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ANALYSIS OF FACTORS AFFECTING ADOPTION OF PREMIER HYBRID SEED AMONG MAIZE FARMERS IN SABON-GARI LOCAL GOVERNMENT AREA OF KADUNA STATE, NIGERIA.

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ABSTRACT

The study investigated the factors affecting adoption of premier hybrid seed among maize farmers in Sabon-Gari Local Government Area of Kaduna State. Multi-stage sampling technique was employed to select 54 respondents for the study. Primary data were collected with the aid of structured questionnaire administered to (54) maize farmers in the study area. The data were analyzed using descriptive and logistic statistics (frequencies, percentages and logit regression model). The results of the socio economic characteristic of the maize farmers revealed that the mean age of the maize farmers was 35 years and average years of farming experience was 21 years. The average household size of the maize farmers was 8 persons per household. The result of the socio economic factors influencing adoption show that level of Awareness, Age, level of education, extension contact, household size, and output were positive and significant at different levels while farming experience was negative but significant at 10 percent. Major constraints affecting the adoption of premier hybrid maize seed were inadequate input, high cost of the hybrid maize seed, insufficient capital to boost their farming activity and high labour cost. It is therefore recommended that farmers should pull their resources together through cooperative or farmers association to be able to raise funds for the purchase of farm inputs at lower cost.

Keywords: Analysis, Maize, Hybrid seed, adoption, factors affecting, logit regression

INTRODUCTION

Maize (*Zea mays* L.) is an important food and feed crop in Nigeria widely grown across agro-ecological zone and remains an important crop for rural food security (Chete, 2021). The production of the crop must be increased in order to ensure food and income security through the development of improved maize varieties and technologies. The production of the crop must be increased in order to ensure food and income security through the development of improved maize varieties and technologies.

Maize (*Zea mays* L.) is the third most important cereal in the world after wheat and rice, and the second most cultivated crop in Nigeria in terms of area harvested In 2018, about 10.2 million tons of maize was produced from 4.8 million hectares, making Nigeria the highest producer in Africa (FAO, 2018) and about 6.5 million ha second to Cassava's 7.1 million hectare in 2021 (Food and Agriculture Organization Corporate Statistical Database, FAOSTAT, 2021. It is also the most important cereal crop in sub-saharan Africa (Onuk, Ogara, Yahaya, and Nannim, 2010; International Institute of Tropical Agriculture, IITA, 2013). Maize is high-yielding, easy to process, and cheaper than other cereals in terms of cost. Every part of the maize plant has economic value. The grain, leaves, stalk, tassel and cob can all be used to produce a large variety of food and non-food products (IITA, 2013). As one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions, its importance lies in its wide industrial applications besides serving as human food and animal feed (Srikanth, Kausadikar, Jondhale and Gandhi, 2017).

The global production of maize in 2021/2022 was estimated to be 1,206 million metric tonnes (STATISTA 2022). United States of America (USA) is the highest producer of maize grain in 2021/ 2022 with a total production of 383.94 million metric tonnes (STATISTA,2022). The Nigeria maize production in 2021/2022 was estimated to be 11.6 million metric tonnes which is 14.7 percent and 0.98 percent of the production in Africa (75 million metric tonnes), and the world (1,197 metric tonnes) respectively (STATATISTA, 2022). Maize is a staple food of great socioeconomic importance in developing countries and it has a wide range of uses these include; baking, brewing industries and livestock feed. It is an important source of carbohydrate, protein, iron, vitamin B, and minerals. Green maize (fresh on the cob) is eaten parched, baked, roasted or boiled; playing an important role in filling the hunger gap after the dry season and serving as a staple diet for 200 million people (Kudi, Bolaji, Akinola and Nasa, 2011), while in developed countries, maize is consumed as second-cycle produce in the form of meat, eggs and dairy products.

