International J. of Ext. Educ. Vol. XXI : 01-10, 2025 ISSN : 2319-7188

Assessment of Climate-smart Practices among Citrus Producers in Oyo State, Nigeria

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ABSTRACT

Climate change has become a trending issue affecting agriculture in recent years, and a major global concern for which world leaders are seeking a common platform to tackle it. This paper assessed the usage of various climate smart practices by citrus producers in Oyo State. Oluyole and Afijio Local Government Areas (LGAs) within the state were purposively sampled for the study due to their comparative advantage in fruit production. Seventy-two respondents were randomly selected from lists presented in both the adopted village of Cocoa Research Institute of Nigeria in Oluyole LGA and All Farmers Association of Nigeria (AFAN), Afijio Chapter. Data collected using interview guide were analyzed with frequencies and percentages,chi-square and regression. The results revealed that majority (81.9%, 91.3% and 95.8%) of the respondents were males, married and farmers. The level of awareness of climate smart practices (CSA) by farmers (40.3%) and access to climate practices (37.5%) was low. Similarly, extent of use of CSA was also very low (38.3%). However, positive significant relationship exists between access to credit and extension and the utilization of climate smart practices. Specific programs need to be evolved for enlightenment of farmers to the current reality of climate change effects and encouragement for utilization in order that the citrus industry will be protected.

Key words: *Fruit farmers, climate change, CSA, fruit production*

INTRODUCTION

Horticulture has potential to make more significant contributions to efforts at attaining food security and self- sufficiency (Ogunwolu and Ekoja,2011). It has been described as a growing economic power house (ISHS, 2012) with diverse crops notable for providing nutrition, health, income generation and livelihood. An array of crops such as fruits, vegetables, spices and nuts form part of the horticultural chain. The global output of these crops forms a basis for the development of various economies of the world whether developing or developed countries. Fruits and vegetables are the most important sources of micronutrients, fiber, vitamins and minerals essential for a balanced and healthy diet. They are referred to as protective foods which play a significant role in nutritional security of humans (Kaur and Singh, 2021, Ganry et al,2011). Horticultural crops such as citrus are fruit tree crops which are permanent and provide regular income to farmers once they attain fruit bearing stage.

Climate plays a significant role in plant growth and productivity. Horticultural crops are largely dependent on climate, and its productivity may be influenced by changes within the climate which can invariably reduce crop productivity and in some cases, total loss can occur. Climate change is the long-term alteration in global weather patterns, measurable increases in the average temperature of earth's atmosphere, oceans and land masses, brought on by rising levels of heat trapping atmospheric gases known as greenhouse gases, which over time affects the quality, quantity, volume and stability of crop production (Nwoko et al,2018 and Olasantan,2010). Nkumulwa and Pauline,2021 reported a resulting decline of agricultural productivity and increased deforestation in Tanzania due to climate change. In Nigeria, climate change has been reported to lead to consistently higher temperatures, heavier floods and drought which has impacted negatively on crops (Godson-Ibeji et al,2018). Furthermore, Adigun and Adelasoye, 2021 affirmed a change in rainfall pattern in Nigeria with resultant effect on commencement of planting season and poor harvest yield. In 2021 there was flood in different parts of Nigeria which ravaged farms and brought untold

losses to farmers. Such floods have been traced to changes in weather patterns with resultant effect on change in rainfall output.

All horticultural crops are sensitive to temperature, and most have specific requirements for optimum yield and quality. Temperature increase affects photosynthesis directly, causing alterations in sugars, organic acids, flavonoids content, firmness and antioxidant activity (Kaur and Singh,2021). However, some adaptation measures can be put in place to cushion the negative effect of climate change on crop productivity. In a study by Remigius et al, 2018, cucumber growers employed crop diversification, planting of early maturing varieties, adoption of irrigation techniques and crop rotation as measures for climate change adaptation. Similarly in Yobe State, Nigeria, climate smart agricultural practices such as improved seed varieties, intercropping and integrated soil fertility management which was used gave resultant benefits of food, income diversification and improved resilience (FAO,2023). Although there is presently no policy to mainstream climate agriculture in different spheres of Nigeria, it is imperative to tackle climate change affecting farmers' productivity with climate smart agriculture for sustainability of the food system (Maigari,2022). Thus, the main objective of the study is to assess climate smart practices being used by citrus producers to reduce effect of climate change on fruit production. Specific objectives are to:

- identify social and personal characteristics of fruit producers
- ascertain the utilization of climate smart practices by fruit producers in the study area
- identify sources of information on climate smart agricultural practices
- identify factors influencing choice of climate smart agricultural practices
- identify constraints involved in use of climate smart practices

Test of Hypotheses

1. There is no significant relationship between utilization of climate smart agricultural practices and socio-personal characteristics of citrus farmers
2. There is no significant relationship between utilization of climate smart agricultural practices and factors affecting choice.

