ADOPTION OF IMPROVED TECHNOLOGIES BY MAIZE FARMERS IN ESAN SOUTH EAST LOCAL GOVERNMENT AREA OF EDO STATE, NIGERIA

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ABSTRACT
Extant research has shown that regardless of how profitable an improved technology may be, there is no guarantee that it will be adopted by target users. This study therefore assessed the adoption of improved agricultural technologies by maize farmers in Esan South East Local Government Area of Edo State, Nigeria. It specifically described the socio-economic characteristics of maize farmers; maize farmers' awareness; technologies adopted and factors influencing adoption of improved agricultural technologies. A two-stage sampling procedure was employed for the simple random sampling of 120 respondents for the study. Collected data were analyzed using both descriptive and inferential statistics. Results showed that awareness and adoption of improved maize technologies was generally low with NPK 15:15:15 as the most aware (93%) and adopted (78%) by the respondents among other variables. Factors that significantly influenced respondents' adoption of improved technologies were age ($r = -0.341$; $p \leq 0.05$), educational qualification ($r = 0.265$; $p \leq 0.05$), labour sources **(**$r = 0.227$; $p \leq 0.05$) and annual income ($r = 0.255$; $p \leq 0.05$). It was therefore recommended that effort should be intensified by extension workers to ensure the timely delivery of improved technologies to farmers as this will undoubtedly increase the awareness and consequent adoption.

Keywords: Adoption, Awareness, Extant, Factors, Technologies,

INTRODUCTION

The changing global economy has necessitated the need for the deployment of alternative approaches to farming. There has been a constant threat to human survival which has become apparent in the sharp difference between the rate of food production and human growth rate (Emokaro and Ejuetueyin, 2017). Beside changes arising from the global steady increase in human population, Kumar, Singh and Kaswan (2012) had reported that natural resources are degrading, poverty is growing and overall change in climatic variables resulting to widespread hunger and malnutrition.Consequently, the realization that reliance on tradition farming method limits the scope of agricultural yield to effectively address the food need in a dynamic economy has triggered the quest for sustainable farming methods through the development and adoption of improved agricultural technologies (Adekoya *et al.,* 2012).

Technological advancement has been the major driving force for increasing agricultural production today. According to Jain, Arora and Raju (2009) agricultural technologies include all kinds of improved techniques and practices which significantly enhance the growth of agricultural output. Improved technologies such as hybrid seed, inorganic fertilizer, pesticides, herbicides, and better management practices constitute the basic activities for crop improvement.An improved agricultural technology that enhances sustainable production of food and fiber has made the dynamics of technical change in agriculture to be an area of intense research since the early part of twentieth century (Loevinsohn *et al.,* 2013). The early applications of technology have not only increased food production in real terms, but have dramatically reduced the number of individuals directly involved in food production enabling the diversification of society to address social issues not directly related to "survival", but generally seen to increase the quality of life (Adekoya *et al.,*2012).

Technology adoption refers to the acceptance of a group or an individual to use a new product or innovation. The process of adopting an idea or new innovation does not happen as a single unit act, but rather a mental process that consists of at least five stages namely; the awareness stage, the interest stage, the evaluation stage, trial stage and finally, the adoption stage (Cheteni *et al.,* 2014; Sennuga and Oyewole, 2020). In the views of Morris, Tripp and Dankyi (1999) and Ekong (2010) the adoption of any agricultural technology can be measured in two ways: (1) in terms of the number of farmers who adopt the innovation, or (2) in terms of the total area on which the innovation is adopted. These two measures will generate similar outcome when farmers possess same socioeconomic features or rate of adoption is constant across farming households, but often this is not the case.

Maize, an important cereal crop is cultivated in all parts of Nigeria andcontributes about 33% of the total household food consumption (Minot, 2010). Its usefulness has increased recently because of the federal governments' restriction on imported flour. In addition to its relevance as a widely consumed staple food, maize is particularly important in Nigeria from a nutritional perspective because many popular

weaning foods for infants are made from maize. Available evidence clearly indicates that proper adoption of improved technologies in maize production is fundamental for the attainment of increased productivity levels. Unfortunately, knowledge that improved technologies have enhanced nutritional qualities does not necessarily mean that farmers make an effort to adopt those technologies. This is therefore of great implication to the extension service providers charged with ensuring that relevant improved technologies get to the reach of targeted end users.