Despite the potential benefits of improved technologies such as fertilizer and hybrid seed the huge gap between the actual and achievable yields in maize production threaten household food security. farmers are reluctant to invest in

them because of high cost of purchase and low adoption of improve maize production technologies is often cited as one of the major cause of low yields due to constraints to adoption such as poor extension services limited fund, scarcity and high cost of inputs, diseases and pests attacks among others (Ugwumba and Okechukwu, 2014).Since agricultural production innovations have no value if they are not taken to the end users, identification of the factors determining adoption of premier hybrid seed will help improve the effectiveness of research and extension services, and thereby directing agricultural policy towards increased productivity of traditional farmers. this study therefore aim to identify the socio-economic characteristic of the maize farmer, identify the types of hybrid maize seeds available to farmers from premier seeds as well as assess the extent to which the farmers have adopted the hybrid maize seed produced by premier seed, and the factors that influence the adoption of premier hybrid maize seed by maize farmers in the study area.

MATERIALS AND METHODS

The study Area

The study was carried out in Sabon-Gari Local Government Area of Kaduna State. Sabon-Gari L.G.A of Kaduna State lies in the Northern Guinea savanna ecology. Sabon-Gari is located between longitude 7^0 and 8^0 East and latitude 10^0 and 12^0 North and the area has an average altitude of 675m above sea level. (Kaduna Agricultural Development Agency, KADA, 2018) with a projected population of 725,069 in 2018 at an annual growth rate of 3.2 percent (National Population Commission, NPC and National Bureau of Statistics, NBS, 2016). The farming systems practiced in the area are livestock and crop production. Livestock are reared under extensive animal husbandry with little of semi– intensive practice of rearing. Mixed cropping is a common practice of crop production in the area. Crops grown include maize, sorghum, millet, cowpea and groundnut or a mixture of these as in maize and cowpea.

Sampling procedure and sample size

A multi-stage sampling procedure was adopted in this study in selecting the appropriate sample size of maize farmers. The first stage was purposive selection of five wards out of the 11 wards based on the intensity and concentration of maize farmers in the areas. The selected wards are Zabi, Dogarawa, Angwan-Gabas, Chikaji and Jushi wards. The second stage involved random selection of two villages under each ward selected. This gave a total of ten (10) villages viz: Dan Makwarwa, Bauda, Sakadadi, Machiya, Tsugugi, Yan-awaki, Ungwan Nainna, Rimin Tsiwa, Yan Tukwane and Bakin Dogo. Finally, a simple random sampling procedure was employed in selecting maize farmers from each of the villages to get the sample size. A sample size of fifty-four (54) maize farmers for the study was obtained from the sample frame of five hundred and forty (540) using 10 % of the sample frame. The proportionate number of farmers was selected from each village because the number of maize farmers varies from one village to another. Hence the total sample size for this study was 54.

Method of data collection

Primary data were used in this study. The primary data were obtained through the administration of structured questionnaires to maize farmers.

Analytical Tools

Analysis of data collected was done using descriptive statistics and Multiple regression analysis

Descriptive statistics

Simple descriptive statistics such as mean, percentages and frequency distribution tables were used in the analysis of data

Logit regression model

Logit regression was used to determine factors that influence the adoption of premier hybrid maize seed by maize farmers in the study area. which is represented by a binary variable (1 or 0).

The logistic regression model is stated thus

$$X_2 = f(z) = \log\frac{pi}{1-pi}\sum n_1\beta_i x_i$$

$where\left[\frac{pi}{1-pi}\right]$ is the ratio of the probability that the farmer would adopt premier hybrid maize seeds to the probability that he will not. Thus, the dependent variable is dichotomous that is, 1 for adopters and 0 for non-adopters. Adopters are defined as farmers who cultivated at least one of the premier hybrid maize seeds in the cropping season and non-adopters refers to farmers that did not grow the premier hybrid maize seeds in that season. X_i is a linear function of explanatory variables as follows

$$Y_i = f(X_1, X_2, X_3 \Lambda\ \Lambda\ \Lambda\ \Lambda\ \Lambda\ \Lambda\ XN)X_{10} + \lambda_i$$

Explicitly, the model for linear regression becomes;

$$Y_i = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \mathrm{K}\ \mathrm{K}\ \beta_{10} X_{10} + \lambda_i$$

Y_I = Adoption of premier hybrid maize seed (Adoption = 1, Non-Adoption = 0)

X_1 = age of the respondents (years)

