



LEVEL OF AWARENESS AND ADOPTION OF CLIMATE SMART
AGRICULTURAL PRACTICES (CSAP) AMONG IRISH POTATO FARMERS IN
PLATEAU STATE, NIGERIA

¹Goni, I. C., ¹Garba, M., ²Bose A. A., and ¹Abdullahi, S.

¹Department of Agricultural Extension and Rural Development, Faculty of Agriculture and Agricultural Technology, Abubakar Tafawa Balewa University, Bauchi.

²Department of Agricultural Economics, Faculty of Agriculture and Agricultural Technology, Abubakar Tafawa Balewa University, Bauchi.

Corresponding Author's E-mail: ishayagoni@gmail.com

GSM: +2348065941921

ABSTRACT

The study examined the factors influencing the adoption of climate smart (CSA) agriculture among irish potato farmers in Plateau State, Nigeria. A multi-stage sampling technique was in selecting 390 respondents. Data were collected using structured questionnaire and were analysed using Descriptive and Inferential statistics. The results revealed that the respondents' major sources of information on CSAP were (84.2%) from television, radio (71.9%), print media, (48.2), and extension agents (37.0%) which were ranked 1st, 2nd, 3rd, and 4th, respectively. Most (93.1%) of the respondents had awareness of increase in temperature, 45.4% and 40.3% of the respondents had awareness of delay in onset of rainfall and increase in crop pests and diseases due to climate change respectively. The results also showed that 35.5% and 34.9%, of the respondents had awareness of increase in drought and shortage of rainfall, respectively. Similarly, respondents were aware of the used of organic manure (72.2%), improved variety of potato (85.7%), adjusting planting dates (79.3%), and shifting to another crop (69.6%) respectively. The results further revealed that the major CSAP adopted by the respondents were the use of using improved potato varieties (95.0%), early maturing varieties (89.0%), and using organic manure (83.0%). The results of level of adoption of CSAP revealed that using organic matter, shifting to another crop, using improved potato varieties and early maturing varieties with a mean score of 33.6, 33.6, 33.1, and 33.0, respectively were all within the medium level of adoption. The study concluded that most potato farmers in the study area rely on television and radio, as primary sources of information on CSA practices, with limited use of social media platforms. Farmers exhibit high awareness of climate change impacts, and are moderately aware of various CSA practices with medium level of CSA practices adoption. The study recommended that Traditional channels like television and radio should be strengthened, while modern platforms such as WhatsApp and Facebook should be integrated to effectively reach younger, tech-savvy farmers. Extension agents should organize training to enhance farmers' technical skills for adopting CSA practices. Additionally, governments should provide subsidies or credit schemes and foster collaboration between farmers, research centers, and extension services to ensure access to inputs and updated knowledge on climate change mitigation strategies while farmers should encourage to form and join cooperatives in order to enjoy economies of scale.

Keywords: Adoption, Awareness, Climate Change, Climate Smart Agriculture.

INTRODUCTION

Agricultural sector influences the economic growth process, increases the supply of food and fiber for domestic consumption (Sasu, 2023). It generates foreign exchange through exports, increasing domestic saving and rural purchasing power (Uche *et al.*, 2023). In the year 2023, Agriculture account for a significant portion of 22.91% of Nigeria's Gross Domestic Product (GDP) as a key activity for the country's economy after oil (NBS, 2023). For instance, in the year 2023, agriculture accounted for 19.63% Gross Domestic Product (GDP) of Nigeria (NBS 2023). The confluence of economic meltdown and food security has placed enormous

emphasis on resilience across the globe. Nigeria like many countries is facing the double burden of economic recession and food insecurity, and the critical role of the agricultural sector in the Nigerian economy cannot be overemphasized. (Nwachukwu, 2023).

In recent times, climate poses a great challenge to agriculture (Okelana, 2022). Climate is the long-term pattern of weather that a particular area experiences from over a long period of time, for example between 30 to 35 years. (Cowling and Jaeger, 2021). Climate change is one of the most pressing challenges of our time, with far reaching impacts on the environment, societies, and economies. Bulus and Nimfa (2017), reported that the variation of weather (Rainfall, Temperature, Extreme events has negatively affected Potato quality production in Plateau State, Nigeria. Also, as a traditional method of being climate Smart in the area of Potato production in Plateau State, the farmers inter crop Potato with Maize, and the chemical fertilizers which were initially applied for potato will also be used for the Maize, reducing the effects of its toxicity in the soil, i.e. reducing the greenhouse gas emission (GHGs) (Tiamiyu *et al.*, 2019).