Regardless of how profitable an improved technology may be, there is no guarantee that it will be adopted by target users. Baruwa, Kassali and Aremu (2015)pointed that low adoption level of improved agricultural production technologies have been a major reason for the inadequacy in Nigerian agricultural production. Efforts put in agricultural research may not yield the desired results if they are not put to use by farmers. According to Agbarevo and Obinne (2010) farmers will not adopt a given technology if they are unaware or delivered to them in form and language that they would understand.Agricultural technology embodies a number of factors that may influence adoption decisions. For instance, Akudugu (2012) have classified such determinants as: social, economic and physical factors. Therefore identification of the factors influencing adoption of improved technologies is very vital. This will help in raising the productivity of the farmers, and thereby improve their livelihood.

Series of studies by Audu and Aye (2014); Parke (2015) and Sennuga *et al.,* (2020) attempted to examine the effects of improved maize technology on household welfare and impact of technology on agriculture. However, these studies were not focused on the adoption of improved technologies by maize farmers, particularly in Edo State, Nigeria. It is against this backdrop that the research was set to assess theadoption of improved technologies by maize farmers in Esan South East Local Government Area of Edo State, Nigeria.Specifically, this study aimed to:describe the socio economic characteristics of maize farmers in Esan South East Local Government Area of Edo State; examine maize farmers' awareness of the available improved technologies;identify the improved technologies adopted by respondents; and determine factors influencingthe adoption of improved technologies by maize farmers in the study area.

RESEARCH METHODOLOGY

The study was carried out in Esan South East Local Government Area (LGA) of Edo State, Nigeria with its administrative headquarters, Ubiaja. Esan South East LGA is located the Edo Central agro-ecological zone of the State and lies within Latitude 6° 35' 12" North and Longitude 6° 28' 33" East of the Greenwich Meridian. It covers a total land area of about 1,306 $km^2$with a projected population of 217, 900 (National Bureau of Statistics, 2016). Primary data was obtained using structured questionnaire administered to 120 maize farmers. A two-stage sampling procedure was employed as follows: The stage one (1) involved simple random sampling of six (6) communities out of 9 communities in Esan South East Local government Area of Edo State.At stage two (2) a simple random sampling of 20 maize farmers from each of the 6 communities was employed which gave a total of 120 respondents for the study. Collected data was analyzed using descriptive statistics such as frequency counts, percentages and mean scores, while Pearson Product Moment Correlation was used to draw inferences.

RESULTS AND DISCUSSION

Socioeconomic characteristics of maize farmers

Results in Table 1 shows that more than half (54.17%) the proportion of maize farmers in the study area were male while (45.83%) were female. It further shows that majority (79.17%) of themwere married with a mean age of 43 years. This implies that maize farming was practiced by both male and female farmers who were in their economical active age group. Table 1also presents that most (95.83%) of the respondents acquired at least one form of formal education,and includes:secondary education (59.16%), primary education (21.67%) and tertiary education (15.00%) respectivelywith only 4.17% of them who had no formal educational attainment. It is believed that education enhances ones capacity to comprehend and adopt relevant agricultural information. Therefore, this infers that most of the maize farmers possessed the basic education required for better understanding and ability to embrace new technologicaladoption. Again, the majority (72.50%) of farmers had farm size between 1.1 – 2.0 hectares whose major source of farm labour were both family and hired labour (65.83%). By implication, maize farming in the area was dominated by smallholder farmers judging by the 1.83 mean farm size who utilized both hired and family labour.This result compares well with the findings of konkwo (2019) where majority of arable crop farmers cultivated parcels of land that were less than two (2) hectares. Hence, Mgbenka and Mbah (2016) affirmed that the nation's agriculture is dominated by the category of farmers referred to as smallholders, whose greater percentage engage in arable crop production on patches of land less than two hectares , which is in conformity with this study.