X_2 = sex (Female = 0 and Male = 1)

X_3 = education (years spend in formal education),

X_4 = household size (number of individuals in a given household)

X_5 = farming experience (years)

X_6 = extension (number of extension contacts per farming season)

X_7 = Level of awareness

X_8 = farm size (ha)

X_9 = output (kg/tons) ha

X_{10} = income (in naira)

β = vector of poison maximum likelihood estimates

RESULTS AND DISCUSSION

Farmers Socio-Economic Characteristics

The important socio-economic characteristics of the farmers considered in this study were age, marital status, gender, household size, level of formal education, years of farming experience, farm size, maize output, farm income, and extension contact. These are described below.

Table 1: Distribution of Maize farmers based on socioeconomic characteristics

Variables	frequency	percentage	Mean	SD	Min	Max
Sex						
Male	45	83.3				
Female	9	16.7				
Age			**35**	**8.50**	**18**	**60**
< 29	8	14.8				
30-39	19	35.2				
40-49	16	29.6				
>50	11	20.4				
Marital Status						
Single	9	16.8				
Married	45	83.2				
Household size			8	2.33	1	25
1-5	21	38.8				
5-10	25	46.2				
>10	8	14.8				
Level of Education						
No formal education	2	3.7				
Primary education	8	11.1				
Secondary education	35	64.8				
Tertiary education	11	20.4				
Farming Experience			**21**	**9.22**	**1**	**40**
1-10	63	30.7				
11-20	88	42.9				
≥21	3	1.5				
Output						
1-4	24	44.4				
5-8	21	38.8				
≥9	8	14.8				
Farm size			**3**	**0.80**	**0.1**	**4.1**
0.1-1	20	37.0				
1.1-2	21	38.9				
2.1-3	8	14.8				
3.1-4	4	7.4				
≥4.1	1	1.9				
landownership						
borrowed	4	7.5				
purchased	2	3.7				
rented	6	11.1				
inherited	34	63.0				
others	8	14.8				
Extension contact						
Yescontact	43	80				
No contact	11	20				
Amount of credit						
40000-80000	12	22.22				
81000-120000	20	37.03				
121000-16000	13	24.07				
≥161000	9	16.66				

The result in table 1 revealed the socioeconomic characteristics of maize farmers. 83.3 % of the respondents were male, the mean age of the farmers was 35 years. Farmers within this age range are believed to be in their active and productive age, implying that there is likelihood of high productivity. This agrees with studies

conducted by Ayana *et al.* (2021); Ezra et al. (2016). In addition, 96.3% of the farmers had one form of education and another. From the result, it can be said that majority of the maize farmers have formal education which can influence their decision making concerning the adoption of new technology and innovation. The mean household size of maize farmers was 8 persons with the lowest being 1 person and highest 25. This indicates that there might be a good number of family labour supply to achieve different farming activities. This finding is in agreement with Ajayi *et al.* (2016) who posited that in Nigeria, larger household size has been recognize to play a vital role in the adoption of new technology packages than small ones. The mean years of farming experience is 21 years. This indicated that majority of maize farmers in the study area are experienced in maize farming. This finding agrees with the results of Nwaobiala *et al.* (2019) and Etuk *et al.* (2018), who found that farmers had many years of practical experience on farming ranging from 16-25 years. The mean ginger farm size was 3 hectares, implying that the study area comprises of small-scale farmers. This is in contrast with that of Ayinde *et al*, (2011) who reported in their study that some farmers cultivated on a large scale. Also, majority about 63 % of the respondents acquired their land through inheritance.