Climate-smart agriculture (CSA) is an integrated approach that uses a set of agricultural practices and technologies which boost adaptation, resilience and productivity as well as reduce/stem down Green House Gasses (GHGs) emissions. Generally, it is built on: existing agricultural knowledge, technologies and sustainability principles (Zaman, *et al.*, 2021). The agricultural policy ambitions of the Nigerian government cannot be met without climate-smart agriculture (Alalade *et al.*, 2023). In order to create adaptation methods in order to deal with the challenges and risks of climate variability in the agricultural sector, farmers' awareness and adoption of Climate-smart agriculture (CSA) is very essential (Abubakar, *et al.*, 2022). Such knowledge is essential in Nigeria since the key predictor of how well agriculture can be carried out is climate, and changes in climate (rainfall, temperature, extreme events) have significant effects not just on the agricultural sector but also on other sectors particularly potato crop in Plateau State, Nigeria. (Olagunju *et al.*, 2022).

Potato is one of the food crops grown in Plateau State, Nigeria, but it is not being grown fast enough in relation to the major problems farmers are experiencing in its production. These include drought, flood, extreme temperatures, drastic changes in rainfall patterns and rise in temperatures. All these factors pose unfavorable growing conditions into the cropping seasons. These changes modify growing seasons and subsequently reduce yield. Production is greatly dependent on environmental factors provided by nature and the optimum combination of these factors plus production inputs determine yield (Adekunmi, 2022).

Apart from the works of Bulus and Nimfa (2017) on "effects of climate change on Irish potatoes in Plateau State", similar works by Henri-Ukoha (2019) on "financing climate change smart agriculture: a panacea for sustainable food production in Nigeria", Goni (2021) on "analysis of extension services delivery on improved potato in Northern zone of Plateau State, Nigeria", Adamu *et al.* (2022) on "analysis of factors influencing the adoption of potato planting material technologies in Plateau State, Nigeria", Malum and Habakkuk (2023) on "potential yield of Irish potatoes under surface irrigation in Semi-Arid Zone of Benue Valley of Makurdi, Nigeria" and Gabriel *et al.* (2023) on "State of climate smart agricultural (CSA) Practices in the North Central and Northwest zones Nigeria", did not address the level of awareness and adoption of climate smart agriculture respectively in the study area, creating dearth of literature with regard to CSAP. It is against this backdrop that the was conducted and specifically;

- i. describe the sources of information on CSA practices;
- ii. asses the level of climate smart agriculture practices awareness of the respondents and
- iii. assess the level of adoption of climate smart agricultural practices among the respondents in the study area;

MATERIALS AND METHODS

The Study Area

The study was conducted in Plateau State, Nigeria. The State has 17 Local Government Areas, divided into 3 zones- Northern, Central and Southern zones. It is located between Latitudes 80° 24' N to 10° 30' N and Longitudes 80° 32' and 100° 38' East (NBS, 2022). Plateau State is Primarily an agrarian community having a land mass of 26,026km² with a projected population of 4,717,300 (PLSG, 2021; NBS, 2022). The mean annual rainfall stands at 1200 mm, with a mean temperature of about 22°C (Binbol *et al.*, 2020). The State is bounded to the North by Bauchi State, North-West by Kaduna State, West by Nassarawa State and South-East by Taraba State. The major food crops produced in the State are Cereals like Maize, Sorghum, Millet, Acha, Root and tubers like Yam, Cassava, Sweet potato, Irish potato, Livingstone potato, Leguminous crops like Ground nut, Soya beans, Cowpea, vegetables such as Cabbage, Lettuce, Cucumber, Radish, Carrots, Sweet pepper, Egg plants, Chili peper, Tomatoes, Strawberry, Green beans, Persely, tree crops like Apple, Avocado, Olives among others. The State has area has high concentration of Irish potato farmers in the Central and Northern zones. The major economic activities of the people are production and marketing of potato (Adamu, *et al.*, 2022).

