test in their farms during awareness to facilitate adoption. Also, Awareness time was found to be positively signed and significant at 1%; this implies that creating awareness among farmers at the appropriate time will increase the likelihood of adopting improved maize varieties by the farmers. When innovations or improved varieties are introduced to the farmers prior or close to the time or season of use, it enable farmers to put them to use immediately, thereby speeding up the practical application of the improved technologies. In a related study, Umar *et al*. (2014) reported that timeliness of information to farmers reduces the gap between agricultural innovation invention and usage by the farmers.

Table 3: Factors influencing the adoption of improved maize variety

Factors	**Linear**	**Exponential**	**Cobb-douglas**	**Semi-log**
Age	1379.771	0.006	0.860	91062.32
	(1.17)	(0.32)	(1.49)	(2.34)**
Education	4297.406	0.203	0.295	6400.291
	(1.29)	(3.81)***	(3.27)***	(1.06)
Income	1301.534	0.049	0.155	2810.32
	(0.95)	(2.23)**	(2.74)***	(0.74)
Farm size	12319.95	-1.265	-0.162	11671.14
	(0.53)	(-3.41)***	(-1.09)	(1.18)
F/experience	-2183.756	-0.042	-0.163	-40898.32
	(-1.32)	(-1.57)	(-0.75)	(-2.80)
Incentive	2560.992	0.154	0.639	15532.99
	(1.73)	(6.49)***	(10.87)***	(3.93)***
Household size	-0.062	7.00e-07	0.053	2681.373

	(-0.74)	(0.53)	(3.05)***	(2.31)**
Awareness time	0.135	0.000	0.044	-183.676
	(0.82)	(4.82)***	(1.15)	(-0.07)
Constant	-55514.76	7.245	4.578	-221554.9
	(-1.40)	(11.38)***	(2.36)**	(-1.70)*
R^2	0.122	0.582	0.695	0.257
R^2 – adjusted	0.043	0.545	0.667	0.190
F- ratio	1.54	15.51***	25.30***	3.85

Note: ***=significant at 1%, **=significant at 5%, *=significant at 10%.
Figures in the parenthesis are the t-values.

Influence of Improved Maize Variety on Livelihood of Farmers

The result in Table 4 shows the influence of improved maize variety on livelihood of farmers, of which the incidence of high livelihood for full adopters was about 70.0% and none for the partial adopters of improved maize variety. On the other hand, the incidence of low livelihood was common among the partial adopters with 81.0% response rate than the full adopters with only 5.1% response rate which was lower than that of partial adopters. The implication of this, is that the percentage of people that are in low livelihood status or category and possibly living in poverty was higher among the partial adopters than the full adopters, which could be as a result of the positive economic effects of adopting improved maize variety on the full adopters.

Table 4: Influence of improved maize variety on livelihood status of farmers

Adopters	Livelihood status					
	Low livelihood		Moderate livelihood		High livelihood	
	Freq	(%)	Freq	(%)	Freq	(%)
Partial adopters (n=21)	17	(81.0)	4	(19.0)	-	-
Full adopters (n=99)	5	(5.1)	27	(25.2)	69	(69.7)

CONCLUSION

From the findings of the study, it was concluded that the respondents were in their youthful active ages. The adoption of open pollinated improved maize variety was wide spread in the study area. Unexpectedly farm size had negative significant influence on the adoption of improved maize variety. The percentage of respondents that are in low livelihood status was higher among the partial adopters than the full adopters of improved maize variety in the study area.

RECOMMENDATIONS

The level of education significantly influenced adoption of improved maize variety by farmers in the study area. Thus, government should make qualitative education available to rural farmers through the existing schools particularly the adult schools.

Farm size had negative effect on adoption of improved maize variety; implying that the advantage of large farm size to encourage farmer's adoption of improved maize varieties can be discouraged by insufficient availability of essential and complementary inputs such as fertilizers, agrochemicals and capital. Thus, government and agro-input companies should intensify effort in making technological package inputs available and accessible to the farmers on time. This can be done by strengthening existing policies under agricultural programmes such as Anchor Borrowers Scheme.

Extension organizations and improved varieties' promoters should encourage maize farmers to adopt improved maize varieties during awareness by giving them incentives in form of free seeds and synchronizing time of awareness with season of use of the improved varieties based on their positive effects on adoption and livelihood.

