Impact of Agricultural Technology on Maize Farming in Kaduna State, Nigeria

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***Abstract*: The study examined the impact of agricultural technologies on the output of maize in Kaduna State, Nigeria. Cross sectional survey method was adopted in sampling the opinions of the respondent. As such, structured questionnaire was utilized in eliciting respondents' opinions that formed the data for the study. In the first stage of selection, the study randomly selected two out of the three senatorial zones in Kaduna state for the study; which are Kaduna central and Kaduna South senatorial zones. In the second stage, one local government area was also selected for the study. In the third stage, three communities were selected from each of the local government. In the fourth stage, a sample frame of one thousand, one hundred and five (1105) farmers was obtained. As such, the study randomly selected about 10% of the total respondents from each of the communities which formed the sample size of 99 for the study. The variables utilized in the study include; maize output and maize farmers income (dependent variables), the regressors include; credit facility, fertilizers, pesticides, improved seedlings, and infrastructures. Frequency tables, and simple percentage were utilized to analyzed information's elicited from the respondents relating to socio-characteristics. While, the state hypotheses were tested using 2-way ANOVA. The study found that the utilization of agricultural technologies impacts positively on maize output production and farmers income at 1 percent significance level. Whereas, credit facility was found to exerting no significant impact on the output of maize and maize farmers income. While also, the socio-economic characteristics of the maize farmers was found to stimulating maize farming positively. The study concluded that agricultural technologies has the capacity to stimulate output of maize and farmers income. As such, the study recommended that government at all levels and non-government organization, should work-out a policy framework that will stimulate increased availability and access of agricultural technologies to the maize farmers.**

***Keywords*: Agricultural technologies, Maize output, Farmers income, seedlings, and fertilizer**

I. INTRODUCTION

In recent time, farming has gone beyond the utilization of traditional methods of farming to include the adoption of technological methods so as to meet up with the growing demand of food produce and mitigate against hunger. From the global stage, developed countries adopted technological methods of farming many decades ago, as such, they have been able produce enough food for their domestic consumption and for export. Where as in the less developed countries like Nigeria, poor adoption of technological method of farming jeopardizes farmers effort at growing food for the teeming population of Nigeria. Punctuation

With respect to cereal cash crops such as maize, it's economic benefit cut across several industries. Consequently, maize is a raw material for the production of range of other foods, particularly chicken feds. In line with this, Food and Agriculture Organization (FAO, 2018), reported that maize production in Nigeria alone in 2018 was 11 million metric tonnes (MMT), whereas maize consumption was 11.4MMT. this suggest a deficit of about 400,000 tonnes. They however projected that by 2020 maize production in Nigeria would be 11.1 million tonnes, denoting that Nigeria would struggle with about 300,00 tonnes deficit of maize. Incidentally, the emergence of covid-19 pandemic that resulted to lockdown, implies that farmers were not able to go to farms, and not many will be able to return to farm. As such, stakeholders in the line of maize value chain will continue to deal the production shortfall in maize as demand surpasses supply.

Nevertheless, in Nigeria, Kaduna state is the highest producer of maize. This means that Kaduna State has comparative advantage in maize production. Kaduna State Agricultural Structure Survey (KASS 2017) report revealed that the state has 1,322,226 farming families, 428,352 farming families were engaged in maize farming in 2016, 172,133 farming families were engaged in rice farming and 34,645 farming families were into yam production. Therefore, due to its comparative advantage in maize production, the state produced about 2,166,799.8 million metric tonnes in 2016 (KASS 2017). This implies that, the state produces 22 percent of the total country's maize in Nigeria (KASS 2017). Incidentally, the agricultural produce of maize in Kaduna state has been grossly unstable.

Moreover, the Kaduna State Commercial Agriculture Development Project (CADP), assisted by the World Bank, has divers' approach with the intension of stimulating agricultural production system and facilitate access to market for focused value chain such as maize, amongst small and medium scale farmers, with the notion to positively boost farmers output and income. Regrettable, despite the claim of provision of matching grants to farmers through the Commercial Agriculture Development Project over three million dollars($3,000,000) so far accessed by Kaduna State government (KDSCADO, 2014 Report), the extent of farmer's performance, and that of output of maize is still below expectations as there are deficit in the supply of maize (Christopher, Otohinoyi, and Shanum, 2017). Hence, the crux to this study is to evaluate the impact of agricultural

technologies on maize farming in Kaduna state with respect to maize output and maize farmers income.