The major tribes found in the State were Ngas, Berom, Fer, Hausa, and Fulani to mention a few. About two third of the land area is arable. Cereal production on the Plateau represents about 43% of all the agricultural produce; root and tubers represent about 21%. The least is Forest products which represents 13% (Oladimeji *et al.*, 2020). Indeed, the study area, being a temperate area, it favours the production of temperate crops like Potato (*Solanum tuberosum* L), avocado pear, apple, cabbage and radish just to mention but few. It is on this backdrop that the crop in question i.e. potato is being researched upon. The main commercial activities of the people are farming mining and trading (McKenna, 2023).

Sampling Technique and Sample Size

A multi-stage sampling technique was adopted for this study. In the first stage, a purposive sampling of two (2) zones comprising Central (Pankshin, Mangu and Bokkos) and Northern zones (Barkin-Ladi, Jos South and Riyom) were selected. In the second stage three (3) Local Government Areas (LGAs) were purposively selected from each zone giving a total of six. This was due to their prominence in Potato (*Solanum Tuberosum* L.) production in the area. The selected LGAs includes Pankshin, Mangu and Bokkos (central zone) and Barkin-Ladi, Jos South and Riyom (Northern zone). In the third stage, two (2) districts were purposively selected from each LGA making a total of 12 districts. In the fourth stage, two (2) villages were purposively again selected in each district based on their prominence in potato production, giving a total of 24 communities. In the final stage, a total of 394 Potato farmers were selected randomly and proportionately (5%) as presented in Table 1. However, only 392 questionnaires were returned after data collection. The procedure was adopted from Onyemma *et al.* (2020) as stated below:

$$n = \frac{N}{1 + N(\alpha)^2} \quad \dots(1)$$

Where;

N = sample frame for the three Local Government Areas

n = sample size

α = margin of error (fixed at 5%)

$$n = \frac{5,232}{1 + 5,232(0.05)^2} \quad n = \frac{5,232}{1 + 5,232 \times 0.0025}$$
$$n = \frac{5,232}{1 + 12.325} \quad n = \frac{5,232}{13.325} = (394)$$

Table 1 Sample size Selection Plan

Zones	LGAs	Districts	Villages	Sampling frame	Sample size (5%)
Central	Pankshin	Pankshin	Tambes	144	11
			Bwarak	142	11
		Fer	Fer	141	10
			Takas	143	11
			Sub-Total	570	43
	Mangu	Mangun	Mangun	315	24
			Tokchar	315	23
		Kerang	Kerang	315	24
			Bwonpe	315	24
			Sub-Total	1,260	95
	Bokkos	Bokkos	Maikatako	403	31
			Butura	403	30
		Daffo	Daffo	402	30
			Mbar	402	30
			Sub-Total	1,610	121
Northern	B-Ladi	Heipang	Heipang	195	16
			Kassa	195	15
		Fan	Fan-loh	195	15
			Sangasa	195	13
			Sub-Total	780	59
	Jos South	Gyel	Kull	168	13
			Gura-Ryom	168	13
		Vwang	K-Vom	167	12
			Hwak	167	12
			Sub-Total	670	50
	Riyom	Riyom	Tahos	86	7
			F/Lamba	86	7
		Bachit	Bachit	85	6
			Rim	85	6
			Sub-Total	342	26
Grand Total				5,232	394

Source: Field Survey

Method of Data Collection

Primary data were used for this study, and were collected from farmers with the use of structured questionnaire. The questionnaire was categorized into eight sections, each of which aimed at a particular pre-determined objective of the study.

Method of Data Analysis

Data collected were analysed using descriptive statistics such as frequency distribution table, percentages, ranking and mean to achieve the objectives of the study.

RESULTS AND DISCUSSION

Respondents' Sources of Information on CSA Practices

Results in Table 2 showed that the respondents' sources of information were majorly (84.2%) from television, radio (71.9%), print media, (48.2), extension agents (37.0%). The findings also revealed that other sources of information on CSA practices include internet

(38.0%), WhatsApp (12.0%), Facebook (11.4%), Instagram (8.1%), Telegram (4.3%), Twitter (3.3%), LinkedIn (2.8%). The implication of this results is that the farmers were majorly cosmopolitans (living mostly in the local government headquarters had access to electricity wasn't an issue) hence, they were used to their television and radio sources as one of the characteristics such farmers. This finding was contrary to that of Adetayo *et al.* (2023), who reported that the majority of the farmers in the study area's sources of information were through the social media, even though their age range were still within the bracket of youths i.e. 25-34 years. Also, Abashe and Ayatse (2023), reported that the potato farmers in Plateau State, Nigeria had their sources of information from families and friends and through agro dealers.