METHODOLOGY

The study area

The study was conducted in Oyo State. It is an inland state in southwestern Nigeria, bordered to the north by Kwara State, to the east by Osun State, and to the southwest by Ogun State and the Republic of Benin. Agriculture is currently the main contributor to Oyo State's economy comprising 38% of gross state product (GSP), and directly or indirectly employing as much as 70% of the workforce. Oyo State has an estimated landmass of 28,454km2 and a favourable climate for equatorial crop production. The dry season lasts from November to March while the wet season starts from April-October. Average daily temperature ranges between 250C and 350C (Wikipedia 2023, OBG,2023). The climate favours cultivation of crops like maize, yam, cassava, millet, rice, cocoa, plantain, cashew and palm produce. There is an equally strong horticultural output of fruit crops such as oranges (321,490tonnes), banana (61,770tonnes) and tomatoes (6210tonnes). The state is located within coordinates 80 00'N 40 00'E. In 2016, the projected population was 7,840,864 to make it the fifth most populous state in Nigeria.



Plate 1: Map of Oyo State showing the local government areas

Sampling procedure

The state has 33 Local Government Areas with four agricultural zones namely: Shaki, Ogbomoso, Oyo and Ibadan/Ibarapa. Population for this study comprised of the fruit producers in Oluyole and Afijio Local Government Areas of Oyo State. A three stage sampling method was used for the study. In the first and second stages,Oyo agricultural zone and Oluyole and Afijio Local Government Areas of Oyo State were purposively sampled due to their comparative advantage in fruit production. In the third stage, the survey sample was drawn from list of the All Farmers Association of Nigeria, Afijio Chapter, and that of adopted farmers of Cocoa Research Institute of Nigeria (CRIN) to give a total of 72 respondents. The research was carried out in 2021.

Data collection and analysis

Data was collected with the aid of an interview schedule and analyzed with frequencies, percentages, chi-square and regression.

RESULTS AND DISCUSSION

Socio-personal Characteristics of Citrus Farmers

The result in Table 1 showed that majority (76.4%) falls between the ages of 40-69 which is an indication that most of the farmers interviewed were in their middle age and are getting old. Attah et al (2018) also found that citrus farmers in Benue State were middle aged and mostly between the ages of 51-60 years (46.67%), a scenario which does not favour the horticulture industry. Also, majority (81.9%) were males with the females being in the minority (18.1%). This could be attributed to socio-cultural factors which prevent women from possessing economic trees which are permanent in nature. (Koyenikan and Anozie,2017). Furthermore, most (55.6%) of the respondents are Christians with 43.1% being Moslems respectively, an indication of the freedom to embrace modern religion. Majority (95.8%) of the respondents are farmers, and have farm experience between 30 and 60 years. This is in consonance with the findings of Attah et al, (2018) who reported involvement of 53% of the respondents in citrus production for more than 25 years in Benue State. Farming experience is very important in farming activities as it helps the farmer in the area of proper farm management to maximise profit. (Adebisi,2022) A sizeable proportion of the respondents (95.8%) have farming as their main source of income, which suggests the agrarian nature of the rural areas. Majority (84.8%) has one form of education or the other ranging from primary education, secondary, tertiary respectively. Anzaku et al, (2016) and Attah et al (2018) in studies carried out. found that most of the citrus farmers in Benue State were educated. It further showed that total farm size for 40.3% of the citrus farmers was between 1-4 hectares. This is similar to the findings of Attah et al (2018) who affirmed that 74.17% of the citrus farmers in Benue State had farm size of 1-3 hectares.

