Inclination of young maize farmers to practice climate-smart agriculture

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Abstract: Dependency on rainfall and other climatic factors have exposed farmers to various climate risks. To reduce the effect of climate risk, various climate change adaptive strategies have to be employed including climate-smart agricultural practices. Hence, the study researched the inclination of youth maize farmers to practice climate-smart agriculture. A total of 120 maize farmers were selected in Ogun State, Nigeria through a multi-stage sampling procedure. Data was obtained using a structured questionnaire and interview schedule. The data were described using frequency counts, mean, percentages and ranks. Chi-square and PPMC analyses were used to test the relationship between independent variables and dependent variable. The result shows that most (83.3%) of the respondents rented land used for farming, with a mean farm size of 7.90 ± 9.98 acres and mean years of farming experience of 16.21±9.53 years. Fellow farmers (($\bar{x}$ = 1.22) were the main source of information on climate smart agricultural practices. There was high level (70.8%) of knowledge of climate smart agriculture. Channel of information for climate change information ($\bar{x}$ = 1.44) and high labour cost ($\bar{x}$ = 1.41) ranked first of constraints to practice climate smart agriculture. Willingness (70.8%) to practice climate smart agriculture was high. There was a significant relationship between respondents' source of labour (χ^2=6.001, p< 0.05), farm size (r= 0.338, p<0.05) and inclination to use climate-smart agricultural practices. The study concludes that young farmers involved in maize production are willing to practise climate smart agriculture. Extension agents from government and non-governmental organizations should adopt e-extension for disseminating climate- smart agricultural practices to young farmers.
Keywords: Climate Smart Agriculture, Maize Farmers, Youth.

INTRODUCTION

In recent years, agricultural production has been threatened by climate change. Impacts of climate change vary depending on the state of development of a region. For example, IPCC (2013) suggested that rising temperatures and changing precipitation rates will most likely hamper the success of rain-fed agriculture in most developing countries. Africa is one of the continents that is projected to experience rising temperatures of at least 1 to 2°C and a higher likelihood of extreme weather (Mulenga, Wineman and Sitko, 2017). Thus, the effects of climate change will more directly affect agriculture because about three-quarters of Africa's population depends on agriculture for a livelihood and Africa's agriculture is mainly rain-fed (Amondo and Simtowe, 2018; Tetteh, Opareh, Ampadu and Antwi, 2014).

For Sub-Saharan Africa (SSA) including Nigeria, agriculture is the occupation of majority of the people in rural areas and significantly contributes to the Gross Domestic Product (GDP) of most countries. Thus, many people in SSA including Nigeria are employed in agriculture and increasing agricultural productivity is necessary to reduce poverty and food insecurity (AGRA, 2014). However, the rise in temperatures and increased stochastic rainfall variations have both direct and indirect grave consequences on crop yields and agricultural productivity.

Though it is important to build the agricultural sector of developing countries like Nigeria, however, most agricultural sectors in SSA have performed poorly relative to other developing world regions (Tetteh, Opareh, Ampadu and Antwi, 2014). According to Kotir (2011) in the past 50 years, agricultural productivity has been steadily declining in SSA and recorded the slowest increase across the world over and this would only get worse with climate change. This evidence suggests the production of maize, a vital crop for many millions in SSA (Shiferaw, Prasanna, Hellin and Bänziger, 2011) may have its production in danger in the face of climate change. Maize, a field crop that is one of the most cultivated crops in the world, is a staple crop for most countries in SSA (Shiferaw *et al*.,, 2011). While maize remains an important crop for many millions in SSA, its yields in developing countries are lower than in developed countries (Ng'ombe, Brorsen and Raun, 2019). More importantly, maize production depends on water availability, and most of SSA's agriculture is rain-fed, which makes maize production an obvious candidate to be affected by weather shocks such as droughts—one of the negative consequences of climate change.