Objectives of the Study

The cardinal objective of this research is to evaluate the impact of agricultural technologies on maize farming in Kaduna State, Nigeria. However, the specific objectives of this study include:

i. Examine the socio-economic characteristics of the agrarian population in maize farming.
ii. Examine the effect of agricultural technologies utilization on the output of maize
iii. Examine the degree to which agricultural technologies utilization enhances the income of maize farmers.

Hypotheses

In order to achieve the above stated objectives, the following hypotheses have been formulated:

H_{01} There is no significant relationship between agricultural technologies and output growth of maize.

H_{02}: There is no significant relationship between agricultural technologies on income of the farmers.

II. METHODOLOGY

Study Design

The study adopted cross sectional survey design, that facilitates sampling of opinions and thoughts of the respondents for the study. in doing this, structured questionnaire was utilized in generating responses that formed the data from respondents.

The Study Area

The study was carried out in Kaduna state, because the state has comparative advantage in maize production, with over 1,322,226 farming families, and about 428,352 faming families engaged in maize farming. The state has three senatorial zone that consists of; Kaduna North senatorial zone, Kaduna South senatorial zone, and Kaduna Central senatorial zone. Most of the farming areas in these senatorial zones are predominantly occupied by rural population. These rural population are poor and mainly utilizes primitive method of farming and inputs.

The major occupation of the populace in these areas is farming. Consequently, due to the vast range of climate and vegetation of the area, various kinds of arable crops (such as maize, millet, rice, sorghum, beans, soyabeans, yam, cassava, cocoyam, irish potato and sweet potato) are cultivated. Specifically, the reconnaissance survey has shown that maize farming is the major cereal cash crop predominately cultivated by majority of the farmers in the study area.

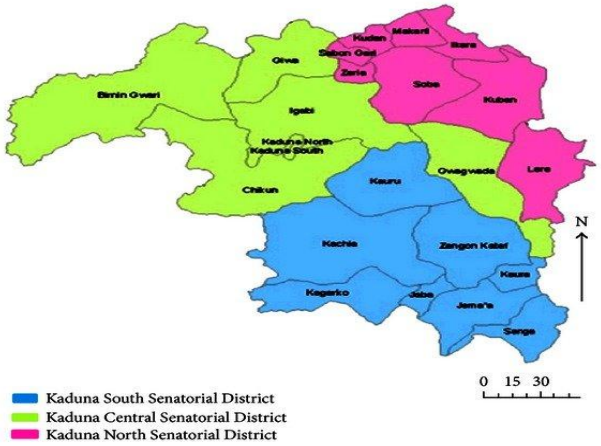

Figure 1: Illustrated map of Kaduna State showing the Three Senatorial Districts

Source: http://www.ncocusa.com/constituencieskaduna.html

Sampling Procedure and Sample Size

A multi-stage sampling technique was used in selecting respondents for the study. In the first stage, two senatorial zones were randomly selected, these include; Kaduna Central senatorial zone and Kaduna South senatorial zone. In the second stage, one local government area was purposively selected from each of the senatorial zone; these are Igabi in Kaduna Central and Chikun in Kaduna South. At the third stage, three participating communities were selected from each local government areas, making a total of six communities. The selected communities include; Igabi, Gwaraji and Gwada, from Igabi local government, while Kakau, Maichibi and Unguwar-Barde were selected from Chikun local government. In the fourth stage, a sample frame of one thousand, one hundred and five (1105) farmers was obtained. As such, the study randomly selected about 10% of the total respondents from each of the communities which formed the sample size of 99 for the study.

Distribution of respondents by Local Government Area

Senatorial Zone	Local Government Area	Communities	Farmers	Sampled Farmers
Kaduna Central	Igabi	Igabi	140	12
		Gwada	160	14
		Gwaraji	210	19
Kaduna South	Chikun	Kakau	175	16
		Maichibi	260	24
		Unguwar-Barde	160	14
			1105	99

Source: Field Survey

Analytical Technique

The study utilized frequency tables, and simple percentage to analyzed information's elicited from the respondents relating to socio-characteristics. More so, the state hypothesis was tested using 2-way ANOVA.

