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Factors Affecting the Adoption of Improved Varieties of Maize, Among Farm Families of Ardo-Kola Local Government Area of Taraba State, Nigeria

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ABSTRACT

The study analyze' the factors affecting the adoption of improve varieties of maize (Sammaz17, 18, 19, 22, 35 and 37), among farm families of Ardo-kola local government area of Taraba State, Nigeria. The study objective were to describe the socio economic characteristics of the respondents; identify the sources of maize variety, identify factors responsible for changing varieties of maize within a short time, identify the maize varieties used by the respondents and identify the constraints faced by the respondents. Multi-stage random sampling techniques were used to select 80 respondents for the study. Descriptive statistics was used to analyze the data. The study revealed that, the levels of adoption of improved maize Farming technologies in the area were generally low while majority of the farmers had no formal education. The study also revealed that most (72.5%) of the maize farmers had no contact with agricultural extension agents, which can negatively affect adoption of improved maize farming technologies in the study area. Majority of the respondents used Sammaz 37 in 2019 planting season. The cost of the technology, complex nature of the technology, lack of skills to adopt the technology, risk and uncertainty of the technology and lack of productive resources were identified as challenges inhibiting the adoption of improved maize farming technologies in the area. The study recommends that Government and other development bodies should intensify training on the technologies to enable farmers understand their full benefits before they can fully adopt them. The government should subsidize the cost of technological inputs to enable low-income maize farmers afford.

INTRODUCTION

Maize (*zea mays*) is a very important food crop for human beings and livestock. Maize (*Zea mays L.*) stands as the world's most cultivated cereal crop and ranks third in terms of global consumption, following wheat and rice (FAO, 2021). Worldwide, maize production totals approximately 1,127 million tons (OECD/FAO, 2019). Nigeria leads the continent in maize production, producing 33 million tons, followed by South Africa, Egypt, and Ethiopia (IITA, 2021). Maize provides energy, vitamins and protein (NAERLS, 2017). It is the world's most widely grown cereal, as it is grown in a range of agro-ecological environments, and is the most important cereal crop in the economy of African countries, and most importantly communities used it for food and owing to the fact that it is cheaper than other cereals (such as rice and wheat), it is more affordable to the vast majority of the population, and therefore, occupies a prominent position in the agricultural development agencies of several countries in Africa (IITA, 2012, IITA ,2017). African produce just 6.5 percent of the world's maize with Nigeria being the largest African producer (Badmus & Ariyo, 2018). Output of maize in Nigeria has continued to increase, however its contribution to Gross Domestic Product is still low (Ater *et al.*, 2018). It is an important staple food for more than 1.2 billion people

in sub- Saharan African (SSA) and Latin American. It is an important source of carbohydrate, protein, iron, vitamin B and minerals. As food, the whole grain, freshly green or dried, may be used or may be processed traditionally by wet and dry milling methods to give a variety of food products. Preparation and uses of maize alone or in combination with other food material as staple food or snacks in Nigeria include the followings: ogi (in hot and cold forms), tuwo, donkunnu, massa, ajepasi, aadun, kokoro, elekute etc (Abdulrahaman & Kolawole, 2011). All parts of the crop can be used as food and non-food products (IITA, 2012) they differ from location to zone or from one cultural minority to another and it has over 500 uses, e.g maize grains can be made into a paste by boiling or roasting ('eko'), *'abado'*, and or as popcorn, which is consumed throughout West Africa. It is simply identified as "elekute" in Nigeria and "kenke" in Ghana. Despite the utilization of new technology, Nigeria's maize output has not been adequate to fulfill industrial demands, needs for food and livestock, and other purposes (Olaniyan, 2015) and as a versatile crop; maize has been put to a wider range of use than any other cereal.