Result on maize output revealed that majority (44.4 %) of maize farmers realized output of 1 to 4 tons/ha. Majority 37.03 percent of the respondents had income between ₦80,000-₦120,000. Respondents with high income tend to adopt more improved technologies if they are capital intensive. This result agrees with the study of Kaliba *et al*, (2000); Asfaw *et al* (2012) who reported that adopting improved maize varieties will result to realizing higher income depending on the size of land under cultivation

80.0% of maize farmers had extension visit or contact, and about 20 % had no access to extension visit

Source of information

Data in Table 2 shows that about 33.3 percent of the respondents obtained information about premier hybrid maize seeds from their village/ward head, and 27.8 percent of the respondents obtained information about premier hybrid maize seed from other farmers, 25.9 percent of respondents obtained information about premier hybrid maize seeds from extension agents, 7.4 percent obtained information about hybrid maize seeds from friends, while only 5.6 percent of respondents obtained information about premier hybrid maize seed from radio source. This result disagrees with that of Abdulrahman, (2010); Issa *et al*. (2016) who found extension agents to be the most sources of information on improved technologies. From the study few respondents about (5.6 percent) obtained information from radio which means that the dissemination of information about new improved varieties in the study area is mostly not through radio but through village/ward heads and other farmers. This result reveals the importance of village heads in extensive information dissemination among farmers.

Table 2: Distribution of respondents according to sources of information

Source of information	Frequency	Percentage
Radio	3	5.6
Extension visit	14	25.9
Other farmers	15	27.8
Friends	4	7.4
Village/ward head	18	33.3
Total	54	100

Awareness of premier hybrid maize seed

Results in Table 3 shows that many farmers are aware of premier hybrid maize seed from the result about 96.3 percent of the respondents are aware of premier hybrid maize seed while only 3.7 percent of the respondents were not aware of premier hybrid maize seed. This shows that most of the respondents were aware of the hybrid maize seed. For a farmer to adopt a particular technology he has to be aware of it (Edward, 2006). It is during the period of awareness process that the farmer learns about an innovation and gains some understanding of how it functions (Rogers, 1995). This study is in line with that of Kudi *et al*, (2011) who reported that about 98 percent of farmers in their study area Kwara State were aware of improved maize variety which eventually lead to high adoption rate in that area.

Table 3: Distribution of respondents' base on awareness of the types of premier hybrid seed

Types of hybrid maize seed	Frequency	Percentage
NEW KADUNA	10	18.5
OBA 98	6	11.1
OBA SUPER1	20	37.0
OBA SUPER 2	14	26.0
TZEE	4	7.4
Total	54	100

Level of adoption of premier hybrid maize seed

Results on levels of adoption of improved maize premier hybrid maize seed (Table 2) indicated thatmajority (75.0 %) of the respondents adopted premier hybrid maize seed while only 25.0 % of the respondents did not adopt premier hybrid maize seed. This shows that most of the respondents adopted the hybrid maize seed. This study is in line with that of Fadre *et al*, (2014) who reported that about 90 percent of farmers in a study in Nigeriaadopted improved maize variety.

Table 4: Distribution of respondent's base on level of adoption of premier hybrid maize seed

Adoption	Frequency	Percentage
Yes	40	75.0
No	14	25.4
Total	54	100

Rate of adoption of the types of premier hybrid maize seed

Results in Table 5 show the level and types of premier hybrid maize seed that were adopted by farmers. 29.6 percent of the respondents adopted Oba 98 which took the highest percentage because it has a yield potential that is greater than the other varieties, 22.2 percentage of the farmers adopted Oba super 2, 20.4 percent of the respondents adopted Oba super 1, 18.5 percent of the respondents adopted New Kaduna, while only 9.3 percent of farmers adopted Tzee which took the lowest percentage because the yield potential is just 3 tonnes/ha compared to other varieties. This study agrees with the findings of (Lawal *et al*, 2004; Fadre *et al*., 2014) who reported that farmers will adopt an improve variety that has a higher yield potential than a variety with lower yield potential.

Table 5: Distribution of respondents according to the types of premier hybrid maize seed they adopted

Adopted	Frequency	Percentage
NEW KADUNA	10	18.5
OBA 98	16	29.6
OBA SUPER 1	11	20.4
OBA SUPER 2	12	22.2
TZEE	5	9.3
Total	54	100

The influence of socio-economic variables on adoption of premier hybrid maize seed.