III. PRESENTATION AND ANALYSIS OF RESULTS

Socio-economic characteristics of respondents Results in Table 1 show that the mean age of the farmers was 36.2 ± 3.9 years, showing that majority of the farmers are aged, indicating that the old age of the farmers could exert negative effect on utilization of improved technologies because the elasticity of older farmers to utilizing improved technologies is very slim.

Table 2: Socio-Economic Characteristics of the Respondents n= 99

Variables	Frequency	Percentage (%)	Mean	Standard Deviation
Age				
≤ 30	10	10.1	36.2	3.9
31 – 40	25	25.2		
41 – 50	42	42.4		
≥ 51	22	22.2		
Sex				
Male	70	70.7		
Female	29	29.2		
Marital Status				
Single	2	2.0		
Married	86	86.8		
Divorce/Separated	4	4.0		
Widow/Widower	7	7.1		
Educational Level				
No formal education	40	40.4		
Adult education	2	2.0		
Primary education	35	35.4		
Secondary education	13	13.1		
Tertiary education	9	9.1		
Farm Land Size (HA)				
≤ 1.00	20	20.2	1.8	0.9
1.5 – 2.00	65	65.7		
2.10 – 4.00	10	10.1		
≥ 4.10	4	4.0		
Years of Experience				
≤ 10	50	50.5	16.1	3.5
11 – 25	34	34.3		
26 – 35	11	11.1		
≥ 36	4	4.0		
Income (thousand, Naira)				
100 – 200	16	16.1	263.3	9.7
210 – 300	65	65.7		
310 – 400	11	11.1		
410 – 500	7	7.1		

Source: Field Survey, 2021

The table above showed that 70.7% of the farmers are male. This is because men are more inclined to adopting technology than women, more so, they have dependent who rely on them for their daily survival. The table also showed that majority of the farmers are married people. As such, 86.8% of the farmers derived their income from farming. Consequently, marital status has implications for the utilization of farming technologies, as such, Idrisa (2009) and Mohammad (2014) held that married people have more responsibilities and thus starts any enterprise with high degree of resoluteness. Therefore, they are more inclined to source for new information's about innovative way of farming; such as improved seedlings and technologies so as to enhance the welfare of their families (Solomon, Esther and Michael, 2020). More so, the table indicated that the respondents have 59.6% had on form of education or the other, showing that a large percentage of the sampled respondents are literate. Thus, the educational attainment of the respondents will enable them source the right kind of information and in the adoption of technologies. As such, the implication of this is that the respondents are expected to be utilizing more of farming technologies against those with no formal education. In terms of farming experience, the mean years of experience of the respondents is 16.1 ± 3.50 years. This denotes that the farmers are well experienced and have exceptional knowledge of farming. Thus, experience is very critical in farming because it offers good prospects for adopting agricultural technologies. Lastly, the table also showed that the mean farm size of the respondents was 1.8 ± 0.9 hectares, confirming that majority of the respondents were smallholder farm lands. Finally, it is established that the socio-economic distribution of the farmers has a positive relationship with adoption and utilization of agricultural technologies.

Table 3: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Item	No of Items
.990	.991	6

Source: Field survey, 2021

The Cronbach's Alpha (0.99) of the estimated model showed a high level of reliable result.

Table 4: Model Summary[a]

Model	R	R^2	Adjusted R^2	Standard Error of the Estimate
1	.941[a]	.920	.920	.214

Source: Field survey, 2021

Dependent Variable**:** Agricultural technologies utilization have led to an increase in maize output by the farmers.

Table 4 above showed that 92.0 percent changes in the dependent variable (output growth of maize) is explained by the total variations in increased utilization of agricultural technologies.

Table 5: ANOVA[a]

Model	**Sum of Squares**	**Df**	**Mean Square**	**f**	**Sig.**
Regression Residual	2515.467 110.324	5 1107	741.451 .053	5613.674	.001
Total	**2625.791**	**1112**			

Source: Field survey, 2021

It can be seen from table 5 above that the estimated model is statistically significant with f-statistic=5613, and sig= .001 at 1 percent significance level. As such, this depict that the included regressors in the models assisted the model and thus could be regarded as significantly different from zero.