Table 1: Socioeconomic characteristics of respondents

Variables	Description	Freq.	%	Mean
Sex	Male	65	54.17	
	Female	55	45.83	
Age	21 – 30	6	5.01	
	31 – 40	40	33.33	
	41 – 50	61	50.83	43.02
	51 – 60	13	10.83	
Marital status	Married	95	79.17	
	Single	16	13.33	
	Divorced	9	7.5	
Educational qualification	No formal education	5	4.17	
	Primary education	26	21.67	
	Secondary education	71	59.16	
	Tertiary education	18	15.00	
Primary occupation	1.1 - 2.0	87	72.50	
	2.1 - 3.0	33	27.5	1.83
	Farming	36	30.00	
	Trading	58	48.33	
	Civil service	18	15.00	
	Artisan	8	6.67	
Labour source	Family labour	19	15.83	
	Hired labour	22	18.33	
	Both	79	65.83	

Awareness of improved agricultural technologies by maize farmers

Result in Table 2 presents that 34.2% of the respondents were aware of OBA 98 maize variety while (65.8%) were not aware. On the other hand only 5.8%, 5.0% and 2.5% were aware of SAMMAZ 52, SAMMAZ 54 and SAMMAZ 53 respectively. This implies that awareness of improved varieties by respondents in the study area was very low. With respect to fertilizers, Table 2 further shows that most (93.3%) of the farmers were aware of NPK 15.15.15 among other fertilizer compositions. However, 35.8% were aware of glyphosate, 23.3% aware of urea while only 10.1% were aware of paraquat. On the awareness of farming equipment, it was observed that respondents were rarely aware of most improved maize production technologies as expressed by the 38.7% of Maize harvester, 14.2% of Tractor planters with seed and fertilizer hoppers, 13.3% and Manure corn seeder respectively. However, bin seed storage equipment was least (2.5%) in awareness among equipment by respondents. On the aspect of farm operations, result in Table 2 points that more than half (57.5%) the proportion of maize farmers were aware of pest and disease treatment of seeds. This was closely followed by 54.2% of the farmers who were aware of soil treatment practice. There was moderate level of awareness on other farm operation technologies as shown by48.3% of band fertilizer application, 45.0% of row planting and 37.5% of soaking of maize water among others.The study in general portrays that adoption of improved technologies among respondents was low. It could be inferred that this group of farmers have no prior knowledge of these technologies. This result corroborates with the view of Okechukwu (2015) who expressed that, for farmers to adopt a new agricultural technology, they must be aware of the technology, have valid and up-to-date information on the technology. Ekong (2010) pointed that awareness starts when an individual first hear or learn about the existence of an innovation ora technology. The individual at this stage lacks details concerning the way it works, how to use it, the cost and benefits of the technology apart from probably knowing its name.

Table 2: Awareness of improved maize production technologies by respondents

	Aware		Not aware	
Improved technologies	**Freq.**	**%**	**Freq.**	**%**
Improved Varieties				
OBA 98	41	34.2	79	65.8
SAMMAZ 52	7	5.8	113	94.2
SAMMAZ 53	3	2.5	117	97.5
SAMMAZ 54	6	5.0	114	95.0
Fertilizers/Chemicals				
NPK 15:15:15	112	93.3	8	6.7
Urea	28	23.3	92	76.7
Super grow	16	13.3	104	86.7
Atrazine	23	19.2	97	80.8
Glyphosate	43	35.8	77	64.2
Paraquat	12	10.1	107	89.9
Implements/Equipment				
Hand push mini-corn seeder	9	7.5	111	92.5
4 rows maize corn precision seeder	7	5.8	113	94.2
Manure corn seeder	16	13.3	104	86.7
Boom sprayers drawn by tractor power	11	9.2	109	90.8
Tractor planters with seed and fertilizer hoppers	14	11.8	105	88.2
Maize harvester	46	38.7	73	61.3
Maize Sheller	17	14.2	103	85.8
Improved granary storage for maize	9	7.5	111	92.5
New maize storage bag	7	5.8	113	94.2
Bin sense storage	3	2.5	117	97.5
Farm Operations				
Spacing 0.5m x 0.75m	35	29.2	85	70.8
Row planting	54	45.0	66	55.0
Band fertilizer application	58	48.3	62	51.7
Soaking of maize in water	45	37.5	75	62.5
Pest and disease treatment of seeds	69	57.5	51	42.5
Thinning	34	28.3	86	71.7
Soil treatment	65	54.2	55	45.8