Maize is one of the most cultivated cereal crops in Ardo Kola Local Government Area. Over the years, there seems to be no increase in the farmer's production level despite the use of improved varieties of maize. This shows that even though research findings have made a big headway during the past five decades, the benefit, of research findings may have not been fully utilized by farmers. The farmers keep trying different varieties of improved maize cultivars without adopting any (adopting process is defined according to (Ani, 2007, Koutsouris 2018) as a mental process which an individual goes through from hearing about a new idea to the complete and full incorporation of the idea into the total system of his behavior). Wilkening 1956 cited in Charlse (2012) and Loevinsohn *et al.,* (2013) defined adoption as ''a process composed of learning, deciding and acting over a period on innovation. On the other, Feder et al., (1985), cited in Umar, 2016), defined adoption as the degree to which new technology is used in long-run equilibrium when farmers have complete information about the technology and it's potential. It is likely possible that the inability of the farmers not adopting a particular variety of improved maize cultivar may be responsible for their low level of production.

As such, this study is put in place to address the issue of the factors affecting maize production in Ardo-Kola Local Governments Area of Taraba State, Nigeria. Thus, in order to harvest the full benefit of research in science and technology, there is dire need of popularization or effective dissemination of the potentials of the improved technologies to the peasant farmers (Maize farmers in particular). This is very necessary if we are to attain the noble target of self-sufficiency in food production.

Therefore, the following objectives were examined; factors that affect the adoption of new varieties of maize, among respondents in the study area... Specifically, the study described socio-economic characteristics of the maize farmers in the study area, identify the sources of maize variety in the study area, identify factors responsible for changing varieties of maize within a short time in the study area, identify the maize varieties used by the respondents in the last five years and described the constraints faced by maize respondents in the study area.

METHODOLOGY

The study was conducted in Ardo-Kola is a Local Government Area in Taraba State, Nigeria. Its headquarters is in the town of Sunkani. The Local Government headquarters is 24kilometers away from Jalingo the State capital. It has an estimated land area of 2,262 km² with an estimated population of 86,921 people (NPC 2006) and 125,964 is estimated to be the population as at 2021. The study area is characterized by high and lowlands area. It lies between latitude 8^{o}.34' and 9^{o} 10' and longitude 10^{o}.58' and 11^{o} 30' East of the Greenwich meridian. It is bounded to the North by Jalingo to the East by Gassol, to the South-West by Lau and to the West by Yorro Local

Government Area. The study area is heterogeneous in ethnic composition with rich but diverse historical and cultural heritage. Although the various groups have their distinct languages and dialects, the major tribes in the area include Fulani, Mumuye, Kona, Jenjo, others include: Nyandang, Jukun, Kunini, Wurkum, Bambuka, Bandawa. The climate of the study area is marked by dry season between (November-March) and rainy season between (April-October). It has an average annual rainfall of between 800mm to 1,525mm and temperature variation of 28^0C to 35^0C.

Multistage sampling procedure was used to select the respondents in the study area. First stage involved the purposive selection of four communities out of the ten communities in the study area because of their prominence in maize production. In the second stage two villages each were randomly selected to give a total of eight villages. Lastly, eighty (80) respondents were randomly selected using Taro Yamane (1967) sample size determination.

The sample size was determined by using the formula given by Taro Yamane (1967):

$$n = \frac{N}{1+N(e)^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where;

n = sample size.

N = population of the study; because the number of target population is not known, 80 sample frame was used as a default.

e = error of margin taking at 5% level

Therefore, a total of 80 respondents were selected proportionally for the study.

$$n = \frac{100}{1+100(5\%)^2}$$

$$n = \frac{100}{1+100(0.05)^2}$$

$$n = \frac{100}{1+100(0.0025)}$$

$$n = \frac{100}{1+0.25}$$

$$n = \frac{100}{1.25}$$

n = 80

The targeted population is maize farmers in Ardo-Kola Local Government Area of Taraba State. Primary data was used for the study. The Primary data were collected through the administration of questionnaire.