The result of the logit regression analysis in Table 6 revealed the Chi-square value of 0.0000 was highly significant at 1 % level of probability indicating goodness of fit of the logistic regression line giving a log likelihood of -75.45 indicating that with new variable introduce into the model it shows that they have significant effect when

compare with the model that have only the intercept. Seven variables were found to significantly adoption of the new maize varieties in the study area. These variables include level of awareness, level of education, age, farming experience, household size, extension contact and output of the improved maize varieties. The level of awareness had a positive and significant relationship at 10 percent level of significance with the probability of adoption of premier hybrid maize seed implying a direct relation with the farmer's level of awareness of the premier hybrid maize seed. The odds-ratio in favour of adopting premier hybrid maize seed, other factors being kept constant increase by factor of 1.053 as the level of awareness of the maize farmer increase by one unit. The positive sign implies that the more the rate at which farmers are aware of an innovation the higher the rate of their chance to adopt agricultural innovation. This is in line with that of Ogundari, (2006) who found a positive relationship between the level of farmers' awareness and adoption of improved maize variety. Age had a positive and significant relationship at 1 percent level of significant with the probability of adoption of premier hybrid maize seed implying a direct relationship with adoption of hybrid maize seed. The odds-ratio in favour of adopting premier hybrid maize seed, other factors being kept constant increase by factor of 1.107 as the age of the maize farmers increase by one unit that is an increase in age will lead to increase in the adoption of premier hybrid maize seed, probable reason is that older farmers have more experience into farming than the younger once and they tend to adopt new innovation technologies. This result is contrary to the findings of related empirical studies of Chete, (2021), Islam *et al.* (2012), Kudi, (,2011) which revealed a positive and significant relationship of farmers' age

farming experience had a negative and significant relationship at 1 percent level of significance with the probability of adoption of premier hybrid maize seed. The odds-ratio in favour of adopting premier hybrid maize seed, other factors being kept constant decrease by factor of -0.931 as the farming experience of the maize farmers increase by one unit. This implies that farmers acquire more experience as the rate of adoption of new varieties decrease.

Educational level had a positive and significant relationship at 1 percent level of significance with the probability of adoption of premier hybrid maize seed. The odds-ratio in favour of adopting premier hybrid maize seed, other factors being kept constant increase by factor of 1.526 as the educational level of the maize farmers increase by one unit for the farmers who are literate than the once who are not. This implies that there is a direct relationship between adoption of improved maize varieties and educational status, indicating that as educational status increases, adoption level also increases among farmers. Educated farmers are more likely to adopt improve maize variety than those who are not educated. This may be because educated farmers have more access to information and they become more aware of new technology and this awareness enhances the adoption of new technology This study is in line with the works of Chete, (2021); Danladi *et al*. (2021); Ezra *et al*. (2017); Issa, Kagbu and Abdulkadir (2016); kudi *et al*. (2011). who reported that high level of education of farmers in their study area will enable them to adopt new technology and innovation. Household size had a positive and significant relationship at 10 percent level of significance with the probability of adoption of premier hybrid maize seed. The odds-ratio in favour of adopting premier hybrid maize seed, other factors being kept constant increase by factor of 1.161 as the household size of the maize farmers increase by one unit This suggests that farmers with larger households have a higher probability of embracing innovation especially if it is labour-intensive, as they could harness labour from household members at little or no cost. This finding is in line with that of chete, (2021); Danladi *et al*. (2021); Sodjinou *et al*. (2015) and Kudi, (2011). Extension contact had a positive and significant relationship at 1 percent level of significance with the probability of adoption of premier hybrid maize seed. The odds-ratio in favour of adopting premier hybrid maize seed, other factors being kept constant increase by factor of 1.264 as the number of extensions contact of the maize farmers increase by one unit implying a direct relationship with the maize farmers and extension contact. A unit increase in extension contact will led to an increase in the adoption capacity of the maize farmers this is because the method of delivery of extension service to the maize farmers are appropriate and the farmers are well info during extension visits by extension agents who are properly trained.

Output had a positive and significant relationship at 1 percent level of significance with the probability of adoption of premier hybrid maize seed. The odds-ratio in favour of adopting premier hybrid maize seed, other factors being kept constant increase by factor of 0.219 as the number of outputs of the maize farmers increase by one unit implying a direct relationship with the maize farmers. Thus, increase in yield will lead to increase in adoption of new maize variety by the farmers. This means that the output realized will depend on the farmers' level of adoption. Higher output will make the farmers to adopt faster because the aim of every farmer is to get a bumper harvest. This result agrees with that of Chete, 2021 and Kudi *et al*, (2011) that reported that yield significantly influenced farmers' decision to adopt improved maize variety

Table 6: Logit model estimates of the influence of socio-economic variables on the adoption of premier hybrid maize seed.