Table 1
Socio-personal Characteristics of Citrus Farmers

S/N	Variable	Frequency	Percentage
1	Age		
	30-39	6	8.3
	40-49	15	20.8
	50-59	21	29.2
	60-69	19	26.4
	70 and above	11	15.3
2	**Sex**		
	Male	59	81.9
	Female	13	18.1
3	**Religion**		
	Christianity	40	55.6
	Islam	31	43.1
	Traditional	1	1.4
4	**Occupation**		
	Farming	69	95.8
	Artisan	1	1.4
	Trader	1	1.4
	Others	1	1.4
5	**Experience in farming categorised**		
	<20	6	8.3
	20-29	26	36.1
	30-39	15	20.8
	40-49	8	11.1
	50-59	11	15.3
	60 and above	6	8.3
6	**Education**		
	No formal education	11	15.2
	Primary education	27	37.5
	Secondary education	22	30.6
	Tertiary	12	16.7
7	**Total farm size categorized**		
	<1 hectare	10	13.9
	1-4 hectares	29	40.3
	5-8 hectares	9	12.5
	9-12 hectares	9	12.5
	>12	15	20.8

Extent of Utilization of Climate Smart Agricultural Practices

The result in Table 2 revealed that majority (91.7%) never engage themselves in the utilization of harvesting rain water as a form of climate smart practices followed by 63.9%, 62.5% and 59.8% who never utilized control of soil erosion and run-offs, use of cover crops (diversification practices), use of improved seed variety, integrated pest management and crop rotation. However, Opeyemi et al (2021) found that, mixed crop and mixed farming were the most popular climate smart agricultural practices utilized among farmers in Ika North East Local Government Area of Delta State. Others include cover crop, mulching, intercropping, organic manure, use of compost, crop rotation and agro forestry. Oluwatayo and Ojo (2016) found that adaptation strategies used by farmers to improve yam production in spite of climate change include mixed cropping, irrigation, diversification and change in planting dates. Orowole et al (2015) found that multiple cropping (97.26%) and adjusting time/date of planting (91.78%) were used as most climate smart adaptation strategies among crop farmers in Lagos State.

Table 2
Extent of Utilization of Climate Smart Agricultural Practices

S/N	CSA Practices	Very often	Often	Rarely	Never
1	Minimum or zero tillage practice	9(12.5)	6(8.3)	24(33.3)	33(41.7)
2	Use of organic fertilizer	6(8.3)	12(16.7)	12(16.7)	42(58.4)
3	Shifting cultivation	8(11.1)	11(15.3)	19(26.4)	33(45.9)
4	Use of improved seed variety	4(5.6)	8(11.1)	15(20.8)	45(62.5)
5	Integrated pest management	5(6.9)	9(12.5)	15(20.8)	43(59.8)
6	Crop rotation	9(12.5)	7(9.7)	13(18.1)	43(59.8)
8	Control of soil erosion and run-offs	7(9.7)	8(11.1)	11(15.3)	46(63.9)
9	Different methods of crop establishment				
10	Use of cover crops (diversification practices)	5(6.9)	8(11.1)	14(19.4)	45(62.5)
12	Agroforestry				
13	Harvesting of rain water	1(1.4)	3(4.2)	2(2.8)	66(91.7)

Sources of information on climate-smart agricultural practices (CSA)

The result in Table 3 revealed that 37.5%, 33.3%, 26.4%, 23.6% and 22.2% of respondents often listen to radio, have contacts with extension agents, farmers organisation, view television, utilise fellow farmer as their sources of information on climate smart practices, while 80.6%, 75.0%, 73.6%, 69.4%, and 68.0% never obtain information on climate smart practices from University, Non-Governmental Organisations, social media, relatives, bulletin and research institutes. Nzeadibe et al (2011) affirmed that the mass media (radio/TV and newspaper) was the main source of information on the climate change phenomenon in Niger Delta Region of Nigeria. Also Adebisi-Adelani and Oyesola (2014) equally established that the information sources available on climate change to the majority (91.9%) of the respondents in Benue State, Nigeria are radio (87.0%), friends (82.1%) and GSM (69.9%).