Data Analysis

Data obtained from the survey was analyzed using descriptive statistics to realize the objectives of the study.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Maize Farmers

The socioeconomic characteristics of the maize farmers were obtained from 80 respondents across 4 communities as presented in Table 1. Majority (75.0%) of the maize farmers were male while 25.0% were female. This is in agreement with the findings of Akinwale *et al.* (2020), that majority of maize farmers in Akure South and Akoko North West Local Government Area of Ondo state were predominantly male. This result shows that men are more involved in maize farming, because of the much energy required for the activities. The results agrees with Akudugu *et al.*, (2012) and Umar *et al.*, (2014) that male-head households were more likely to adopt and use new technologies than the females. Age has been found to determine how active and productive the head of the household would be. As shown in Table 1, majority of the respondents (36.2%) were within the active age range of 41-50years. The survey revealed that the mean age of the respondents was 42years with a standard deviation of 9.54. It was obvious from the survey that the most (36.2%) of the respondents who are maize farmers were within the economically active age group as the average age shows a relatively young population. Age is also considered to be a determinant to the adoption of improved technology. Older farmers are supposed to have increased knowledge and experience over time and are able to evaluate information of technology than younger farmers (Mignouna *et al*., 2011; Kariyasa and Dewi, 2011). The age of a farmer influences the levels of information access and farming experience. The majority (60.0%) of the respondents who were into maize farming in the area were married. This result agrees with Omodona (2016) who reported that married farmers adopted improved soya bean production technologies more than farmers that are single, in Kogi State. The study revealed that respondents‟ household size comprised an average of 9 individuals with a standard deviation of 4.47 (Table 1). This large family size may serve as cheap and reliable source of labour for maize farming within the household. As household size can be used to measure labour availability which influence adoption process as larger household have the ability to relax the labour limits required during introduction of improved farming technology (Mignouna *et al.*, 2011). The mean farm size of households in the study area was about 3.9 hectares with a standard deviation of 2.2. This result agrees with Bakut (2013) reported on study of factors influencing adoption of cassava recommended practice in FCT were stated that relatively large farm size farmers adopted recommended were stated that relatively large farm size farmers adopted recommended production practice in the FCT-Abuja. This small farm size shows that farmers in the area are smallholders (Table 4.1). The implication of this is that greater proportion of the maize farmers in the area was smallholder maize farmers. This is an indication that farming in the area is at the subsistence level. This could constraint the adoption of improved technologies due to the small farm size (Agwu *et al*., 2008). One of the resources that indicate wealth and proxy for social status is land size which has influence on farmers in the Ardokola Ardo-kola and in the country as a whole. Basically, farm size influences the adoption costs, credit constraints, human capital, labour requirements, risk perceptions, tenure arrangements and more. Farm size can influence and in turn be exaggerated by the other factors affecting adoption (Lavison, 2013). Farmers with big farms sizes are better informed, richer and keener in searching for improved technologies information (Okwu & Iorkaa, 2011). In terms of maize farming experience, an average of 16 years with a standard deviation of 9.17 was recorded among the sampled farmers. The mean number of years in maize farming has shown a significant experience in maize farming and this can have significant effect on the adoption of new and improved farming technologies in maize farming. The farmer socio-economic characteristics that include level of education, farm size and farming experience influence the adoption of improved technologies (Hudson & Hite, 2003).

The survey revealed that about 42.5% of the respondents have no formal education, 8.8% had primary education, 33.8% had secondary education and 15.0% had tertiary/college education. It is obvious from the survey that majority of the maize farmers in the Ardo-Kola Ardo-kola have not had formal education, which could consequently affect their adoption of improved maize farming technology as enlightenment enhances people decision making and analysis of situations. Since, access to agricultural information is influenced by the farmer's level of education. Farmers with formal education stand high chance of adopting a new technology to increase productive. Education gives the farmer ability to derive, decode and evaluate useful agricultural information for production (Ani, 1998).