Lobell, Bänziger and Magorokosho (2011) suggest maize is sensitive to daytime high temperatures above 30°C and with climate change, the projected 2°C in temperatures for most parts of Africa would affect maize production, which would further lower maize productivity levels in SSA despite the increasing demand for maize.

In recent years, there has been an increased level of participation of youth in agriculture. Challenges such as climate change can lead to low profit which would then justify the long-held belief that agriculture is related to poverty. This could lead to the disengagement of agriculture as a profession among the youth. Hence, the need to encourage youth farmers to adopt climate-smart agriculture in a bid to mitigate the effect of climate change. Climate change impacts are seemingly being felt, numerous studies have examined the impacts of climate change on maize production and productivity resulting in several adaption strategies being promoted to negate the negative effects of climate change (e.g., Mulenga, Wineman and Sitko, 2017; Cairns, Hellin, Sonder Araus, MacRobert, Thierfelder, Prasanna, 2013). However, studies on the inclination of youth to practice climate smart agricultural practices, a practice that can reduce the impact of climate change have not been explored. Hence, the study examined the inclination of youth farmers to practice climate smart agriculture. The study specifically;

1. described the enterprise characteristics of respondents in the study area;
2. ascertained the sources of information on climate smart agriculture among respondents;
3. determined respondents' knowledge of climate smart agricultural practices;
4. identified perceived constraints to respondents' practice of climate smart agriculture.

The following hypotheses were tested for this study:

1. There is no significant relationship between enterprise characteristics of respondents and inclination to use climate smart agricultural practices.
2. There is no significant relationship between respondents' knowledge on climate smart agricultural practices and inclination to practice climate smart agricultural practices.

METHODOLOGY

The study was carried out in Ogun State of southwest Nigeria. The population of the study constituted all youth involved in maize production between the ages of 18-45 years in Ogun state. A Multistage sampling procedure was used to select respondents for the study. The first stage involved the selection of four local government areas using a random sampling technique. The local governments were Obada-Oko (273) Ado- Odo (205) Ilishan (487) and Ososa (256) LGAs. (OGADEP, 2021). The second stage involved the random selection of 10% of youth maize farmers each from the selected local government areas Obada-Oko (27), Ado-Odo (20), Ilishan (48) and Ososa (25) making a total of 120 respondents. A structured questionnaire along with an interview schedule were used in obtaining data for the study.

The dependent variable of the study is the inclination to practice climate smart agricultural practices. Respondents were presented with some climate smart agricultural practices for maize production and selected from response options, willing, less willing, and not willing which were assigned scores of 2, 1 and 0 respectively.

Other key variables are knowledge of climate-smart agriculture: A list of 11 statements indicating the knowledge of climate smart agricultural practices was generated and the level of agreement of the respondents to each statement was indicated as True or False. Scores of 1 and 0 were assigned to correct and incorrect answers respectively.

Perceived constraints to the practice of climate smart agricultural practices: From a list of possible constraint, challenges to practice climate smart agriculture were measured with response options; not a constraint, mild constraint and severe constraint which were assigned scores of 0, 1 and 2 respectively.

RESULTS AND DISCUSSION

Enterprise characteristics of respondents

As revealed in Table 1, 83.3% of respondents rent the land used for farming while 16.7% inherited the land. Also, the mean farm size of respondents was 7.90±9.98 acres with majority (89.2%) having a farm size of 1-10 acres. Majority (68.9%) of the respondents hired labour for their agricultural production while 20.8% made use of family labour and 1.7% make use of communal labour. The mean years of farming experience as revealed in Table 2 was 16.21±9.53 years. Findings further showed that 72.5% of the respondents got credit for their production activities from personal savings, 14.2% got theirs from family and friends while 11.7% got theirs from cooperative societies and 1.7% through bank loans. The results are in line with the findings of Folayan and Bifarin (2013) which showed that most farmers depend on their personal savings as a source of credit.