Table 3
Respondents' sources of information on climate-smart agricultural practices (CSA)

S/N	Source	Often	Rarely	Never
1	Fellow farmer	16(22.2)	19(26.4)	37(51.3)
2	Friends	11(15.3)	11(15.3)	50(69.4)
3	Relatives	13(18.1)	6(8.3)	53(73.6)
3	Radio	27(37.5)	30(41.7)	15(20.9)
4	Farmers Organization	19(26.4)	12(16.7)	41(56.9)
5	Extension agents	24(33.3)	19(26.4)	29(40.3)
6	Television	17(23.6)	14(19.4)	41(56.9)
7	Bulletin	7(9.7)	15(20.9)	50(69.4)
8	NGOs	8(11.1)	10(13.9)	54(75.0)
9	Social media	7(9.7)	11(15.3)	54(75.0)
10	Research Institute	6(8.3)	17(23.6)	49(68.0)
11	University	2(2.8)	12(16.7)	58(80.6)

Factors affecting the choice of climate smart adaptation practices

The result on Table 4 revealed that farm experience, soil fertility, access to improved seedlings (43.1%) ranked first as factors affecting the choice of climate smart adaptation practices, followed by finance (41.7%), access to water (40.3%), access to credit (37.5%) and fertilizer (36.1%). Adebisi- Adelani (2018) in a related study found out that farming experience ranked first (95.2 %) as a major factor that influenced adaptation strategies used by horticultural farmers followedby tenure right (64.9 %), household size (64.4 %), soil fertility (63.7 %) access towater (57.1 %), off farm activities (53.5 %) and access to improved seedlings(52.8 %). Similarly, Apata (2011) opined that education of the head of household, livestock ownership and extension for crop and livestock production, availability of credit and temperature are factors influencing choice of adaptation strategies to climate smart adaptation strategies in Nigeria. Chete (2019) affirmed that factors influencing farmers' choice of adaptation methods included household size, access to credit and contact with extension agents, monthly farm income and access to climate change information. Adeagbo et al (2021) found that household size, depreciation ratio, frequency of extension visits, access to extension, and non-farm income were factors influencing the adoption of climate change adaptation strategies among maize farmers in southwest Nigeria.

Table 4
Factors affecting the choice of climate smart adaptation practices

Factors	Yes	No
Farm experience	31(43.1)	41(57.0)
Finance	30(41.7)	42(58.4)
Access to credit	27(37.5)	45(62.5)
Access to water	29(40.3)	43(59.8)
Tenure	21(29.2)	51(70.8)
Household tenure	11(19.4)	61(84,7)
Access to Extension	23(31.9)	49(68.0)
Soil fertility	31(43.1)	41(56.9)
Access to improved seedlings	31(43.1)	41(56.9)
Access to fertilizer	26(36.1)	46(63.9)

Challenges faced by the respondents in using climate-smart agricultural practices

The findings on Table 5 revealed that majority (62.5%) of respondents stated that lack of government support is a very severe problem facing respondents in the use of climate -smart agricultural practices. Half (50.0%) of the respondents adduced that lack of knowledge on CSA practices, lack of technical knowhow (45.8%) and unavailability of improved planting materials (44.4%) posed a very severe problem to the use of CSA. Furthermore, high cost of CSA practices (37.5%) lack of finance, division of labour, difficulty in application of CSA practices (36.1%) were also part of the challenges affecting the use of CSA practices. Opeyemi et al (2021) reported that high cost of production and inadequate financial resources were very serious constraints to adaptation of CSA practices in Ika Local Government Area of Delta State. Orowole et al (2015) also affirmed that the main constraints to climate change adaptation among crop farmers in Lagos State were inadequate financial resources (94.5%) and poor access to the technologies necessary for adaptation (76.7%). Ifeanyi-Obi et al (2022) opined that insufficient funding and support by government in programme planning and implementation, policy inconsistencies and poor farmers' attitude and resistance to change were the challenges to the uptake of climate smart agricultural practices in Nigeria.