The average number of years spent in formal schooling in the area among the sample respondents was about 2 years. Imoru and Ayamga (2015), also found the average number of years in school among maize farmers to be 2 years. This low level of education among the rural households in the Ardo-Kola Ardo-kola may have negative impact on adoption of agricultural technologies. The mean years of schooling of the respondent farmers in the area also mean they are unable to read and write. High level of education among farmers would make them more responsive to many agricultural extension programmes and policies (*Agwu et al.,* 2008) leading to adoption of new and improved technologies. Results of the institutional characteristics being accessed showed that, 28.8 percent were visited by an extension officer during the maize production season, while 71.2 percent of the respondent farmers do not have access to any of these institutional support which can negatively affect adoption of improved maize farming technologies. As reported by Agwu *et al.* (2008), low extension farmer contact does not augur well for adoption agricultural technologies.

Table 1: Socioeconomic Characteristics of the Respondents

Characteristics	Frequency (n = 80)	Percentage (%)	Mean
Sex Distribution			
Male	60	75.0	
Female	20	25.0	
Age			
21-30	11	13.8	
31-40	28	35.0	42
41-50	29	36.2	
51-60	9	11.2	
60 & above	3	3.8	
Marital Status			
Single	25	31.8	
Married	48	60.0	
Widow	7	8.8	
Widower	-	-	
Divorced	-	-	
Education Level			
No Formal Education	**34**	42.5	
Primary School	**7**	8.8	
Secondary School	**27**	33.8	
Tertiary	12	15.0	

Household Size			
1-5	**21**	26.2	
6-10	34	42.5	9
11-15	**17**	21.2	
16-20	**8**	10.0	
Farm Size			
1-5	41	51.2	
6-10	31	38.8	3.9
11-15	5	6.2	
16-20	3	3.8	
Farming Experience			
1-5	6	7.5	
6-10	22	27.5	
11-15	14	17.5	16
16-20	16	20.0	
21-25	13	16.2	
26-30	9	11.2	
Method of Acquiring Land			
Inheritance	70	87.5	
Bought	2	2.5	
Hired	8	10.0	
Respondent Access to Extension Service			
Yes	23	28.8	
No	57	71.2	

Sources of Maize Variety in the Study Area

The study revealed about 50.0 percent of the maize farmer's respondent's source their improved maize seeds from Taraba Agricultural Development Project (TADP). It therefore means that most of the farmers within the study area are using improved maize seeds.

Table 2: Major Source of Improved Maize Seeds

Major source	Frequency	Percentage (%)
TADP	40	50.0
NGOs	3	3.8
Farmers Based Organization	35	43.75
Market	2	2.5
Total	**80**	**100.0**

Factors responsible for changing varieties of maize within short time in the study area

The result in Table 3 shows the distribution of the farmers based on the reasons for changing different varieties of seeds without adoption. It shows that 62.5% of the respondent change variety for its high yield, about 15.0% changes variety for its market value, about 12.5% change variety for its early maturity; about 6.25% changes it for its drought tolerance and about 3.75% of the respondents change variety for its resistance to striga hermonthica. This result indicates that most 62.5% of the respondents change variety for its high yield.

Table 3: Distribution of Farmers Based on the Reasons for Changing Maize Variety

Reasons	Frequency	Percentage (%)
High yield	50	62.5
Market value	12	15.0
Drought tolerance	5	6.25
Early maturity	10	12.5
Tolerance to drought	3	3.75
Total	**80**	**100.0**

The Maize Varieties Used by the Farmers in the Last Five Years

The result in Table 3 shows the distribution of the farmers based on the varieties used for the last five years. The study revealed that most 53.75% of the respondent used Sammaz 37 in 2019, about 51.2% used sammaz35 in 2018, about 32.5% of the respondent used Sammaz 18 in 2016 planting season, about 30.0% of the respondent used sammaz22 in 2017 planting season and about 28.8% used sammaz17 in 2015 planting season. The result therefore revealed that most 53.75% of the respondents used sammaz37 in 2019 in the study area. Implying the predominant type of variety used by farmers and the least (28.8%) used is (sammaz17).