Income significantly increases the adoption of improved maize varieties. Based on this, there is need for the stakeholders such as Non-Governmental Organization to improve farmers' access to other income generating activities such as off-farm activities, skills acquisition and economic empowerment programmes.

REFERENCES

Akinbile, L. A. and Odebode, S. O. (2012). Determinants of farmers use of sustainable soil conservation practices in Osun State, Nigeria. American- European journal of sustainable agriculture, 1(1):1-7

de Janvry, A., Graff, G., Sadoulet, E. and Zilberman, D. (2001). Technological change in agriculture and poverty reduction: Concept paper for the WDR on poverty and development 2000/01.

Dereje, H. (2006). Assessment of farmers' evaluation criteria and adoption of improved bread wheat varieties in Akaki, Central Ethiopia. Unpublished M. Sc. thesis presented to school of graduate studies Alemeya University, Ethiopia.

Ebojei, C.O., Ayinde, T.B. and Akogwu, G.O. (2012). Socio-economic factors influencing the adoption of hybrid maize in Giwa Local Government Area of Kaduna State, Nigeria, *The journal of Agricultural Science*, 7(1):25-27.

Federal Ministry of Agriculture and Rural Development Abuja, Nigeria (2011), Agricultural Transformation Agenda (ATA); we will grow Nigeria's Agricultural sector (Draft for discussion) 9th September.

Franklin, S., Menale, K., Solomon, A., Bekele, S., Emmanuel, M., Moses, S. (2012). Welfare effects of agricultural technology adoption: The case of improved ground nut varieties in rural Malawi. Selected paper prepared for presentation at the International Association of Agricultural Economists (JAAE) Triennial Conference, Foz do Iguacu, Brazil, 18-24 August.

Idrisa, Y.L., Ogunbameru, B.O. and Madukwe, M.C. (2012). Logit and Tobit analyses of the determinant of likelihood of adoption and extent of adoption of improved Soybean seed in Borno State, Nigeria, *Greener Journal of Agricultural Science*, 2: 37- 45.

Mafimisebi, T.E., Oguntade, A. E. and Mafimisebi O.E. (2010). Re-engineering agriculture for enhanced performance through financing, *Journal of Economics, finance and Administrative Sciences*, 15(29):35-49.

Niger State Geographic Information System (2007). Background information. Retrieved in April 4th, 2013. From www.nigeris.com/about-nigerstate

Rahmeto, N. (2006). Determinants of adoption of improved haricot bean production package in laba special woreda, Southern Ethiopia. Unpublished M.Sc. Thesis submitted to School of Graduates Studies, Haramaya University.

Ojiako, I.A., Manyoung, V.M. and Ikpi, A.E. (2007). Determinant of rural farmers' improved soyabean adoption decision in Northern Nigeria. *Journal of Food, Agriculture and Environment*, 5(2): 215-223.

Oladele, O. I. (2005). A Tobit analysis of propensity to discontinue adoption of agricultural technology among farmers in Southwestern Nigeria. *Journal of Central European Agriculture*, 6 (3):249-254.

Umar, S. I., Ndanista, M. A., Tyabo, I. S. and Ibrahim, M. (2014). Effect of quality service indicators on the attitude of farmers towards demand-driven extension services in Niger State, Nigeria. *Research on Humanities and Social Sciences*, 4 (21) : 88-93.

Umar, I.S. (2015). Practice of sustainable fisheries regulations in Niger State, Nigeria. *International Research Journal of Agricultural and Aquatic Sciences,* 2 (3) : 120-123.

Umar, I. S., Olaleye, R.S. and Adeniji, B. O. (2015). Attitude of fadama farmers towards demand-driven extension delivery system in Niger State, Nigeria. *International Research Journal of Agricultural and Aquatic Sciences*, 2 (3) : 114-119.

Yusuf, O. J., Abdullahi, K. A. and Haruna, S. K. (2015). Effectiveness of e-wallet scheme in curbing sharp practices associated with agricultural input accessibility among smallholders farmers in Kano State, Nigeria. *Nigeria Journal of Rural Sociology*, 15 (2): 67-75.