Sources of information on climate smart agriculture

As shown in Table 2, fellow farmers ($\bar{x} = 1.22$) ranked first as the main source of information on climate smart agricultural practices among youth farmers. The result of the study further revealed farmers' association ($\bar{x} = 1.15$) as second in rank among the sources of information on climate smart agricultural practices. This result is not surprising as it is expected that common problems facing farmers, among which is climate change will be raised, discussed and provided solutions to, during farmers' associational meetings. As shown on Table 3, radio ($\bar{x} = 1.02$) ranked 3rd among the sources of information on climate smart agricultural practices to youth farmers in the study area. This could be because most radio stations disseminate information in vernacular languages which will enhance the utilization of climate smart agricultural practices. In addition, radio is the most cost-effective channel in terms of transmission, presentation and portability (Khanal, 2013).

Table 2: Distribution of respondents by enterprise characteristics

Variable	Frequency	Percentages	Mean
Land ownership			
Rent	100	83.3	
Inheritance	20	16.7	
Farm size			
1-10	107	89.2	
11-20	6	5.0	
21-30	1	.8	
31-40	2	1.7	
41-50	4	3.3	7.90±9.98acres
Labour used			
Family labour	25	20.8	
Hired labour	93	77.5	
Communal labour	2	1.7	
Years of farming experience			
1-10	50	41.7	
11-20	41	34.2	
21-30	23	19.2	
31-40	6	5.0	16.22±9.53years
Farm yield			
1-10	93	77.5	
11-20	19	15.8	
21-30	6	5.0	
31-40	2	1.7	8.70±7.68 tonnes
Source of credit			
Personal Savings	87	72.5	
Family and friends	17	14.2	
Bank loans	2	1.7	
Cooperative society	14	11.7	

Source: Field Survey, 2021

Table 2: Distribution of respondents by frequency of access to source of information on climate smart agricultural practices

Sources of information on climate smart agricultural practices	Always		Occasionally		Never		Mean	Rank
	F	%	F	%	F	%		
Television	0	0	104	86.70	16	13.30	0.87	5th
Radio	11	9.20	100	83.30	9	7.50	1.02	3rd
Newspaper	1	0.80	92	76.70	27	22.50	0.80	8th
Farmers association	26	21.70	86	71.70	8	6.70	1.15	2nd
Extension agents	5	4.20	103	85.80	12	10.00	0.94	4th
Internet	8	6.70	60	50.00	52	43.30	0.63	10th
Fellow farmers	39	32.50	68	56.70	13	10.80	1.22	1st
Seminars	1	1.70	97	80.80	21	17.50	0.84	6th
Conference	1	0.80	77	64.20	42	35.00	0.66	9th
Friends and neighbors	16	13.30	66	55.00	38	31.70	0.82	7th
Handbills	7	5.80	47	39.20	66	55.00	0.51	11th
Posters	0	0	23	19.20	97	80.80	0.19	12th
Journals	1	1.70	17	14.20	101	84.20	0.18	14th
Facebook	4	3.30	15	12.50	101	84.20	0.19	12th
Twitter	4	3.30	8	6.70	108	90.00	0.13	15th
Instagram	4	3.30	4	3.30	112	93.30	0.10	16th

Source: Field survey, 2021

Knowledge of climate-smart agricultural practices

As revealed on Table 3, majority (98.3%) of the respondents ascertained that climate-smart agricultural practices are aimed at achieving the following: increased productivity, enhanced resilience and reduced emissions. The result in Table 3 further revealed that majority (83.3%) knew that climate smart agriculture entails addressing climate change from different perspectives of agricultural production. In addition, majority (80.0%) of the respondents established that adopting a comprehensive soil cover of vegetation is an important climate smart agricultural practice. This could be because soil cover is a less expensive and tedious climate smart agricultural practices which have proven to produce results for the farmers. However, majority (82.5%) of the respondents did not know that climate smart agricultural practices is dependent on the location of the agricultural enterprise. This could have contributed to their dependence on fellow farmers as main source of information on climate smart agricultural practices.