Table 5
Challenges faced in use of climate-smart agricultural practices

Challenges	Very Severe	Severe	Not severe	Not a challenge
No government support	45(62.5)	12(16.7)	3(4.2)	11(15.3)
High cost of CSA practices	27(37.5)	17(23.6)	2(2.8)	25(34.8)
Lack of finance	26(36.1)	20(27.8)	11.4	25(34.8)
Unavailability of improved planting materials	32(44.4)	25(34.7)	22.8	12(16.6)
Division of labour	26(36.1)	14(19.4)	1926.4	12(16.6)
Lack of knowledge on CSA practices	36(50.0)	28(38.9)	1(1.4)	6(8.4)
Lack of technical knowhow	33(45.8)	28(38.9)	4(5.6)	6(8.4)
Difficulty in application of CSA practices	26(36.1)	25(34.7)	4(5.6)	15(20.8)

Test of relationship between utilization of climate smart agricultural practices and socioeconomic characteristics of citrus farmers

Table 6 revealed that respondents' Local Government Area ($P \leqslant 0.000$) and Community ($P \leqslant 0.003$) were significantly related to utilization of CSA practices. This implies that community where each of the farmers belong determines their level of utilizing CSA practices. It also suggests that since the areas of study were notable for citrus production as a major industry for income generation, farmers will want to seek every means to protect the citrus trees from being negatively affected by the vagaries of weather so that the communities will still remain a frontline community in the citrus industry.

Table 6
Test of relationship between utilization of climate smart agricultural practices and socio-personal characteristics of citrus farmers

Socio-personal characteristics	P-Value	Chi-square value	Contingency coefficient	Decision
LGA	15.164	.000	.420	S
Community	25.058	.003	.511	S
Age	40.378	.010	.602	NS
Sex	1.509	.219	.144	NS
Marital status	4.522	.210	.245	NS
Religion	4.470	.107	.243	NS
Occupation	1.922	.589	.162	NS
Experience	20.609	.244	.474	NS
Education	6.994	.072	.299	NS
Household size	12.278	.424	.384	NS

Regression analysis showing factors affecting utilization of CSA practices by citrus farmers

The results on Table 7 reveal that the access to credit coefficient was significant which implies that a farmer's access to credit will influence his/her utilization of climate smart practices. Olutumise (2023) affirms the crucial role of credit in adopting and utilizing of climate adaptation practices among farmers in rural areas. Access to water was also a significant coefficient affecting utilization of CSA practices. Citrus production is critically dependent on water since it is rainfed, lack of which has adverse effect on its productivity. Negative and significant relationship exists between access to water and utilization of CSA practices, and similarly between access to improved seedlings and utilization of CSA practices. Improved citrus seedlings which are drought tolerant if not readily available to farmers may make it impossible to be used as a means to combat effect of climate change. Off farm activity is significant and has positive coefficient which suggest that proceeds from different off farm activities may assist the citrus farmers to utilize climate smart practices. Access to extension was a positive significant coefficient, and this implies that the more a farmer is in contact with extension agents who are trained in the delivery of CSA practices, the more the farmer will be able to utilize CSA practices for higher level of productivity.

Table 7
Regression analysis showing factors affecting utilization of CSA practices by citrus farmers

Factors	Coefficients	T	Sig.	Decision
Finance	.497	1.022	.311	NS
Access to credit	1.010	3.057	.003	S
Access to water	-1.041	-3.198	.002	S
Land tenure	.289	1.220	.227	NS
Household size	.103	.538	.593	NS
Off Farm activity	.491	2.850	.006	S
Access to Extension	.510	2.796	.007	S
Access to soil fertility	-.409	-1.538	.129	NS
Access to improved seedlings	-1.482	-3.644	.001	S
Access to. Fertilizer	.284	1.115	.269	NS

CONCLUSIONS

The study established that the citrus industry is male dominated with small holdings. Electronic media (radio and television), contact with extension agents, farmer organisations and fellow farmers were major sources of information on climate smart practices explored by the citrus farmers. Lack of government support, lack of knowledge and technical knowhow on CSA practices, and unavailability of improved planting materials were some of the challenges faced by the citrus farmers.

The level of awareness of climate smart practices (CSA) by farmers and access to climate practices was low. Similarly, extent of use of CSA was also very low. However, positive significant relationship exists between access to credit and extension and the utilization of climate smart practices. The study hereby recommends that:

I) Sponsored agricultural programs on radio and television stations should include advocacy and enlightenment for farmers to create awareness and proffer solutions to address climate change issues.

ii) Government policies should focus on addressing climate change concerns and adequate budget allocated to assist farmers in utilization of climate smart practices

iii) Breeding of drought tolerant and improved planting materials by relevant Research Institutes for uptake by the citrus farmers.

iv) Training of extension agents with relevant technical knowhow on climate change so the information can cascade down to farmers.

Paper received on 06/03/2025
Accepted on 02/06/2025

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