Table 6: Analyses of Coefficients[a]

Model[a]	Unstandardized Coefficient		Standardized Coefficient	t	std.
	B	**Std. Error**	**Beta**		
(constant)	.021	.030		.524	.567
Provision of credit facility	.045	.023	.031	1.412	.161
Provision of fertilizer	.034	.027	.071	9.912	.001
Provision of pesticide	.041	.022	.081	12.137	.000
Provision of infrastructure	.711	.034	.210	2.523	.002
Provision of improved seedlings	.621	.031	.451	13.711	.000

Source: Field survey, 2021

Dependent variable: Agricultural technologies utilization have led to an increase in maize output by the farmers.

The result as presented in the table above showed that there is a positive relationship between agricultural technologies and increase in the output of maize. Consequently, a 1 percent increase in the utilization of (credit facility, fertilizer, pesticide, infrastructure and seedlings, respectively) will lead to 3%, 7%, 8%, 2% and 4.5%, respectively, increase in the output of maize at 1 percent level of significance. Moreover, the findings showed that access to credit exhibits no significant effect on the output of maize. The implication of this is that farmers do not get external source of financing. They either depend on their personal savings to fund their farming activities or rely on cooperative (Esusu) to raise money for their farming activities. Therefore, availability of credit will help in stimulating increased output of maize.

Table 7: Model Summary[b]

Model	R	R^2	Adjusted R^2	Standard Error of the Estimate
1	.891[b]	.885	.864	.142

Source: Field survey, 2021

Dependent variable: Agricultural technologies utilization have led to an increase in maize farmers income

The table 7 above showed that 88.5 percent changes in the dependent variable (farmers income) is explained by the total variations in the utilization of agricultural technologies.

Table 8: ANOVA[b] (Hypothesis 2)

Model	Sum of Squares	Df	Mean Square	f	Sig.
Regression Residual	2413.772 120.621	5 2105	827.710 .061	6331.720	.000
Total	2534.393	2110			

Source: Field survey, 2021

Dependent variable: Agricultural technologies utilization have led to an increase in maize farmers income

It can be seen from table 8 above that the estimated model is statistically significant with f-statistic= 6331, and sig= .000 at 1 percent significance level. Showing that the included regressors in the models assisted the model and thus could also be regarded as significantly different from zero.

Table 9: Analyses of Coefficients[b]

Model[b]	Unstandardized Coefficient		Standardized Coefficient	t	std.
	B	Std. Error	Beta		
(constant)	.042	.031		.498	.511
Provision of credit facility	.039	.030	.033	2.012	.250
Provision of fertilizer	.043	.021	.084	10.124	.001
Provision of pesticide	.034	.025	.076	13.330	.000
Provision of infrastructure	.531	.036	.321	2.734	.002
Provision of improved seedlings	.552	.014	.641	11.171	.000

Source: Field survey, 2021

Dependent variable: Agricultural technologies utilization have led to an increase in maize farmers income

The result as presented in the table 9 above showed that there is also a positive relationship between agricultural technologies utilization and increase in the maize farmers income. As such, a 1 percent increase in the utilization of (credit facility, fertilizer, pesticide, infrastructure and seedlings, respectively) will lead to 3%, 8%, 7.6%, 3% and 6.4%, respectively, increase in maize farmers income at 1 percent level of significance. Again, access to credit showed no significant impact on maize farmers income.

IV. CONCLUSION AND RECOMMENDATIONS

This study examined the effect of agricultural technologies utilization on maize production in Kaduna state, Nigeria. The study set out to achieve three key things; explore the effect of agricultural technologies on output of maize, maize farmers income and socio-economic characteristics of maize farmers. As such, the study established that the utilization of agricultural technologies impacts positively on maize output production and farmers income at 1 percent significance level. While also, the socio-economic characteristics of the maize farmers was found to stimulating maize farming positively. The literate level of the farmers is critical for agricultural productivity. Denoting that their elasticity to adopting and utilizing agricultural technologies is very high. More so, educational level of the farmers was found to be averagely 59%. Consequently, men were found to dominating maize farming than women. The implication of this is that output will be high because men are relatively more skilled and fuller of energy than women in farming. Based on the findings, it is recommended that government at all levels and non-government organization, should work-out a policy framework that will stimulate increased availability and access of agricultural technologies to the maize farmers.

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