The result in Table 4, shows a high level (70.8%) of knowledge of climate smart agricultural technologies among respondents. The prevalence of the climate change problem could have contributed to the desire for solutions that can mitigate this effect. Search for solutions to climate change might have increased the farmer's knowledge of climate smart agricultural technologies. A high level of knowledge of climate smart agricultural technologies could favour farmers' willingness to adopt climate smart agricultural practices among the youth farmers. This position was asserted by Lorenzoni *et al.*, (2007) who stated that in order to increase harvests, improve farming and hasten efforts in adaptation and fathoming climate change and variability, frequent education, awareness, knowledge become critical components in improving farmers' understanding.

Table 3: Distribution of respondents by knowledge of climate smart agricultural practices

Knowledge statements	Correct		Incorrect	
	F	%	F	%
Climate smart agricultural practices is aimed at achieving all of the following; increased productivity, enhanced resilience and reduced emissions	118	98.30	2	1.70
Climate smart agricultural practices to be adopted is not dependent on the location of the agricultural enterprise	21	17.50	99	82.50
Climate smart agricultural practices do not address the relationship between agriculture and poverty	31	25.80	89	74.20
Breeding of higher-yielding crop varieties is a climate-smart agricultural practice	91	75.80	29	24.20
Climate smart agriculture entails addressing climate change from different angles of agricultural production	100	83.30	20	16.70
Index based insurance is among the enabling environment for climate smart agricultural practices	83	69.20	37	30.80
Climate-smart agricultural practices do not involve soil water management	88	73.30	32	26.70
Adopting a comprehensive soil cover of vegetation is an important climate smart agricultural practice	96	80.00	24	20.00
The use of inorganic fertilizers is encouraged in climate-smart agricultural practices	35	29.20	85	70.80
Land terracing is a climate-smart agricultural practice	91	75.80	29	24.20
Replacing potentially vulnerable annual crop with hardier perennial crop is a climate smart agricultural practice	112	93.30	8	6.70

Source: Field survey, 2021

Table 4: Categorisation of respondents by level of knowledge of climate smart agricultural practices

Level of knowledge	Frequency	Percentage	Min	Max	Mean	SD
Low (3.00-7.21)	35	29.2	3.00	11.00	±7.22	1.56
High (7.22-11.00)	85	70.8				
Total	120	100				

Source: Field survey, 2021

Perceived constraints to practise climate-smart agriculture

As revealed in Table 5, the inadequate channel of information for climate change information ($\bar{x}$ = 1.44) ranked first among the constraints to the use of climate smart agricultural practices. This corroborates with the report of Rohila, Shehrawat and Malik (2018) who reported that lack of climate-related information ranked first among the constraints in the adoption of climate smart agricultural practices. Though farmers are faced with the reality of climate change, however, the desire to mitigate this largely depends on available information. Climate smart agricultural practices are a set of information that needs to be taught. Farmers would only be willing to use the information they are familiar with. It was further revealed on Table 5 that high labour cost ($\bar{x}$ = 1.41) ranked second among the constraints to the use of climate smart agricultural practices. This shows that the respondents perceive climate smart agricultural practices to be labour-intensive. This calls for the introduction of less labour-intensive climate smart agricultural practices to farmers. Farmers' thought that most climate smart agricultural practices are labour intensive can affect their willingness to adopt climate smart agricultural practices. Inadequate knowledge of climate smart agricultural practices ($\bar{x}$ = 1.39) ranked third of the constraints to the willingness to adopt climate smart agricultural practices. Adequate knowledge various disseminated climate smart agricultural practices will enable the farmers to choose the practices that best address their climate change problems whereas, inadequate knowledge will leave them with nothing to choose from. Also ranked third is inadequate access to climate-resistant varieties ($\bar{x}$ = 1.39). This corroborates the report of Rohila *et al* (2018) who reported lack of resources as a major constraint to the adoption of climate smart agricultural practices. Farmers who lack resources such as climate-resistant-varieties would be unwilling to use climate smart agricultural practices even in the face of the great effect of climate change.