Table 2: Distribution of Respondents based on Sources of Information used on CSAP

Variable (n=392)	Frequency	Percentage *
Radio	282	71.9
Television	330	84.2
Print Media	189	48.2
Internet	149	38.0
Face book	45	11.4
WhatsApp	47	12.0
Telegram	17	4.3
Instagram	32	8.1
Linkdin	11	2.8
Twitter	13	3.3
Extension Agents	145	37.0

Source: Field Survey, 2024

*Multiple responses

Respondents' Level of Awareness of Climate Change in Study Area

Results in Table 3 shows the level of climate change awareness of the respondents in the study area. The results revealed that majority (93.1%) of the respondents had awareness of increase in temperature. Substantial proportion (45.4% and 40.3%) of the respondents had awareness of delay in onset of rainfall and increase in crop pests and diseases due to climate change. The results also showed that 35.5%, 34.9%, 18.6%, 15.8% and 15.1% of the respondents had awareness of increase in drought, shortage of rainfall, prevalence of windstorm and increase in floods in the study area, respectively. This implies that the change in temperature events has been a major challenge to the farmers in the study area. These findings are in conformity with that of Madaki *et al.* (2023) who reported that farmers perceived an increase in temperature, drought, evaporation, and frequency of floods, increase in crop pest and disease outbreaks in the last 10 years.

Table 3: Distribution of Respondents According to Level of Awareness of Climate Change

Variable (n=392)	Frequency *	Percentage
Increase in Temperature	365	93.1
Shortage in rainfall	137	34.9
Increase in Drought	139	35.5
Increase in Flood	62	15.8
Increase in Crop pest and Diseases	158	40.3
Delay in on-set of rainfall	178	45.4
Windstorm	73	18.6
Rising Sea level	59	15.1

Source: Field Survey, 2024

*Multiple responses

Respondents' Awareness of Climate Smart Agricultural (CSA) Practices

The results in Table 4 explain the level of awareness of the respondents on Climate Smart Agricultural Practices (CSA). The findings indicated that using organic manure, improved variety of potato, adjusting planting dates, shifting to another crop had 72.2, 85.7, 79.3 and 69.6 percentages respectively. The results further showed that planting early maturing

varieties, drought-tolerant varieties, Crop-livestock integration, disease-resistant varieties, pest-resistant varieties, water conservation management and avoiding bush burning had 84.4, 78.6, 66.1, 74.5, 72.5, 71.9 and 72.2 percentage respectively. The implication of the above findings was that the potato farmers in the study area were aware of the CSA practices. This conforms to the findings of Montcho *et al.* (2022) who opined that despite most people being aware of climate change, a deeper understanding of their experiential mindset is necessary to reveal their attitude toward climate change mitigation measures. Global food systems are responsible for up to 37% of the total greenhouse gas emissions in the world. In Nigeria, land cover changes and forestry contribute 38.2%, while agriculture contributes 13% of national greenhouse gas emissions, with an increase of 25% between 1990 and 2014.

Table 4: Distribution of Respondents according to Awareness of CSA

Variable (n=392)	Frequency*	Percentage
Using Organic Manure	283	72.2
Using Improved Variety of Potato	336	85.7
Adjusting Planting Date	311	79.3
Shifting to another crop	273	69.6
Planting Early maturing varieties	331	84.4
Drought-tolerant varieties	308	78.6
Crop-Livestock integration	259	66.1
Disease-resistant varieties	292	74.5
Pest-resistant varieties	284	72.5
Water conservation management	282	71.9
Avoiding bush burning	283	72.2

Source: Field survey, 2024 *Multiple Responses, CSA= Climate Smart Agriculture

Climate Smart Agricultural Practices Adopted by the Respondents

Results from Table 5 revealed the various CSA practices adopted by Irish potato farmers in the study area. The results revealed that most (95.0%) of the respondents adopted improved potato varieties. The results also indicated that majority of the respondents adopted the use of early maturing potato varieties, disease-resistant potato varieties, adjusting planting dates and drought-tolerant varieties respectively. The implication of the results is that the potato farmers adopted and/or were adapted to at least one or more smart agricultural practices. These findings are in tandem with that of Andati *et al.* (2023) who reported that the potato farmers in the study area adopted at least five (5) CSA practices which at least was a step forward in mitigating the challenges of climate change.