Variables	Odds ratio	Standard error	P value
Awareness	1.053	0.068	0.068*
Age	1.107	0 .025	0.000***
Sex	1.310	0.455	0.986
Education Status	1.526	0.250	0.071*
Household size	1.161	0.086	0.058*
Extension contact	1.264	0.602	0.000***
Farming experience	-0.931	0.027	0.004***
Income	0.942	1 .311	0.716
Output	0.219	0.010	0.007***
Farm size	0.019	0.107	0.147
Constant	-5.412	1.378	0.000
Observations	52		
LR chi^2 (10)	106.70		
Prob> chi^2	0.0000		
Pseudo R^2	0.4142		
Log likelihood	-75.457078		

Note: *, ** and * significant at 1 percent, 5 percent and 10 percent levels of probability**

Constraint affecting the adoption of premier hybrid maize seed in the study area.

The problems faced by maize farmers in the study area were ranked according to their magnitude as stated by the maize farmers. The results of analysis in table 7 show that inadequate input (31. 5%), high cost of hybrid maize seed (20.3%), insufficient capital (16.7%) high labour cost (11.1), inadequate extension service (9.3 %), poor storage facilities (5.5 %), problem of transportation (3.7 %) and pest, disease and weed infestation (1.9 %) where ranked as the major factors militating against the adoption of premier hybrid maize seed in the study. This finding agrees with those of Hyun *et al.,* (2008), Tekana *et al.* (2011); Onuk *et al.* (2010); chete, (2021) and Okonji and Awolu (2021) who observed that inadequate inputs, inadequate capital, high cost of labour, poor storage/processing facilities and inadequate extension visits were among the constraints faced by maize farmers. Extension services which are supposed to provide linkage between researchers, policy makers and farmers so as to provide information for increase in productivity is inadequate in the study area. This is in line with the view of chete, (2021) that the extension delivery system is insufficient and as a result is ineffective in delivery of extension services in rural areas.

Lack of credit is also a constraint agreed by maize farmers in the study area. Provision of credit facility can help the farmers to increase their production. This was noted by Nasiru (2010) that access to micro credit can improve farmers productivity and also contribute to improving their livelihoods. High cost of hybrid maize seed is also a constraint agreed by the maize farmers. Hybrid maize seed has high demand for labour which is normally high and expensive especially in time of land clearing, ploughing, weeding, harvesting and processing. Also farm inputs such as fertilizer and herbicides are expensive. There is also problem of transportation in the study area. This is due to the fact that the feeder roads in most cases are poor and impassable especially during rainy season. Pest and disease infestation was also agreed to be a constraint especially in the aspect of maize production.

Table 7: Constraint to maize farming in the study area.

Variable	Frequency	Percentage	ranked
Inadequate input	17	31.5	1st
High cost of hybrid maize seed	11	20.3	2nd
Insufficient capital	9	16.7	3rd
High labour cost	6	11.1	4th
Inadequate extension services	5	9.3	5th
Poor storage facilities	3	5.5	6rd
Problem of transportation	2	3.7	7rd
Pest, disease weed infestation	1	1.9	8th
Total	**54**	**100**	

CONCLUSION AND RECOMMENDATION

From the study, it can be concluded that 75.0 % adopted premier hybrid maize seed and 25.4 % do not adopt premier hybride maize seed and the most sources of information on premier hybrid maize seed were village/ward head, extension and other farmers, the major variable influencing the adoption of premier hybrid maize seed are level of awareness, age, level of education, household size, extension contact, farming experience and output

It is therefore recommended that; there should be frequent contact with village/ward head, extension contact and other farmers. farmers should pull their resources together through cooperative or farmers association to be able to raise funds for the purchase of farm inputs and also credit should be increased and made less bureaucratic as these rural farmers need capital to motivate them to adopt premier hybrid maize seed.

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