Table 5: Distribution of respondents by constraints to practise climate smart agriculture

Constraint	Severe constraint	Mild constraint	Not a constraint	Mean	Rank
Inadequate channel of information for climate change information	47.5	49.2	3.3	1.4417	1st
Lack of trust of climate change information source	41.7	53.3	5.0	1.3667	5th
Inadequate exposure to climate smart agricultural practices	25.8	70.0	4.2	1.2167	6th
High labour cost	46.7	48.3	5.0	1.4167	2nd
Inadequate knowledge of climate smart agricultural practice	40.8	57.5	1.7	1.3917	3rd
Inadequate access to climate resistant varieties	40.0	59.2	0.8	1.3917	3rd
Illiteracy	25.0	50.0	25.0	1.0000	7th
Deviation of climate information to climate realities	3.3	60.0	36.7	0.6667	8th
More incidence of pest and disease	3.3	55.8	40.8	0.6250	9th

Source: Field survey, 2021

Inclination to practise climate smart agriculture

As revealed in Table 6 most of the farmers were willing to integrate crop and livestock production ($\bar{x}$ = 1.94). This could be due to the uncertainties in profit maximization from maize production because of the effects of climate change. This might have led to livelihood diversification. The same livelihood diversification must have led to the practice of intercropping and mixed cropping system ($\bar{x}$ = 1.93) which ranked third of climate smart agricultural practices respondents were willing to use. It is not surprising that crop diversification is among the climate smart agricultural practices respondents were more willing to use. This is because according to Joshi (2005), crop diversification (crop rotation and inter-cropping) is one of the most ecologically feasible, cost effective and rational ways of reducing uncertainties in agriculture especially among smallholder farmers. The respondents who were mainly smallholder farmers and youth just starting out in their agricultural profession would prefer a cost-effective climate smart agricultural practice. As revealed in Table 6, planting drought resistant seed varieties ($\bar{x}$ = 1.86) ranked second among the climate smart agricultural practices respondents were willing to use.

Among the climate smart agricultural practices respondents were least willing to adopt was to stop making use of inorganic fertilizers ($\bar{x}$ = 1.29) which ranked 13th of the climate smart agricultural practices. Close to this is stopping the use of inorganic herbicides and pesticides which ranked 12th among the climate smart agricultural practices respondents were unwilling to adopt. This could be due to several challenges farmers encounter in organic farming. The result justifies the assertion of Adebiyi (2014) that the adoption of organic agriculture in Africa is generally low.

The result in Table 7 revealed respondents' high level (70.8%) of willingness to make use of climate-smart agricultural practices. The high level of knowledge could have influenced the respondents' willingness to make use of climate-smart agricultural practices.

Table 6: Distribution of respondents by the inclination to practise climate smart agriculture

Are you willing to?	Willing		Less willing		Not Willing		Mean	Rank
make use of drought resistant seed varieties for planting	112	93.3	7	5.8	1	0.8	1.93	2nd
adopt crop rotation	97	80.8	19	15.8	4	3.3	1.7750	9th
practice intercropping/mixed cropping system	103	85.8	17	14.2	0	0	1.8583	3rd
stop making use of inorganic fertilizers	51	42.5	53	44.2	16	13.3	1.2917	13th
application of manure to your plants	97	80.8	20	16.7	32	2.5	1.7833	8th
practice zero tillage for maize cultivation	82	68.3	28	23.3	10	8.3	1.6000	
practice mulching on your maize plants	101	84.2	17	14.2	2	1.7	1.8250	4th
manage your residue by incorporating the plant remains into the soil	98	81.7	19	15.8	3	2.5	1.7917	7th
plant trees or shrubs in or around farmland	99	82.5	20	16.7	1	0.8	1.8167	6th
irrigate your maize plants when there is an absence of water	94	78.3	16	13.3	10	8.3	1.7000	11th
stop the use of inorganic herbicides and pesticides	55	45.8	46	38.3	19	15.8	1.3000	12th
make use of high yielding hybrids seeds of maize	100	83.3	13	10.8	7	5.8	1.7750	9th
integrate crop and livestock production	115	95.8	3	2.5	2	1.7	1.9417	1st