Table 5: Distribution of Respondents According to CSA Practices adopted by Irish Potato farmers in the Study area

CSA Practices (n=392)	Frequency	Percentage *
Using Improved Potato Varieties	372	95.0
Early maturing varieties	347	89.0
Using Organic Manure	325	83.0
Disease-resistant variety	324	82.6
Adjusting Planting dates	320	82.0
Drought-tolerant variety	320	82.0
Water conservation Management	308	79.0
Avoiding bush burning	303	77.2
Shifting to another crop	285	73.0
Crop-Livestock Integration	287	73.2
Pest-resistant variety	297	76.0

Source: Field survey, 2024 *Multiple Responses, CSA= Climate Smart Agriculture

Respondents' Level of Adoption of CSA Practices on Potato Production

Adoption level in agricultural extension refers to the rate at which farmers adopt new agricultural technologies or innovations. The results in table 6 revealed that the mean of using organic matter (33.6) CSA practices, shifting to another crop (33.6), using improved potato varieties (33.1) and early maturing varieties (33.0) were all within the medium level. Also, the results showed that adjusting planting dates, crop-livestock integration, disease-resistant varieties, pest-resistant varieties, water conservation management, avoiding bush burning and drought tolerant varieties had the means of 32.8 and 32.5 respectively. The implication of these adoption of CSAs were within medium levels. This is so because, according to adoption index measurement stated that '0' indicates non-adoption, 1-33% indicates low adoption, 34-66% indicates medium adoption while 67-100% indicates high adoption (Mailumo and Onuwa 2022). All other percentages and means were also between the low and medium levels, going by the adoption index principle of measurement. These findings are in tandem with that of Ogbola *et al.* (2021) and Andati *et al.* (2023) who stated that potato farmers in the study area adopted at least 5 CSA practices.

Table 6: Distribution of Respondents according to Level of Adoption of CSA Practices on Potato Production

CSA Practices (n=392)	Percentage Low	Medium	High	Mean
Using organic Manure	22.4	34.2	42.3	33.6
Using improved potato varieties	11.5	47.2	40.6	33.1
Adjusting planting dates	21.2	54.1	23.1	32.8
Shifting to another crop	39.6	40.7	18.6	33.6
Early maturing varieties	26.5	30.6	41.9	33.0
Drought-tolerant varieties	28.1	33.9	35.5	32.5
Crop-Livestock Integration	35.7	40.6	21.7	32.7
Disease-resistant variety	22.6	34.1	41.6	32.8
Pest-resistant variety	21.4	35.7	41.4	32.8
Water conservation management	26.3	43.6	28.6	32.8
Avoiding bush burning	34.0	37.6	26.9	32.8

Source: Field Survey, 2024

CONCLUSION AND RECOMMENDATIONS

The study concluded that most potato farmers in the study area rely on television and radio, as primary sources of information on Climate-Smart Agricultural (CSA) practices, with limited use of social media platforms. Farmers exhibit high awareness of climate change impacts, especially temperature increases, and are moderately aware of various CSA practices with medium level of CSA practices adoption.

Recommendations

Based on the findings of the study, it is recommended that;

- There should be strengthen the use of traditional channels like television and radio while integrating modern platforms like WhatsApp and Facebook to reach younger and tech-savvy farmers effectively.
- Organize targeted training sessions through extension agents to improve the technical skills needed for adopting CSA practices.
- Government should provide subsidies or credit schemes to support the adoption of CSA practices, particularly for drought-resistant and disease-resistant varieties, ensuring access to essential inputs.
- Establish stronger links between farmers, research centers, and extension services to deliver updated knowledge on CSA practices and climate change mitigation strategies.



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