Table 4: Distribution Based on Varieties of Maize Seeds used in the Last Five Years

Varities	Years	Frequency	Percentage (%)
Sammaz17	2015	23	28.8
Sammaz 18/19	2016	26	32.5
Sammaz 22	2017	24	30.0
Sammaz 35	2018	41	51.2
Sammaz 37	2019	43	53.75

Rank 1= Predominant Rank5=least

Challenges Faced in Adopting of Improved Maize Technologies

Technological innovations are regarded as a conduit for improving agricultural productivity. However, many of the smallholder farmers are not able to adopt new improved technologies to increase their productivity as a result of some challenges they faced during the adoption process of the new and improved technologies. The list of major challenges were summarized as follows: cost of the technology adoption, complex nature of the technology, lack of skills to adopt the technology, animals destruction and lack of production resources were acknowledged by the maize farmers as the major challenges inhibiting the adoption of improved technologies in the study area.

The study revealed that about 96.2 percent of the farmers in the area reported that the cost of adopting some technologies was an impending factor to their technology adoption (Table 5). For instance, they argued that the cost of fertilizer was preventing them from early fertilizer application. The cost of adopting farming technology has been reported as a major challenge to adoption of technology.

Similarly, 91.2 percent of the respondent's farmers were of the view that some of the improved maize technologies were complex to adopt (Table 5). Destruction by animals was also mentioned88.8 percent as a challenge, Lack of skills to adopt the technologies was also mentioned as a challenge and 53.75 percent of the sampled farmers have reported that they do not have the skills required by some of the technologies to adopt them (Table 5). This, as they indicated is because of their lack of training or education on such technologies. The outcomes of the technologies are not known to the smallholder farmers as such the motivation to adopt such technologies is low. Lastly, 51.2 percent of the sampled smallholder farmers reported lack of productive resources as a major challenge to the adoption of new and improved technologies (Table 5). Many of the new technologies are resource intensive and this is affecting the adoption of technologies among the smallholder farmers.

Table 5: Challenges Affecting Adoption

Challenges	Frequency	Percentage (%)
Lack of Extension Services	58	72.5
Costly to Adopt	73	91.2
Destruction by Animals	71	88.8
Complex to Adopt	77	96.2
Lack of Skills	43	53.75
Lack of Production Resources	41	51.2

*Multiple responses

CONCLUSION AND RECOMMENDATIONS

There were generally high levels of awareness of the technologies among maize farmers in the study area. However, some of the technologies were having (100%) percent level of awareness, others had less than (40%) percent awareness level. This high level of awareness can positively influence farmer's decision to adopt or not adopt the technology. In terms of training on the technologies, farmers received very low levels of training on all the technologies presented to them. These low levels of training received may have a negative influence on adoption of improved maize farming technologies. The survey revealed that about 42.5% of the respondents have no formal education as one of the socio-economic characteristics of the farmers affect the adoption of improved maize seeds in the study area. This could be due to the facts that farmers do not understand the message passed by the extension agents due to their level of illiteracy. They study revealed that, the levels of adoption of improved maize farming technologies in the study area were generally low. The study further revealed that, lack of skills to adopt the technologies was ranked first as a challenge of adoption as 89 percent of the respondents affirmed it was a major challenge. This was followed by the cost of adopting the technology with 83.1 percent whilst the complexity of the technologies was also mentioned and 80.5 percent of the sampled farmers reported it as a challenge and lack of production resources to adopt the technologies were reported representing 75 percent and 7.1 percent, respectively.

The study makes the following recommendation:

1. Government and research institutes should strengthen extension services and proper distribution channels to ensure effective delivery of improved technologies and inputs such as improved seeds, fertilizer and herbicides at a subsidized price to the farmers.
2. Additionally, the extension agents should also encourage the establishment of more demonstration farms to enable farmers have access to the technologies that are being practice in these demonstration plots.
3. Government should intensify E-Extension, to be able to reach out to large number of these poor resource constraint farmers.
4. There is need to develop and improve existing technologies on production and value addition. The technologies should be affordable to most farmers. These will ensure an increased productivity, production of high-quality produce, reduce losses of wastage and increase rate of adoption.
5. Vibrate farmers organization (such as cooperatives) should be developed to ensure farmers are more organized. Farmer organizations will help farmers in accessing high quality farm inputs, better markets, better extension services, and capacity building.

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