Source: Field survey, 2021

Table 7: Categorisation of respondents by the willingness to practise climate smart agriculture

Level of use	Freq.	%	Minimum value	Maximum value	Mean	Standard deviation
Low	35	29.2	16	26	22.38	±2.47
High	85	70.8				

Source: Field survey, 2021

Hypotheses of the study

There is no significant relationship between enterprise characteristics of respondents, respondents' knowledge of climate-smart agriculture and their inclination to practise climate-smart agriculture.

As revealed in Table 8, there is a significant correlation between the source of labour (χ^2=6.001, p< 0.05) and inclination to practise climate-smart agriculture. Sources of labour could foster an inclination to use climate smart agricultural technologies because some climate-smart practices could be labour intensive. Hence, it is expected that farmers with available labour sources would be more willing to practise climate smart agriculture including practices that are labour intensive. This opinion is supported by Marenya and Barrett (2007) who asserted that climate smart agricultural practices are labour intensive, hence, larger household size are more likely to adopt the practices.

The PPMC analysis revealed in Table 8 reveals a significant relationship between respondents' farm size (r= 0.338, p<0.05) and inclination to use climate smart agricultural practices. This finding concurs with that of Rehman *et al* (2013) who established that an increase in farm size resulted in access to agricultural information including information on climate smart agricultural practices. This significant relationship could be because farmers with large farm size would have invested so much into production and are at higher risk of loss than smaller farmers. The desire to maximize profit from their bulk investment would increase the willingness to make use of climate smart-agricultural practices. This is in accordance with Maddison (2006) assertion that farm size positively influences climate adaptation strategies.

Also, Table 8 reveals there was a significant relationship (r=0.268, p<0.05) between respondents' knowledge of climate smart-agriculture and inclination to use climate smart agricultural practices. This implies that increased knowledge of climate-smart agricultural practices will lead to corresponding increased willingness to practise climate smart agriculture. The result is not surprising as adequate knowledge is needed for climate smart agricultural practices. Farmers would only be willing to adopt an innovation when aware of the benefits as well as the know-how. This finding corroborates Etuk *et al* (2012) who asserted that education of farmers on technologies is important in the adoption and utilization of innovation.

Table 8: Relationship between enterprise characteristics of respondents, knowledge and their inclination to practice climate smart agriculture

Variables	χ^2	df	p-value	r-value	Remark
Source of labour	6.001	2	0.050		Significant
Farm size			0.000	0.338	Significant
Knowledge			0.003	0.268	Significant

Source: Field survey, 2021

CONCLUSION

The study concludes that youth farmers involved in maize production are willing to practise climate-smart agriculture. They have a high level of knowledge of climate smart-agriculture although with various perceived constraints associated with climate-smart agricultural practices. However, the source of labour, farm size and high level of knowledge may influence their willingness to practise climate-smart agriculture.

RECOMMENDATIONS

There was a low level of use of social media to disseminate information on climate-smart agricultural practices, therefore extension agents from government and non-governmental organizations should adopt E-extension for disseminating climate-smart agricultural practices. This will enable youth who are the most users of social media to have increased access to information on climate smart agricultural practices which would, in turn, affect its adoption.

It is recommended that government, extension agents, media personnel and non-governmental organization organize more programmes for the dissemination of climate-smart agricultural technologies to youth farmers.

Practices that are less tedious and require fewer resources should be introduced to the youth farmers so that they can be willing to adopt them.

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