Improved technologies adoption by maize farmers

Result in figure 1presents that only 11.0% of the respondents adopted OBA98improvedmaize variety, while only 2.5% and a tie of 1.7% adopted SAMMAZ 54, SAMMAZ 52 and SAMMAZ 53 respectively. The majority (77.5%) of farmers adopted NPK 15:15:15 fertilizer and was followed by adopters ofGlyphosate (32%), Super grow (16%), Urea (15%) and Atrazine (9%) and paraquat (5%) among the chemicalfertilizers respectively. This implies that apart from NPK 15:15:15, adoption of chemical fertilizers among respondents was low. On the other hand, the adoption of equipment by respondents was low considering the 16% adoption of maize sheller as highest among others. Finally, result in figure 1shows thatthe farm operations technologies adopted by maize farmers were soil treatment (46.7%), pest and disease treatment of seeds (45.0%) as well as 40.0% for row planting and band fertilizer application concurrently. This result further suggests that farmers'adoption of improved farm technology was relatively low in terms of the proportion of respondents who did not adopt.This may be adduced to the fact respondents are not yet fully persuaded to the extent of accepting the use of the given technologies. According to Rogers (1995) adoption is regarded as the decision to make full use of an innovation or technology as the best course of action available. Adekoya and Tologbonse (2005) maintained that adoption begins as a mental process often reinforced by other emotions or circumstances referred to the term "innovation-decision process" hence, the probable pointers to this result.

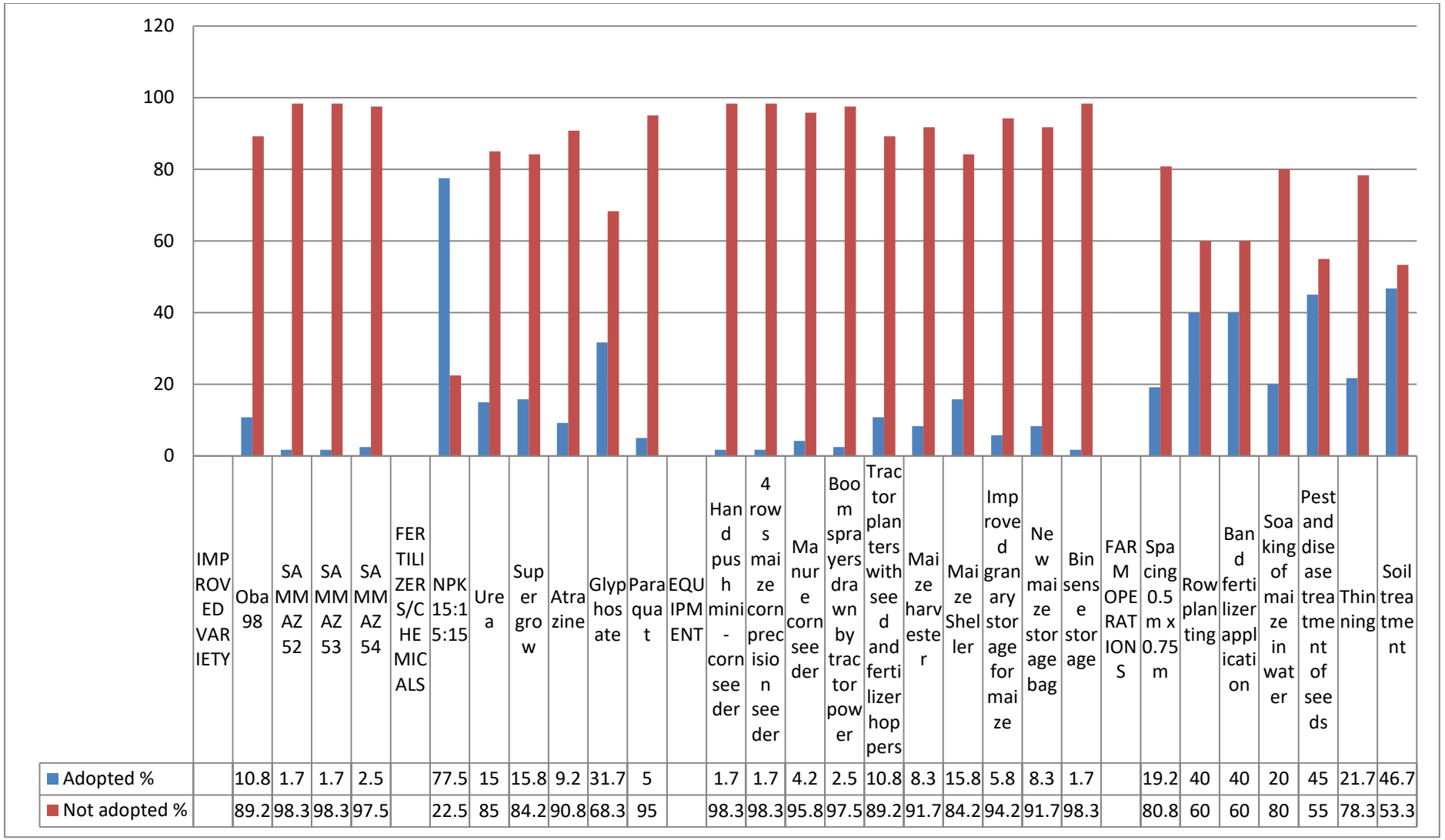

Figure 1: Improved technologies adoption by maize farmers

Factors influencing improved technologies adoptionby maize farmers

Result in Table 3 shows that age, educational qualification, annual income and source of labour were the socioeconomic factors that significantly influenced maize farmers' adoption of improved technologies in the study area. Here, age (r = -0.341; p≤0.05) was found to be significant and negatively influenced respondents' adoption of improved technologies. This implies that younger maize farmers adopted new varieties more than the older counterparts. There was a significant and positive influence of educational qualification (r = 0.265; p≤0.05) of respondent on improved technology adoption. Byimplication, the higher the educational attainment of the farmers, the greater their possibility to adopt improved maize technologies.Also, sources of labour**(**r = 0.227; p≤0.05) was significant and positively related to adoption of improved technologies. Again, annual income (r =0.255; p≤0.05) was significant and positively influenced respondents' adoption of improved maize technologies. This result suggests that high income earners adopted improved maize technologies more than those whose income level was low. This result corroborates with the findings of Ekong (2010) as well as Sennuga and Oyewole (2020) that farmers with higher incomes generally enjoy advantages that facilitate adoption because they may find it easier to make contacts with extension officers or to tap into other sources of technical information. Once they have heard about an improved technology, they may be better able to travel to distant towns in search of agricultural inputs and after they have located the inputs, they may experience less difficulty in raising the cash needed to purchase them.

Table 3: Factors influencing farmers' adoptionof improved technologies

Socioeconomic factors	Coefficient (r)	P-Value
Sex	0.104	0.257
Marital status	0.032	0.732
Age	-0.341**	0.001
Household size	-0.054	0.563
Educational qualification	0.265**	0.001
Primary occupation	0.004	0.966
Farm size	-0.104	0.258
Source of labour	0.227*	0.013
Annual income	0.255**	0.004

**Significant at 1%; * Significant at 5%

CONCLUSION

The study assessed the adoption of improved agricultural technologies by maize farmers in Esan South East Local Government Area of Edo State, Nigeria. Findings from the study has shown that NPK 15:15:15 was prominent among the improved technologies the maize farmers were aware of and adopted in the study area. It however portrayed that respondents' awareness and adoption of improved maize technologies was generally low. Factors that significantly influenced respondents' adoption of improved technologies were age, educational qualification, labour sources and annual income. It was therefore recommended that effort should be intensified by extension workers to ensure the timely delivery of improved technologies as this will undoubtedly increase the awareness and consequent adoption by farmers.

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